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QUALITY ASSURANCE PROJECT PLAN
GROUND-WATER TESTING FROM MONITOR WELLS
REFUSE HIDEAWAY LANDFILL
MIDDLETON, WISCONSIN

State Bid No. C-85B

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SIMON Environmental

QUALITY ASSURANCE PROJECT PLAN
GROUND-WATER TESTING FROM MONITOR WELLS
REFUSE HIDEAWAY LANDFILL
MIDDLETON, WISCONSIN

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ACRONYMS

CLP	Contract Laboratory Program
DQO	Data Quality Objective
LCS	Laboratory Control Sample
QA	Quality Assurance
QAPjP	Quality Assurance Project Plan
QC	Quality Control
RI/FS	Remedial Investigation/Feasibility Study
SOP	Standard Operating Procedure
SOW	Statement of Work
TAL	Target Analyze List
TCL	Target Compound List
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WDNR	Wisconsin Department of Natural Resources

INTRODUCTION

The United States Environmental Protection Agency (U.S. EPA) requires that environmental monitoring and measurement efforts mandated or supported by U.S. EPA participate in a centrally managed quality assurance (QA) program.

Any party generating data under this program has the responsibility to implement minimum procedures to assure that the precision, accuracy, completeness, and representativeness of its data are known and documented. To ensure the responsibility is met uniformly, each party must prepare a written QA Project Plan (QAPjP) covering each project it is to perform.

This QAPjP presents the organization, objectives, functional activities and specific QA and quality control (QC) activities associated with the ground-water monitoring at the Refuse Hideaway Landfill site. This QAPjP also describes the specific protocols which will be followed for sampling, sample handling and storage, chain of custody, and laboratory analysis. Protocols for investigative waste disposal and decontamination procedures are also included.

QA/QC procedures will be in accordance with applicable professional technical standards, U.S. EPA requirements, government regulations and guidelines, and specific project goals and requirements. This QAPjP is prepared by Simon Hydro-Search in accordance with U.S. EPA QAPjP guidance documents and Wisconsin State Bid Request #C-85B requirements, in particular, the Contract Laboratory Program (CLP) guidelines, Interim Guidelines and Specifications for Preparing QAPjPs (QAMS-005/80), and the Region V Model QAPjP (1991).

1.0 PROJECT DESCRIPTION

1.1 Site History/Background Information

The Refuse Hideaway Landfill is a closed municipal, commercial, industrial landfill located in the SW1/4, NW1/4, Section 8, T7N, R8E, Town of Middleton, Dane County, Wisconsin. The landfill operated for 14 years between 1974 and 1988.

The site was closed under court order in 1988 when volatile organic chemicals (VOC s) were discovered in private wells southwest of the site. VOCs and elevated inorganic chemicals have been detected in ground water surrounding the site. The contaminated ground water extends at least 3,800 feet southwest of the landfill boundary. Methane gas has migrated off the site and standing leachate has been documented within the waste mass.

Site geology/hydrogeology includes shallow bedrock, consisting of Prairie du Chien dolomite overlying late Cambrian age sandstone, which is present north, east, and west of the site. South of the site, up to 300 feet of unconsolidated materials exist, consisting of till, glaciolacustrine, outwash, and recent alluvium deposits. Ground water occurs in the sandstone and in the glacial deposits. Ground-water flow is primarily southwest, toward the Black Earth Creek Valley.

The main contaminant plume occurs in the sandstone bedrock and extends at least 300 feet below the ground surface. The primary plume contaminants are VOCs. Inorganic contamination is present near the landfill. Analysis for metals, semi-volatiles, pesticides and PCBs will take place during Summer, 1993.

1.2 Past Data Collection Activity/Current Status

In January 1989, the landfill owner declared bankruptcy and refused to undertake additional remediation of the landfill or investigate the degree and extent of ground-water contamination.

In early 1989, the State of Wisconsin undertook the continued remediation and investigation of the site. Costs for this work have been paid by the Environmental Fund which are monies directly appropriated by the State legislature for environmental clean-ups.

In Fall, 1989, the State began a number of actions designed to remediate the immediate problems of:

1. methane gas and leachate migration from the landfill;
2. private water supply contamination at three wells;, and
3. extent of ground-water contamination and possible involvement of additional private wells.

The following actions were accomplished as of the end of 1992:

1. **Gas and leachate extraction system.** A gas and leachate extraction system is in place and operating on the landfill surface. The system consists of 13 gas/leachate extraction wells, header piping, blower, flow control systems, electrical control systems, telemetry system, a ground flare that meets all applicable air emission standards, and a leachate holding tank. Leachate is extracted from 3 of the 13 wells.

2. **Long-term operation and maintenance of the gas/leachate extraction system.** A consulting firm is under contract to the Wisconsin Department of Natural Resources (WDNR) to operate and maintain the extraction system and landfill surface for the next three to five years. Besides actual O & M of the extraction system, gas probes

surrounding the landfill are monitored for methane migration, leachate samples are analyzed for compliance with a wastewater permit for discharge to the Madison Metropolitan Sewerage District, the landfill cover is inspected for erosion problems, and air emission standards are met.

3. **Repair of Final Cover Soils.** Several areas of the landfill cover experienced significant erosion between 1988 and 1992. In Fall 1992, a cap repair and restoration project was undertaken. At this time, the landfill surface is in fairly good repair. This will be maintained through the State's O & M contract.

4. **Private Water Supply Wells.** Three private water supply wells, serving three homes, were discovered to be contaminated with VOCs in January 1988. Bottled water was supplied and in Fall 1989, design of a point-of-entry (POE) water treatment system was undertaken. The system, an activated carbon filtration system manufactured by Hellenbrand Water Systems, was installed in two home in April and May, 1990. At this time, the homeowners own and maintain the treatment systems. All testing to date indicates that the filtration systems reliably produce safe, drinkable water. The third home is no longer occupied and the water well has been shut down. The third property is used as a business and the State continues to supply bottled water to the business.

5. **Testing of Private Water Supplies Within One Mile of the Landfill.** In October 1989 and January 1990, 43 private water supply wells (serving 53 homes) were tested for the presence of VOCs. The tests showed that all private wells (except the three previously mentioned) were free of VOCs.

6. **Ground-Water Monitoring Study.** In Summer 1990, the State undertook a ground-water investigation to determine the degree and extent of VOC contamination. Twenty-seven ground-water monitor wells were installed. There were 30 existing monitor wells at the site, for a total of 57 monitor wells in the study. The study

evaluated the geology, the vertical and horizontal ground-water flow, the average ground-water velocity in each geologic unit, the extent of aquifer contamination, the direction of plume movement, preliminarily evaluated four remedial actions, and made recommendations on future work at the site.

The study showed that the ground-water plume has the potential to contaminate the Deer Run Heights subdivision, locate approximately 1 mile southwest of the landfill. In January 1991, the State began monitoring private wells in the eastern portion of Deer Run Heights.

7. **Numerical Model Simulation and Assessment of Contaminant Plume Migration.** In Summer 1991, a numerical model was performed in an effort to estimate movement of the plume front downgradient of the landfill. The modeling effort provided an evaluation of the State's ground-water monitoring strategy and suggested that at least one additional monitor well be installed in the Black Earth Valley. Other conclusions and recommendations are contained in the study.

8. **On-Going Ground-Water Monitoring.** The State has established a long-term ground-water monitoring program that monitors the movement of the plume and tests private wells closest to the plume. Testing is conducted semi-annually (in May and October) on 21 monitor wells and 12 private wells. At present, this monitoring will continue through the end of 1994.

9. **Community Relations.** A community relations program was instituted at the beginning of the State's involvement in the Refuse Hideaway Landfill and will continue through the RI/FS process.

1.3 Project Objectives and Scope

The State of Wisconsin, through the Environmental Repair Program, has conducted an investigation of the degree and extent of ground-water contamination emanating from the landfill. The primary ground-water contaminants are VOCs. This scope of work will assess the existence and extent of other classes of contaminants, including metals, semi-volatiles, PCBs, and pesticides.

The goals of the sampling and analysis program are:

1. To collect samples from selected monitor and private wells for specified parameters according to accepted quality assurance/quality control procedures.

2. To analyze the ground-water samples according to EPA contract laboratory program (CLP) procedures as specified in EPA's Statements of Work for Organic Analyses and Inorganic Analyses with detection limits appropriate for drinking water for the specified parameters. All raw data necessary for data validation will be kept by the laboratory for five years.

3. To perform two rounds of sampling, recognizing that the second round may be altered based on results from the first round. The second round of sampling will be carried out after the WDNR reviews the results of the first round of samples.

4. To report the results of each round of analysis upon receipt of the data from the laboratory by submitting laboratory reporting sheets accompanied by the laboratory narrative. Data will also be submitted on computer diskette in WDNR's Groundwater Information Network Format.

1.4 Sample Network Design and Rationale

The sample network design and rationale for sample locations was developed by WDNR and includes the following items:

1. Monitor wells and private wells specified in Table 1-1 will be sampled in mid May 1993. A number of wells are located on private property surrounding the landfill. Property owners will be notified when sampling is scheduled prior to each sampling event. A 4-wheel drive vehicle will be used to access well nest P-22.

2. Purge water from evacuating monitor wells will be containerized and disposed of in the leachate tank on the landfill site.

3. Each of the selected monitor wells and private wells will be sampled for EPA's Target Compound List (TCL) for semi-volatiles and Inorganic Target Analyte List (TAL). Analyses methods will be those specified in EPA's Statements of Work for Organic and Inorganic Analyses. Detection limits will be appropriate to drinking water.

4. Monitor wells P-17S, P-21S, and P-27S will be sampled for EPA's Target Compound List (TCL) for pesticides and aroclors. These wells were selected for analysis of pesticides and aroclors because they are closest to the landfill and are likely to be the most contaminated. PCB and aroclor contamination in ground water is not expected, however, should these wells show positive for these contaminants, this analysis will be included in round 2 sampling.

5. All laboratory analysis results will be submitted to the Department no later than 60 days after sample collection. Laboratory results will be submitted within 45 days of sample collection, if possible.

6. The second round of sampling will be scheduled after the WDNR reviews the first round sampling results. At the WDNR's discretion, the number of wells and parameters sampled may be adjusted during the second sampling round.

1.5 Parameters to be Tested and Frequency

Sample matrices, analytical parameters and frequencies of sample collection can be found in Table 1-2.

1.6 Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support decisions made during RI/FS activities and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality. There are five analytical levels which address various data uses and the QA/QC effort and methods required to achieve the desired level of quality. These levels are:

- Screening (DQO Level 1): This provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at the site, preliminary comparison to applicable or relevant and appropriate requirements, initial site characterization to locate areas for subsequent and more accurate analyses, and for engineering screening of alternatives (bench-scale tests). These types of data include those generated on-site through the use of pH, conductivity, and other real-time monitoring equipment at the site.

- Field Analyses (DQO Level 2): This provides rapid results and better quality than in Level 1. This level may include mobile lab generated data depending on the level of QC exercised. No DQO Level 2 monitoring is proposed for the Refuse Hideaway Landfill investigation at this time.

- Engineering (DQO Level 3): This provides an intermediate level of data quality and is used for site characterization. Engineering analyses may include mobile lab generated data and some analytical lab methods (e.g., laboratory data with quick turnaround used for screening but without full QC documentation). No DQO Level 3 monitoring is proposed for the Refuse Hideaway Landfill investigation at this time.

- Confirmational (DQO Level 4): This provides the highest level of data quality and is used for purposes of risk assessment, evaluation of remedial alternatives and PRP determination. These analyses require full CLP analytical and data validation procedures in accordance with U.S. EPA recognized protocol. No DQO Level 4 monitoring is proposed for the Rufuse Hideaway Landfill at this time.

- Non-Standard (DQO Level 5): This refers to analyses by non-standard protocols, for example, when exacting detection limits or analysis of an unusual chemical compound is required. These analyses often require method development or adaptation. The level of QC is usually similar to DQO Level 4 data. The DQO level 5 monitoring proposed for the Refuse Hideaway Landfill investigation is detailed below.

Parameter	Matrices
TCL Organics (low levels) (semi-volatiles)	Ground water (private wells and monitor wells),
TAL Metals and Cyanide (low levels)	Ground water (private wells and monitor wells)
TCL Organics (low levels) (Pesticides and Aroclors)	Ground water (monitor wells)

1.7 Project Schedule

Samples are planned to be collected during the week of May 17, 1993 for the first round and the second round of samples will be collected within two weeks of the WDNR's permission to proceed with the second round of sampling. A graphic schedule has not been included because of the limited scope of the project, the predetermined date for the first sampling round, and uncertainty of the timing for the second round.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

At the direction of the State Project Manager, Simon Hydro-Search has overall responsibility for all phases of this sampling. Simon Hydro-Search will perform the sampling and prepare the required reports. Project management will also be provided by Simon Hydro-Search. The various quality assurance and management responsibilities of key project personnel are defined below (Figure 2-1).

WDNR

State of Wisconsin Project Manager

The WDNR is the lead agency and is responsible for providing oversight of the sampling contract. The State Project Manager, Theresa Evanson, has overall responsibility for ensuring that the project meets WDNR objectives and Simon Hydro-Search quality standards. In addition, she is responsible for technical QC and project oversight. WDNR, as lead agency for this project, is the organization responsible for QAPjP approval and for external performance and system audits of field activities. No laboratory audit will be completed by the WDNR; Southwest has a current contract with the U.S. EPA's Contract Laboratory Program for residential well analyses and through this program they routinely participate in U.S. EPA's performance evaluations and audits. No additional laboratory evaluations or audits will be completed.

Simon Hydro-Search

Simon Hydro-Search is the contractor for the WDNR implementing the requirements of the sampling contract. The Site Manager, Judy Fassbender of Simon Hydro-Search, is responsible for implementing the project, and has the authority to commit the resources necessary to meet project objectives and requirements. The site manager's primary function is to ensure that technical, financial, and scheduling objectives are achieved successfully.

The site manager will report directly to the WDNR project manger and will provide the major point of contact and control for matters concerning the project. The site manager will:

- Ensure completion of the project objectives and meet the required schedule;
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task;
- Acquire and apply technical and corporate resources as needed to ensure performance within budget and schedule constraints;
- Orient field leaders and support staff concerning the project's special considerations;
- Monitor and direct the field staff;
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness;
- Review and analyze overall task performance with respect to planned requirements and authorizations;
- Approve external reports (deliverables) before their submission to WDNR;
- Ultimately be responsible for the preparation and quality of interim and final reports; and

- Represent the project team at meetings.

Field Leader

The site manager will be supported by the field leader, Todd Thomson. He is responsible for leading and coordinating the day-to-day activities of the various resource specialists under his supervision. The field leader is a highly experienced environmental professional who will report directly to the site manager. Specific field leader responsibilities include:

- Provision of day-to-day coordination with the site manager on technical issues in specific areas of expertise;

- Development and implementation of field-related work plans, assurance of schedule compliance, and adherence to management-developed study requirements;

- Coordination and management of field staff including sampling, and field measurements;

- Implementation of QC for technical data provided by the field staff including field measurement data;

- Adherence to work schedules provided by the site manager;

- Authorship, review, and approval of text and graphics required for field efforts;

- Coordination and oversight of technical efforts of subcontractors assisting the field staff; and

- Identification of problems at the field level, discussion of resolutions with the site manager, and provision of communication between field staff and management.

Technical Staff

The technical staff (field staff) for this project will be drawn from Simon Hydro-Search pool of corporate resources. The technical staff will be utilized to gather and analyze data, and to prepare various task reports and support materials. All of the designated technical members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

QA Director

The QA director is Michael R. Noel. The QA director will remain independent of direct job involvement and day-to-day operations, and has direct access to corporate executive staff as necessary to resolve any QA dispute. He is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, Simon Hydro-Search's policies, and WDNR and U.S. EPA requirements. If required, his specific functions and duties may include:

- Provide QA audit on various phases of the field operations;
- Review and approval of QA plans and procedures;
- Provide QA technical assistance to project staff;
- Report on the adequacy, status, and effectiveness of the QA program on a regular basis to the site manager.

Responsibilities for additional aspects of the project are as follows:

Laboratory - Southwest Laboratory of Oklahoma, Inc. (Southwest)

The laboratory will designate a project manager, operations manager, quality assurance officer and sample custodian to oversee the various aspects of the analyses and related work completed by the laboratory for the project. The duties of these individuals are detailed below.

Laboratory Project Managers

- ensure all resources of the laboratory are available on an as-required basis;
- overview of final analytical reports;
- approval of the QAPjP.

Laboratory Operations Manager

- coordinates laboratory analyses;
- supervises in-house chain-of-custody;
- schedules sample analyses;
- oversees data review;
- oversees preparation of analytical reports;
- approves final analytical reports prior to submission to Simon Hydro-Search.

Laboratory Quality Assurance Officer

- overview laboratory quality assurance;
- overview QA/QC documentation;
- conduct detailed data review;
- decides laboratory corrective actions, if required;
- technical representation of laboratory QA procedures;
- preparation of laboratory Standard Operation Procedures;
- approval of the QAPjP.

Laboratory Sample Custodian

- receive and inspect the incoming sample containers;
- record the condition of the incoming sample containers;
- sign appropriate documents;
- verify chain of custody and its correctness;
- notify laboratory manager and laboratory supervisor of sample receipt and inspection;
- assign a unique identification number and customer number, and enter each into the sample receiving log;
- with the help of the laboratory manager, initiate transfer of the samples to appropriate lab sections; and,
- control and monitor access/storage of samples and extracts.

Primary responsibility for project quality rests with Simon Hydro-Search Site Manager. Independent quality assurance will be provided by the Laboratory Project Manager and QA Officer prior to release of data to Simon Hydro-Search.

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The Overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results which are legally defensible in a court of law. Specific procedures for sampling, chain of custody, laboratory instruments calibration, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPjP. The purpose of this section is to address the specific objectives for accuracy, precision, completeness, representativeness, and comparability.

3.1 Level of Quality Control Effort

Field blank, duplicate and laboratory control samples (LCS) will be analyzed to assess the quality of the data resulting from the field sampling program. Field blanks will be submitted to the analytical Laboratories to provide the means to assess the quality of the data resulting from the field sampling program. Field blank samples are analyzed to check for procedural contamination at the site which may cause sample contamination. No trip blanks will be included for this investigation because trip blanks are used to assess the potential for contamination of samples due to VOC contaminant migration during sample shipment and storage, and VOCs are not a parameter of interest for this investigation. Duplicate samples are analyzed to check for sampling and analytical reproducibility. For organic analysis, a laboratory control sample (LCS) will be analyzed to provide information about the control of the systems in the laboratory with regard to the requested methodology. Similar laboratory QC is performed on inorganics as well. One laboratory QC sample will be analyzed for every 20 investigative samples collected for organic or inorganic analysis.

The general level of the QC effort will be one field duplicate and one field blank for every 10 or fewer investigative samples.

LCSs are control samples of known composition. They are analyzed using the same sample preparation, reagents, and analytical methods employed for the investigative samples received. One LCS sample will be analyzed for every 20 or fewer investigative samples. The number of duplicate and field blank samples to be collected are listed in Table 1-2. Sampling procedures are specified in the SOPs (Appendix A).

The level of QC effort provided by the participating laboratory is described in each SOW as shown below:

Test Category	Reference
Low level TCL semi-volatiles	SOW 10/92*
Low level TAL metals and cyanide	SOW 10/91**
Low level PCBs and pesticides	SOW 10/92*

* Superfund Analytical Methods for Low Concentration Water for Organic Analyses 10/92.

**Superfund Analytical Methods for Low Concentration Water for Inorganic Analyses 10/91.

The QC level of effort for the field measurement of pH consists of pre-measurement calibration and a post-measurement verification using two standard reference solutions each time as appropriate to the sample pH. This procedure will be performed for each sample tested. The QC effort for field conductivity measurements will include daily calibration of the instrument using standard solutions of known conductivity. One duplicate conductivity measurement will be measured for each 10 samples recorded.

3.2 Accuracy, Precision, and Sensitivity of Analysis

The fundamental QA objective with respect to accuracy, precision, and sensitivity of laboratory analytical data is to achieve the QC acceptance criteria of the analytical protocols.

The accuracy and precision requirements for the analytical services are specified in the 10/92 SOW for organics in water, and 10/91 SOW for organics in water. The sensitivities required for CLP analyses will be the Contract-Required Detection Limits shown in Tables 3-1 through 3-3 of this QAPjP.

The SOPs for the field equipment to measure pH, conductivity, and temperature are outlined in Appendix A of the QAPjP. Accuracy and precision requirement for field screening analyses are also included in this appendix.

3.3 Completeness, Representativeness and Comparability

COMPLETENESS is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. It is expected that Southwest will provide data meeting QC acceptance criteria for 95 percent or more for samples tested using the appropriate 10/92 SOW or 10/91 SOW. Following completion of the analytical testing, the percent completeness will be calculated by the following equations: completeness (%): =

$$\frac{\text{(number of valid data)}}{\text{(number of sample collected for each parameter analyzed)}} \times 100$$

REPRESENTATIVENESS expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a

process condition, or an environmental condition. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol. The sampling network was designed to provide data representative of site conditions. During development of this network, consideration was given to existing analytical data, physical setting and processes, and constraints inherent to the Superfund program. The sampling network rationale was established by the WDNR. Representativeness will be satisfied by insuring that the WDNR requested scope of work is completed, proper sampling technique are used, proper analytical procedure are followed and holding times of the samples are not exceeded in the laboratory. Representativeness will be assessed by the analysis of field duplicated samples.

COMPARABILITY expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as documented in the QAPjP, are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of difference in procedures and QA objectives.

4.0 SAMPLING PROCEDURES

Procedures for purging and sampling monitor wells and private wells, specifics for sampling with QED equipment, decontamination procedures, and investigative waste disposal procedures are described in the SOPs included as Appendix A. A summary of sample quantities, containers, preservatives, and packaging is included as Table 4-1.

5.0 SAMPLE CUSTODY

It is U.S. EPA and Region V Policy to follow the U.S. EPA Region V sample custody, or chain of custody protocols as described in "NEIC Policies and Procedures", U.S. EPA-330/9-78DDI-R, Revised June 1985. This custody is in three parts: Sample collection, Laboratory analysis, and Final evidence files. Final evidence files, including originals of laboratory reports and purge files, are maintained under document control in a secure area.

A sample or evidence file is under your custody if they

- are in your possession;
- are in your view, after being in your possession;
- are in your possession and you place them in a secured location; or
- are in a designated secure area.

5.1 Field Chain-of-Custody Procedures

The sample packaging and shipment procedures summarized below will insure that the samples will arrive at the laboratory with the chain of custody intact. Superfund chain-of-custody procedures will be followed as described in Appendix A including chain-of-custody forms, and custody seals. Simon Hydro-Search chain-of-custody forms and seals will be used as included in Simon Hydro-Search's Chain-of-Custody Standard Operating Procedures in Appendix A. Sample tags will not be used for this project.

5.1.1 Field Procedures

a. The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

b. Bottles will be tagged with sample numbers and locations.

c. Sample tags are to be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample tag because the ballpoint pen would not function in freezing weather.

d. The Simon Hydro-Search field leader will review field activities to determine whether proper custody procedures were followed during the field work.

5.1.2 Field Logbooks/Documentation

Field logbook will provide the means of recording data collecting activities performed. As such, entries will be described in as much detail as possible so that persons going to the site could re-construct a particular situation without reliance on memory.

Field logbooks will be bound, field survey books or notebooks. Logbooks will be assigned to field personnel, but will stored in the document control center when not in use. Each logbook will be identified by the project-specific document number.

The title page of each logbook will contain the following:

- Person to whom the logbook is assigned.
- Logbook number.

- Project name.
- Project start date, and
- End date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the site, field sampling or investigation team personnel and the purpose of their visit will also be recorded in the field logbook.

Measurements made and samples collected will be recorded. Entries will be made in ink and no erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark. Whenever a sample is collected, or a measurement is made, a detailed description of the location of the station, which includes compass and distance measurements, shall be recorded. The number of the photographs taken of the station, if any, will also be noted. Equipment used to make measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures documented in Appendix A. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume and number of containers. Sample identification number will be assigned prior to sample collection. Field duplicate samples, which will receive a separate sample identification number, will be noted under sample description.

5.1.3 Transfer of Custody and Shipment Procedures

a. Samples are accompanied by a properly completed chain of custody form. The sample numbers and locations will be listed on the chain of custody form. When transferring the possession of samples, the individuals relinquishing and receiving will

5.1.3 Transfer of Custody and Shipment Procedures

a. Samples are accompanied by a properly completed chain of custody form. The sample numbers and locations will be listed on the chain of custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area.

b. Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be locked and secured with strapping tape and custody seals for shipment to the laboratory. The preferred procedure includes use of a custody seal attached to the front right and back left of the cooler. The custody seals are covered with clear plastic tape. The cooler is strapped shut with strapping tape in at least two locations.

c. Whenever samples are co-located with a source or government agency, a separate Sample Receipt is prepared for those samples and marked to indicate with whom the samples are being co-located. The person relinquishing the samples to the facility or agency should request the representatives signature acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the "Received By" space.

d. Shipments will be accompanied by the Chain of Custody Record identifying the contents.

e. If the samples are sent by common carrier, a bill of lading should be used. Receipts of bills of lading will be retained as part of the permanent documentation. If sent by mail, the package will be registered with return receipt requested. Commercial

carriers are not required to sign off on the custody form as long as the custody forms are sealed inside the sample cooler and the custody seals remain intact.

5.2 Laboratory Chain-of-Custody Procedures

Laboratory custody procedures for sample receiving and log-in; sample storage; tracking during sample preparation and analysis; and storage of data are described in the SOPs (Appendix B). The internal chain-of-custody requirements for the laboratory are described in the CLP SOWs or the SOPs. These custody procedures along with the holding time requirements for CLP samples are described in the appropriate SOW (10/92 for low level organics in water and 10/91 for low level inorganics in water).

5.3 Final Evidence Files Custody Procedures

The evidence files for the project are maintained at the Simon Hydro-Search office. The content of the evidence file will include relevant records, reports, correspondence, logs, field logbooks, analytical data package, pictures, subcontractor's reports, chain of custody records/forms, data review reports, etc. The evidence file will be under custody of the Simon Hydro-Search site manger in a locked, secured area.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes procedures for maintaining the accuracy of the instruments and measuring equipment which are used for conducting field tests and laboratory analyses. These instruments and equipment should be calibrated prior to each use or scheduled, periodic basis.

6.1 Field Instruments/Equipment

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Equipment to be used doing the field sampling will be examined to certify that it is operating condition. This includes checking the manufacturing's operating manual and the instruction and the instructions for each instrument to ensure that maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that the notation on any prior equipment problem are not overlooked, and necessary repairs to equipment have been carried out. A spare electrode will be sent with each pH meter to be used for field measurements. Two thermometers will be sent to sampling locations where measurement of temperature is required, including those locations where a specific conductance probe/thermometer is required.

Calibration of field instruments is governed by the specific SOP for the applicable field analysis method, and such procedures take precedence over the following general discussion. Specific SOPs for field instruments are as follows: 50300 pH meter and 50400 specific conductivity meter. These are included in Appendix A of the QAPjP.

Calibration of field instruments will be performed at the intervals specified by the manufacturer or more frequently as conditions dictate. Field instruments will include a pH

meter, thermometer, and specific conductivity meter). In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service.

The pH meter will be calibrated with standard buffer solutions prior to a field trip. In the field, the meter will be calibrated daily with two buffers before use. Thereafter, the meter will be checked against two buffer solutions will be used for each field trip. Calibration procedures and frequency will be recorded in a field log book along with the lot numbers of the buffer. A general procedures for pH meter, specific conductivity meter and thermometer are described below:

pH Calibration

- Temperature of sample and buffer should be the same.
- Connect pH electrode into pH meter and turn on pH meter.
- Set temperature setting based on the temperature of buffer; place electrode in first buffer solution.
- After reading has stabilized, adjust "CALIB" knob to display correct value.
- Repeat procedure for second buffer solution.
- Place pH electrode in the sample and record the pH as displayed.
- Remove pH electrode from sample and rinse off with distilled water.
- The pH meter must be recalibrated every time it is turned off and turned back on, or if it starts giving erratic results.

The calibrations performed, standard used, and sample pH values are to be recorded in the field notebook. Appropriate new batteries will be purchased and kept with the meters to facilitate immediate replacement in the field as necessary.

Temperature Calibration

Temperature measurements are carried out utilizing a thermometer. The thermometers must be inspected before use to ensure there is no mercury separation. The thermometers should be rechecked in the field before and after use to see if the readings are logical and the mercury is still intact. The thermometers should be checked biannually for calibration, by immersing them in a bath of known temperature until equilibrium is reached. They should be discarded if found to have more than 10% error. The reference thermometer used for the bath calibration should be NBS traceable.

Conductivity Meter Calibration

The conductivity cells of the specific conductivity meter will be cleaned and checked against known conductivity standards before each field trip. In the field, the instrument will be checked daily with NBS traceable standards. The calibration procedure is described below.

- Place the probe in conductivity calibration standard solution.
- Set temperature knob for temperature of standard solution.
- Turn to appropriate scale and set the instrument for the value of calibration standard.
- Rinse off the electrode with distilled water.

- Measure the conductivity for distilled water to be used for a field blank, making sure temperature is set correctly for temperature of solution to be tested.

- If the conductivity of blank (distilled water) is high, it must be discarded and a new blank sample procured.

Readings and calibrations should be recorded in the field notebook.

6.2 Laboratory Instruments

The CLP calibration procedure and frequencies are specified in the CLP organic and inorganic SOWs.

7.0 ANALYTICAL PROCEDURES

Ground water and residential wells water samples collected during field sampling activities for the Refuse Hideaway Landfill investigation will be analyzed by Southwest Laboratory of Oklahoma, Inc.

7.1 Laboratory Procedures

Methods published by U.S. EPA for CLP will be used as the basis for analyses for which such methods exists. For the analysis of low level TCL parameters, the laboratory will follow methods detailed in the CLP 10/92 SOW for water. For analysis of low level TAL parameters the laboratory will follow methods detailed in the 10/91 SOW for water.

7.2 Field Screening Analytical Protocols

The procedures for field measurement of pH, specific conductivity, and temperatures are described in the SOPs in Appendix A.

8.0 INTERNAL QUALITY CONTROL CHECKS

8.1 Field Sample Collection

The assessment of field sampling precision and accuracy will be made through collection of field duplicates and field blanks in accordance with the applicable procedures described in the scope of work at the frequency indicated on Table 1-2.

8.2 Field Measurement

QC procedures for pH, conductivity, and temperature measurements are limited to checking the reproducibility of the measurement by obtaining multiple readings on a single sample or standard and by calibrating the instruments. The SOPs are included as Appendix A of the QAPjP.

8.3 Laboratory Measurements

Internal quality control checks for laboratory measurements are specified in the applicable SOW as follows:

Test Category	Reference
Ground Water:	
Low level TCL semi-volatiles	SOW 10/92
Low level TCL PCBs and pesticides	SOW 10/92
Low level TAL metals and Cyanide	SOW 10/91

8.4 QA Program

The laboratory has a written QA/QC program which provides rules and guidelines to ensure the reliability and validity of work conducted at the laboratory.

The stated objectives of the laboratory QA/QC Program are to:

- Ensure that procedures are documented, including any changes in administrative and/or technical procedures.
- Ensure that analytical procedures are conducted according to sound scientific principles and have been validated.
- Monitor the performance of the laboratory by a systemic inspection program and provide for a corrective action as necessary.
- Collaborate with other laboratories in establishing quality levels, as appropriate.
- Ensure that data are properly recorded and archived.

8.5 Quality Control Checks

These specifications include the types of audits required (sample spikes, surrogate spikes, reference samples, controls, blanks), the frequency of each audit, the compounds to be used for sample spikes and surrogate spikes, and the QC acceptance criteria for these audits.

The laboratory will document, in each data package provided, that both initial and ongoing instrument and analytical QC functions have been met. Any samples analyzed in non-conformance with the QC criteria will be reanalyzed by the laboratory, if sufficient sample volume is available. It is expected that sufficient volume of samples will be collected for reanalyses.

9.0 DATA REDUCTION, VALIDATION AND REPORTING

9.1 Field Measurements and Sample Collection

Raw data from field measurements and sample collection activities will be appropriately recorded in the field log book. If the data are to be used in the project reports, they will be reduced or summarized and the method of reduction will be documented in the report.

9.2 Laboratory Services

The laboratory (Southwest Laboratory of Oklahoma, Inc.) will perform in-house analytical data reduction and review data under the direction of their own Laboratory QA Officer. The Laboratory QA Officer is responsible for assessing data quality and advising of any data which were rated "preliminary" or "unacceptable" or other notations which would caution the data user of possible unreliability. Data reduction, review, and reporting done by Southwest will be documented as described by SOPs. Reporting will be full CLP data packages.

Data reduction reporting procedures will be those specified in the CLP SOW for inorganic and organic analyses.

The laboratory will prepare and retain full analytical and QC documentation similar to that required by the Contract Laboratory Program for a period of not less than five years. Such retained documentation need not be hard (paper) copy, but may be in other storage media (e.g., magnetic tape). As needed, the laboratory will supply hard copy of the retained information.

The laboratory will report the data in the same chronological order in which it was analyzed along with QC data. All laboratories will provide the following information to Simon Hydro-Search in each analytical data package submitted:

1. Cover sheet listing the samples included in the report and narrative comments describing problems encountered in analysis.

2. Tabulated results of inorganic and organic compounds identified and quantified.

3. Analytical results for QC sample spikes, sample duplicates, initial and a continuous calibration verifications of standards and blanks, standard procedural blanks, laboratory control samples and ICP interference check samples.

4. Tabulation of instrument detection limits determined in pure water.

5. Raw data system printouts (or legible photocopies) identifying date of analyses, analyst, parameters determined, calibration curve, calibration verifications, method blanks, sample and any dilutions, sample duplicates, spikes and control samples.

For organic analyses, the data packages must include matrix spikes and matrix spike duplicates or laboratory control samples, surrogate spike recoveries, chromatogram, GC/MS spectra and computer printouts. The data package will be reported to the WDNR for assessment. The WDNR will review the data to identify data deficiencies, if present, however no data validation will be done by the WDNR.

Simon Hydro-Search assessment will be accomplished by the Site Manager. The data assessment by the Site Manager will be based on the criteria that the sample was properly collected and handled according to the scope of work and Section 5 of this QAPjP.

At this time, a formal, independent validation process will not be performed nor will the laboratory have to submit all raw data (bench sheets, chromatograms, etc.), but rather the full CLP data package is to be stored at the laboratory in anticipated of the data or selected portions of the data to undergo this validation process at a later date if necessary. Information will be available from the laboratory to conduct a systematic review of the data

for compliance with the established QC criteria based on the spike, duplicate and blank results provided by the laboratory. Information to complete an evaluation of data accuracy, precision, sensitivity and completeness, based on criteria in Section 3, will be available so this evaluation could be performed and presented in a future report.

Data generated for the Refuse Hideaway Landfill investigation will be computerized in a format organized to facilitate data review and evaluation. Specifically, the data will be presented in the WDNR Groundwater Information Network Format as requested by the WDNR. The computerized data set will include the data flags provided by the laboratory (Southwest Laboratory of Oklahoma, Inc.) in accordance with the National Functional Guidelines for Organic Data Review, June 1991 and Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (July 1988), as well as additional comments of the Data Reviewer. The laboratory-provided data flags will include such items as: 1) concentration below required detection limit, 2) estimated concentration due to poor spike recovery, and 3) concentration of chemical also found in laboratory blank. Information will be available so that upon future validation, the Data Validator comments could indicate that the data are: 1) usable as a quantitative concentration, 2) usable with caution as an estimated concentration, or 3) unusable due to out-of-control QC results.

The Refuse Hideaway Landfill investigation data set will be available for controlled access by the Site Manager, and authorized personnel using a site-specific code. The complete data set will also be forwarded to the WDNR for review.

10.0 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the QAPjP. The audits of field and laboratory activities include two separate independent parts: Internal and External audits.

10.1 Field Audits

Internal audits of field activities (sampling and measurements) will be conducted by the Simon Hydro-Search Field Leader. The audits will include examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain of custody, etc. These audits will be occur at the onset of the project to verify that established procedures are followed. Follow-up audits will be conducted to correct deficiencies, and to verify that QA procedures are maintained throughout the investigation. The audits will involve review of field measurement records, instrumentation calibration records, and sample documentation.

External audits may be conducted by the WDNR.

10.2 Laboratory Audits

The internal performance and system audits of the laboratory will be completed through Simon Hydro-Search's QA officers review and approval of the laboratory's SOPs. The system audits, which will be done on a periodic basis, will include examination laboratory documentation on sample receiving, sample log-in, sample storage, chain of custody procedure, sample preparation and analysis, instrument operating records, etc.

External performance and system audits of the laboratory selected for the project for approval/disapproval will be conducted by the WDNR or U.S. EPA. As part of the U.S. EPA's performance evaluations and audits required for Southwest's contract with the U.S. EPA's Contract Laboratory Program (CLP). The CLP Routine Analytical Services (RAS) and Special Analytical Service (SAS) laboratories are audited on a regular basis by the U.S. EPA. The U.S. EPA EMSL-Las Vegas conducts system audits of the CLP laboratories on an annual basis and conducts performance audits on a quarterly basis.

11.0 PREVENTATIVE MAINTENANCE PROCEDURES

11.1 Field Equipment/Instruments

The field equipment for this project includes thermometers, pH meter, and conductivity meter. Specific preventative maintenance procedures to be followed for field equipment are those recommended by the manufacturer.

Field instruments will be checked and calibrated in the Warehouse before they are shipped or carried to the field. These instruments will be checked and calibrated daily before use. Calibration checks will be performed after every 10 samples and will be documented on the Field Meter/Calibration Log Sheets. (An example field/meter calibration log sheet is included in Appendix A.)

Critical spare parts such as pH probes, electrodes and batteries will be kept on-site to minimize instrument down time. Backup instruments and equipment should be available on-site or within one-day shipment to avoid delays in the field schedule.

11.2 Laboratory Instruments

As part of their QA/QC Program, a routine preventative maintenance program is conducted by the laboratory to minimize the occurrence of instrument failure and other system malfunctions. The laboratory performs routine scheduled maintenance. Laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument service logbook for each instrument. Emergency repair or scheduled manufacture's maintenance is provided under a repair and maintenance contract with factory representatives. Routine Preventative Maintenance Procedures and Schedules are included in Appendix B.

12.0 SPECIFIC ROUTINE PROCEDURES TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

12.1 Field Measurements

Field data will be assessed by the site QC Officer. Field data will be reviewed for compliance with the established QC criteria that are specified in the QAPjP. Accuracy and precision of the field measurements will be assessed by reviewing daily instrument calibration, calibration checks, field duplicate data, and field blank data.

Data completeness will be calculated using Equation 12-1.

$$Completeness = \frac{Valid\ Data\ Obtained}{Total\ Data\ Planned} \times 100 \qquad Equation\ 12\text{-}1$$

12.2 Laboratory Data

Laboratory results will be assessed for compliance with required precision, accuracy, completeness and sensitivity.

12.2.1 Precision

Precision of laboratory analysis will be assessed by comparing the analytical results between LCS/LCSD for organic analysis, and laboratory duplicate analyses for inorganic analysis. The relative percent difference (%RPD) will be calculated for each pair of duplicate analysis using the Equation 12-2.

$$\%RPD = \frac{S - D}{(S + D)/2} \times 100 \qquad Equation\ 12\text{-}2$$

Where:

S = First sample value (original or LCS value)

D = Second sample value (duplicate or LCSD value)

12.2.2 Accuracy

Accuracy of laboratory results will be assessed for compliance with the established QC criteria that are described in Section 3.0 of the QAPjP using the analytical results of method blanks, reagent/preparation blank, LCS/LCSD samples, and field blank. Bottle blanks will not be analyzed. All bottles will be obtained by the laboratory from commercial suppliers who will provide certificates of analysis to the laboratory stating the bottles are clean. The percent recovery (%R) of matrix spike samples will be calculated using Equation 12-3.

$$\%R = \frac{A - B}{C} \times 100 \qquad Equation\ 12\text{-}3$$

Where:

A = The analyte concentration determined experimentally from the spiked sample;

B = The background level determined by a separate analysis of the unspiked sample and;

C = The amount of the spike added.

12.2.3 Completeness

The data completeness of laboratory analyses results will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using Equation 12-1.

12.2.4 Sensitivity

The achievement of method detection limits depend on instrumental sensitivity and matrix effects. Therefore it is important to monitor the instrumental sensitivity to ensure the data quality through constant instrument performance. The instrumental sensitivity will be monitored through the analysis of method blank, calibration check sample, and laboratory control samples, etc.

13.0 CORRECTIVE ACTIONS

Corrective actions may be required for two classes of problems: analytical and equipment problems and noncompliance problems. Analytical and equipment problems may occur during sampling and sample handling, sample preparation, laboratory instrumental analysis, and data review.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the Project QA Director. If the problem is analytical in nature, the Project QA Director will implement proper corrective action. Information on these problems will be promptly communicated to the WDNR Project Manager. Implementation of corrective action will be confirmed in writing through the same channels.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by stop-work order by the State Project Manager.

13.1 Sample Collection/Field Measurements

Technical staff and project personnel will be responsible for reporting suspected technical or QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the Site Manager or designee. This manager will be responsible for assessing the suspected problems in consultation with the Project QA Director on making a decision based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, then a nonconformance report will be initiated by the manager.

The manager will be responsible for ensuring that corrective action for nonconformances are initiated by:

- evaluating reported nonconformances;
- controlling additional work on nonconforming items;
- determining disposition or action to be taken;
- maintaining a log of nonconformances;
- reviewing nonconformance reports and corrective actions taken; and,
- ensuring nonconformance reports are included in the final site documentation in project files.

If appropriate, the Site Manager will ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed.

Corrective action for field measurements may include:

- Repeat the measurement to check the error;
- Check for proper adjustments for ambient conditions such as temperature;
- Check the batteries;
- Re-Calibration;
- Check the calibration;
- Replace the instrument or measurement devices;
- Stop work (if necessary).

The Site Manager is responsible for site activities. In this role, the Site Manager at times is required to adjust the site programs to accommodate site specific needs. When it becomes necessary to modify a program, the responsible person notifies the Site Manager of the anticipated change and implements the necessary changes after obtaining the approval of the Site Manager. The approval of the State Project Manager will also be required before program changes in the field may be made. The change in the program will be

documented on the field change request (FCR) that will be signed by the initiators and the Field Leader. The FCR for each document will be numbered serially as required. The FCR shall be attached to the file copy of the affected document. The Site Manager must approve the change in writing or verbally prior to field implementation , if feasible. If unacceptable, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices and action taken.

The Site Manager for the Refuse Hideaway Landfill site is responsible for the controlling, tracking, and implementation of the identified changes. Reports on changes will be distributed to affected parties which include the WDNR Project Manager. The WDNR Project Manager will be notified whenever program changes in the field are made.

13.2 Laboratory Analyses

Laboratory Corrective Action

Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The investigative action taken is somewhat dependent on the analysis and the event.

Laboratory personnel are alerted that corrective actions may be necessary if:

- QC data are outside the warning or acceptable windows for precision and accuracy;
- Blanks contain target analytes above acceptable levels;
- Undesirable trends are detected in spike recoveries or RPD between duplicates;
- There are unusual changes in detection limits;

- Deficiencies are detected by the QA Department during internal or external audits or from the results of performance evaluation samples; or

- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the laboratory supervisor, manager and/or QA Manager for further investigation. Once resolved, full documentation of the corrective action procedure is filed with the Contractor's QA Officer and the WDNR Project Manager.

13.3 Corrective Action

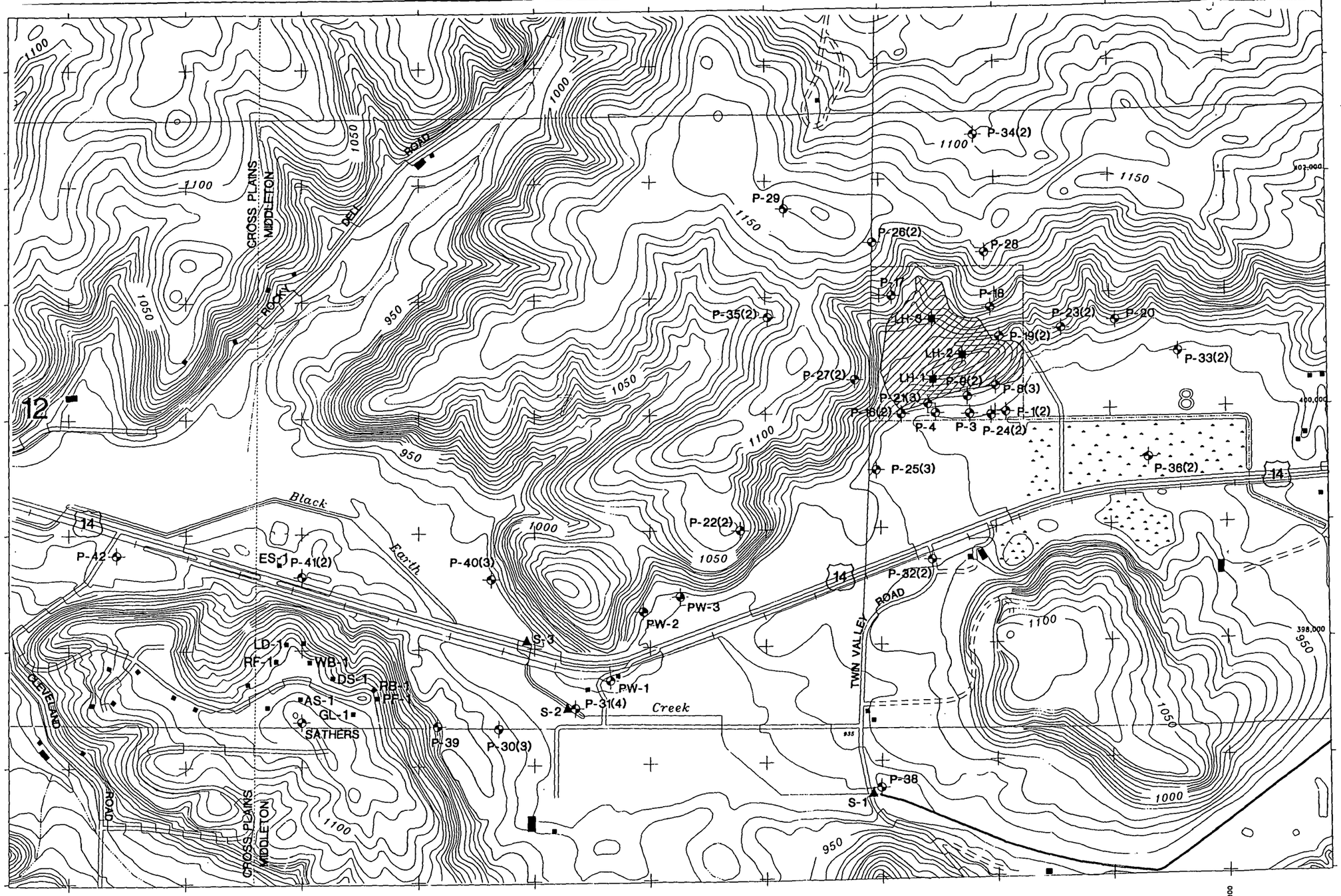
If a quality control audit reveals results in detection of unacceptable conditions or data, the QA officer will be responsible for developing and initiating corrective action. Corrective action may include:

1. Reanalysis if the holding time permits,
2. Resampling and analysis,
3. Evaluating and amending the sampling and analysis procedures,
4. Accepting data acknowledging the level of uncertainty.

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

In addition to the audit reports submitted to the site manager in accordance with QAPjP Section 12, a progress report is submitted to the WDNR Project Manager and the Simon Hydro-Search Management, which addresses Quality Assurance issues. The data submission will contain QA sections that summarize data quality information collected during the project. This will include the following, as available:

- Changes in QA Project Plan;
- Summary of QA/QC programs, training, and accomplishments;
- Results of technical systems and performance evaluation audits;
- Significant QA/QC problems, recommended solutions, and results of corrective actions;
- Data quality assessment in terms of precision, accuracy, representativeness, completeness, comparability, and method detection limit;
- Indication of whether the QA objectives were met; and
- Limitations on use of the measurement data.



EXPLANATION

- REFUSE HIDEAWAY LANDFILL PROPERTY BOUNDARY
- FILL LIMITS
- RESIDENCE
- P-19(2) MONITOR WELL LOCATION AND DESIGNATION (number of wells in nest)
- PW-1 PRIVATE WELL LOCATION AND DESIGNATION
- LH-1 LEACHATE HEAD WELL LOCATION AND DESIGNATION
- S-1 STREAM GAGE LOCATION AND DESIGNATION

SCALE

0 2000

FEET

Base map compiled from U.S.G.S. 7.5' Middleton, WI topographic quadrangle map, 1983.
Contour interval 10 feet. National Geodetic Vertical Datum of 1929.

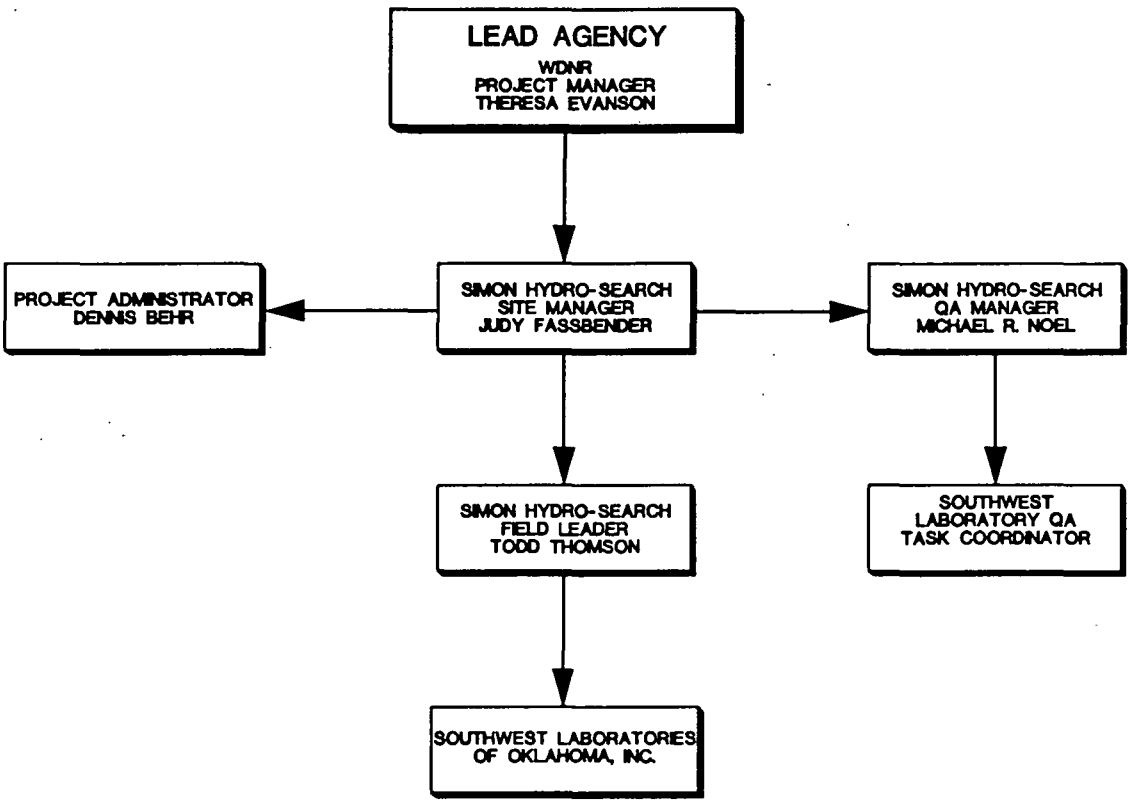
WI DEPT. OF NATURAL RESOURCES
REFUSE HIDEAWAY LANDFILL

EXISTING CONDITIONS
March 1991

PROJECT: 148E13873 | DWG: 1387-P1 | DATE: 04/12/91

Hydro-Search, Inc.
HYDROLOGISTS-GEOLOGISTS-ENGINEERS
Reno Denver Milwaukee Irvine

PLATE: II



SIMON HYDRO-SEARCH

Brookfield Lakes Corporate Center XII
175 N. Corporate Drive, Suite 100
Brookfield, Wisconsin 53045

REFUSE HIDEAWAY LANDFILL
MIDDLETON, WISCONSIN

PROJECT ORGANIZATION AND PERSONNEL

Dsgn. by:	Chk. by:	Apprv. by:
PROJECT: 301483093	DATE: 04/29/93	
DRAWING: 3093-PROJOR	FIGURE: QAPP 2-1	

/hsi/3093/flow-chart/3093-projor

QAPP Table 1-1. Ground-Water Sampling Locations, Refuse Hideaway Landfill

WELL NO.	WELL DEPTH (feet)[1]	DEPTH TO GROUND WATER (feet)[1]	APPROXIMATE PURGE VOLUME (gal)[2]	DEDICATED QED SYSTEM[3]
P-17S	158.75	145	8.2	Yes
P-21S	19.6	16.27	2.2	No
P-21D	41.61	15.2	17.2	No
P-20SR	64.41	45.78	11.1	No
P-26S	237.58	224.78	7.6	No
P-26D	262.13	231.04	18.5	No
P-27S	188.83	180.92	4.7	Yes
P-27D	204.28	181.41	7.5	Yes + p.m.
P-22S	185.15	178.4	4.0	Yes
P-22D	217.34	179.23	7.0	Yes + p.m.
P-29	253.10	246.52	3.9	Yes
P-30I	140.74	25.63	9.0	Yes + p.m.
P-31IA	93.24	11.28	8.5	Yes + p.m.
P-31IB	132.71	10.64	8.5	Yes + p.m.
P-31D	255.93	9.83	8.5	Yes + p.m.
P-34D	273.35	173.42	8.0	Yes + p.m.
P-40I	102.79	16.41	9.0	Yes + p.m.
P-41D	103.02	21.70	8.5	Yes + p.m.
Stoppleworth	private well			
Pauze	private well			

1 Depth in feet below top of well casing

2 4x the estimated casing volume, from "Refuse Hideaway Landfill Ground Water Monitoring Study", June 1991, Table 4-7

3 Yes indicates a bladder pump only; Yes + p.m. indicates a bladder pump and purge mizer system.

QAPP Table 1-2. Table of Samples and Matrices

Matrix	Round #	Laboratory Parameters	Inv. Samples	Field+ Duplicates	Field Blank	Matrix Total
GROUND WATER Monitor Wells	1	TCL Organics (semi-volatiles) - low levels	18	2	1*	21
		TCL Organics - Pesticides & Aroclors - low levels	3	2	1	6
		TAL Inorganics - low levels	18	2	1*	21
	2	TCL Organics (semivolatiles) - low levels	TBD	TBD	TBD	TBD
		TCL Organics - Pesticides & Aroclors - low levels	TBD	TBD	TBD	TBD
		TAL Inorganics - low levels	TBD	TBD	TBD	TBD
Private Wells	1	TCL Organics (semivolatiles) - low levels	2	1	0*	3
		TAL Inorganics - low levels	2	1	0*	3
	2	TCL Organics (semivolatiles) - low levels	TBD	TBD	TBD	TBD
		TAL Inorganics - low levels	TBD	TBD	TBD	TBD

\+ One field duplicate will be collected for each 10 or fewer investigative samples and will include at least one duplicate for each sample collection method including bailers, dedicated equipment, and private wells.

* No field blanks will be collected from private wells or from monitor wells with dedicated QED equipment because the containers are filled directly.

QAPP Table 3-1. Target Compound List for Low-Level Semi-Volatiles and Detection Limits for Water

~~List: 652 LOW CONC TCL S-V; WATER; SOW 4/90+6/91~~ SOW 10/92 U/M : ug/L

1	610	Phenol	5.
2	411	bis(2-Chloroethyl)ether	5.
3	601	2-Chlorophenol	5.
4	620	2-Methylphenol	5.
5	582	2,2'-Oxybis(1-chloropropane)	5.
6	622	4-Methylphenol	5.
7	442	N-Nitroso-di-n-propylamine	5.
8	436	Hexachloroethane	5.
9	440	Nitrobenzene	5.
10	438	Isophorone	5.
11	606	2-Nitrophenol	5.
12	603	2,4-Dimethylphenol	5.
13	410	bis(2-Chloroethoxy)methane	5.
14	602	2,4-Dichlorophenol	5.
15	446	1,2,4-Trichlorobenzene	5.
16	439	Naphthalene	5.
17	475	4-Chloroaniline	5.
18	434	Hexachlorobutadiene	5.
19	608	4-Chloro-3-methylphenol	5.
20	477	2-Methylnaphthalene	5.
21	435	Hexachlorocyclopentadiene	5.
22	611	2,4,6-Trichlorophenol	5.
23	626	2,4,5-Trichlorophenol	20.
24	416	2-Chloronaphthalene	5.
25	478	2-Nitroaniline	20.
26	425	Dimethyl phthalate	5.
27	402	Acenaphthylene	5.
28	428	2,6-Dinitrotoluene	5.
29	479	3-Nitroaniline	20.
30	401	Acenaphthene	5.
31	605	2,4-Dinitrophenol	20.
32	607	4-Nitrophenol	20.
33	476	Dibenzofuran	5.
34	427	2,4-Dinitrotoluene	5.
35	424	Diethyl phthalate	5.
36	417	4-Chlorophenyl phenyl ether	5.
37	432	Fluorene	5.
38	480	4-Nitroaniline	20.
39	604	4,6-Dinitro-2-methylphenol	20.
40	443	N-Nitrosodiphenylamine(1)	5.
41	414	4-Bromophenyl phenyl ether	5.
42	433	Hexachlorobenzene	5.
43	609	Pentachlorophenol	20.
44	444	Phenanthrene	5.
45	403	Anthracene	5.
46	426	Di-n-butyl phthalate	5.
47	431	Fluoranthene	5.
48	445	Pyrene	5.
49	415	Butyl benzyl phthalate	5.
50	423	3,3'-Dichlorobenzidine	5.
51	405	Benzo(a)anthracene	5.

QAPP Table 3-1. Target Compound List for Low Level Semi-Volatiles and Detection Limits for Water (SOW 10/92)

U/M : ug/L

			5.
1	610	Phenol	5.
2	411	bis(2-Chloroethyl)ether	5.
3	601	2-Chlorophenol	5.
4	620	2-Methylphenol	5.
5	582	2,2'-Oxybis(1-chloropropane)	5.
6	622	4-Methylphenol	5.
7	442	N-Nitroso-di-n-propylamine	5.
8	436	Hexachloroethane	5.
9	440	Nitrobenzene	5.
10	438	Isophorone	5.
11	606	2-Nitrophenol	5.
12	603	2,4-Dimethylphenol	5.
13	410	bis(2-Chloroethoxy)methane	5.
14	602	2,4-Dichlorophenol	5.
15	446	1,2,4-Trichlorobenzene	5.
16	439	Naphthalene	5.
17	475	4-Chloroaniline	5.
18	434	Hexachlorobutadiene	5.
19	608	4-Chloro-3-methylphenol	5.
20	477	2-Methylnaphthalene	5.
21	435	Hexachlorocyclopentadiene	5.
22	611	2,4,6-Trichlorophenol	20.
23	626	2,4,5-Trichlorophenol	5.
24	416	2-Chloronaphthalene	20.
25	478	2-Nitroaniline	5.
26	425	Dimethyl phthalate	5.
27	402	Acenaphthylene	5.
28	428	2,6-Dinitrotoluene	20.
29	479	3-Nitroaniline	5.
30	401	Acenaphthene	20.
31	605	2,4-Dinitrophenol	20.
32	607	4-Nitrophenol	5.
33	476	Dibenzofuran	5.
34	427	2,4-Dinitrotoluene	5.
35	424	Diethyl phthalate	5.
36	417	4-Chlorophenyl phenyl ether	5.
37	432	Fluorene	20.
38	480	4-Nitroaniline	20.
39	604	4,6-Dinitro-2-methylphenol	5.
40	443	N-Nitrosodiphenylamine(1)	5.
41	414	4-Bromophenyl phenyl ether	5.
42	433	Hexachlorobenzene	20.
43	609	Pentachlorophenol	5.
44	444	Phenanthrene	5.
45	403	Anthracene	5.
46	426	Di-n-butyl phthalate	5.
47	431	Fluoranthene	5.
48	445	Pyrene	5.
49	415	Butyl benzyl phthalate	5.
50	423	3,3'-Dichlorobenzidine	5.
51	405	Benzo(a)anthracene	

QAPP Table 3-1. Target Compound List for Low Level Semi-Volatiles and Detection Limits for Water (Cont'd)

52	418	Chrysene	5.
53	413	bis(2-Ethylhexyl)phthalate	5.
54	429	Di-n-octyl phthalate	5.
55	407	Benzo(b)fluoranthene	5.
56	409	Benzo(k)fluoranthene	5.
57	406	Benzo(a)pyrene	5.
58	437	Indeno(1,2,3-cd)pyrene	5.
59	419	Dibenzo(a,h)anthracene	5.
60	408	Benzo(g,h,i)perylene	5.

QAPP Table 3-2. Target Compound List for Low Level PCBs and Pesticides and Detection Limits for Water

Pesticides/PCBs	Quantitation Limits - Water $\mu g/\ell$
alpha -BHC	0.01
beta-BHC	0.01
delta-BHC	0.01
gamma-BHC (lindane)	0.01
Heptachlor	0.01
Aldrin	0.01
Heptachlor epoxide	0.01
Endosulfan I	0.01
Dieldrin	0.02
4,4'-DDE	0.02
Endrin	0.02
Endosulfan II	0.02
4,4'-DDD	0.02
Endosulfan sulfate	0.02
4,4'-DDT	0.02
Methoxychlor	0.10
Endrin ketone	0.02
Endrin aldehyde	0.02
alpha-Chlordane	0.01
gamma-Chlordane	0.01
Toxaphene	1.0
Aroclor-1016	0.20
Aroclor-1221	0.40
Aroclor-1232	0.20
Aroclor-1242	0.20
Aroclor-1248	0.20
Aroclor-1254	0.20
Aroclor-1260	0.20

QAPP Table 3-3. Target Analyte List and Detection Limits for Low Level Metals and Cyanide in Water Samples*

Element	Required Detection Limits (ug/l)	Analytical Method
Aluminum (Al)	100	ICP
Antimony (Sb)	5	GFAA
Arsenic (As)	2	GFAA
Barium (Ba)	20	ICP
Beryllium (Be)	1	ICP
Cadmium (Cd)	1	GFAA
Calcium (Ca)	500	ICP
Chromium (Cr)	10	ICP
Cobalt (Co)	10	ICP
Copper (Cu)	10	ICP
Iron (Fe)	100	ICP
Lead (Pb)	2	GFAA
Magnesium (Mg)	500	ICP
Manganese (Mn)	10	ICP
Mercury (Hg)	0.2	Cold Vapor AA
Nickel (Ni)	20	ICP
Potassium (K)	750	ICP
Selenium (Se)	3	GFAA
Silver (Ag)	10	ICP
Sodium (Na)	500	ICP
Thallium (Tl)	10	GFAA
Vanadium (V)	10	ICP
Zinc (Zn)	20	ICP
Cyanide (Cn)	10	Colorimetric

ICP = ICAP
GFAA = Graphic Furnace

* Water includes ground water from monitor wells and residential wells.

QAPP Table 4-1. Sample Quantities, Containers, Preservatives, and Packaging

Matrix	Analysis	Container	Preservation	Holding Time	Volume of Samples	Shipping	Normal Packaging
AQUEOUS	Semi-volatiles Low levels*	Two 1-liter amber	Iced to 4°C	5 days until extraction, analyze within 40 days	Fill bottle to neck	Federal Express Priority 1	Foam liner or vermiculite
	Pesticides and Aroclors Low levels*	Two 1-liter amber	Iced to 4°C	7 days until extraction, analyze within 40 days	Fill to shoulder of bottle	Federal Express Priority 1	Foam liner or vermiculite
	Metals Low levels*	One 1-liter HDPE bottle	Filter through 45 cm filter** HNO_3, to pH <2 iced to 4°C	6 months (28 days Hg)	Fill to shoulder of bottle	Federal Express Priority 1	Foam liner or vermiculite
	Cyanide Low levels*	Two 500-ml high density polyethylene bottles	NaOH to pH >12 Iced to 4°C	14 days	Fill to shoulder of bottle	Federal Express Priority 1	Foam liner or vermiculite

* Detection limits appropriate for drinking water

** Only ground water from monitor wells is field filtered

SIMON HYDRO-SEARCH

Simon Hydro-Search
Suite 100
175 N Corporate Drive
Brookfield, WI 53045

CHAIN-OF-CUSTODY RECORD

PROJECT NAME:

PROJECT NUMBER:

SAMPLERS (SIGNATURE)

PRINTED NAME

CLIENT ID (9 CHARACTERS)

1	2	3	4	5	6	7	8	9

#	GC/MS					GC							INORGANICS				OTHER										
No. of Bottles/Vials	624-8240	625-8270	TCL-VOA	TCL-SVOA	Other:	601-8010	602-8020	608-8080	8140	TCL PEST/PCB's	Herbicides	Other:	Metals	Cyanide	TAL Metals	Other:	TOC	TOX	Oil & Grease	Pet. Hydro.	Phenols						MATRIX: Water/Soil

SAMPLING INFO: DATE | TIME

REMARKS

RELINQUISHED BY:	Date/Time	RELINQUISHED BY:	Date/Time	RELINQUISHED BY:	Date/Time
COMPANY NAME:		COMPANY NAME:		COMPANY NAME:	
RECEIVED BY:	Date/Time	RECEIVED BY:	Date/Time	RECEIVED BY:	Date/Time
COMPANY NAME:		COMPANY NAME:		COMPANY NAME:	
RELINQUISHED BY:	Date/Time	RELINQUISHED BY:	Date/Time	RELINQUISHED BY:	Date/Time
COMPANY NAME:		COMPANY NAME:		COMPANY NAME:	

SHIPPING INFORMATION

Number of Shipping Containers-

Method of Shipment

Special Handling Requirements

Simon Hydro-Search
Suite 100
175 N Corporate Drive
Brookfield, WI 53045

CUSTODY SEAL

Signature _____ Date _____

Simon Hydro-Search
Suite 100
175 N. Corporate Drive
Brookfield, WI 53045

CUSTODY SEAL

Signature _____ Date _____

Simon Hydro-Search
Suite 100
175 N. Corporate Drive
Brookfield, WI 53045

CUSTODY SEAL

Signature _____ Date _____

91000 GROUND-WATER SAMPLING

1.0 Purpose

This manual contains detailed procedures for sampling ground water. Following these procedures will provide samples of ground water that are as representative as possible, the subsequent analysis of which will provide analytical data that is of the highest quality and fully defensible. This manual is not only intended to be used in training personnel involved in sampling, but as a reference to the proper procedures to be followed even by experienced samplers.

The objective of a ground-water monitoring program is to determine to what extent contaminants from a site are impacting the ground water. Federal, state, and local regulatory bodies have established criteria that must be met for clean up standards.

This manual provides the procedures necessary to carry out the first and most critical element in a ground-water monitoring program--the sampling. Other elements of a ground-water monitoring program can be found in the site specific Work Plan, or Quality Assurance Project Plan (QAPP), whichever is applicable.

Field forms are used to document each sampling event. Example forms are included as an attachment to this SOP. Copies of all forms must be maintained in the project files.

2.0 Preliminary Procedures

Prior to any sampling at a site, a number of preliminary tasks must be accomplished. These preliminary procedures may be done infrequently; but if done properly the first time, can insure that the subsequent sampling events are carried out smoothly and cost effectively.

WELL: _____

WATER LEVEL DATA

PROJECT: _____ WELL COORDINATES OR LOCATION: _____

PROJECT #: _____ _____

LOCATION: _____ GROUND SURFACE ELEVATION (ft. msl): _____

DATE (MM/DD/YR)	TIME (MILITARY)	*MEASURING INSTRUMENT	FIELD MEASUREMENT & SURVEY DATA			MEASURED BY	COMMENTS
			TOP OF PVC CASING ELEV. (ft. msl)	MEASURED DEPTH BELOW TOP PVC CASING (ft.)	WATER ELEVATION (ft. msl)		

* OWLP - Olympic Water Level Probe

WELL DEVELOPMENT/PURGE SUMMARY

Well _____

PROJECT: _____
PROJECT #: _____
LOCATION: _____
PERSONNEL: _____

WELL COORDINATES: _____
PVC RISER ELEVATION: _____
GROUND LEVEL ELEVATION: _____
CONSTRUCTED WELL DEPTH: _____
WELL CASING INSIDE DIAMETER: _____

INSTRUMENTS
TEMPERATURE: _____
CONDUCTIVITY: _____
pH METER: _____
WATER LEVEL PROBE: _____
OTHER: _____

Date	Time	Method	Water Level* (ft.msl)	Measured Well Depth* (ft.msl)	Volume Purged** (gallons)	Appearance Color / Odor / Clarity	pH (s.u.)	T (C)	Elec. Cond. (umhos/cm) Measured	Elec. Cond. (umhos/cm) at 25C	Comments

* Record both initial and final measurements when using as Well Development Summary.
** Purge four borehole volumes, if possible, prior to sampling.

SIMON HYDRO-SEARCH

FIELD WATER QUALITY SAMPLING AND ANALYSIS

PROJECT: _____
PROJECT #: _____
LOCATION: _____
PERSONNEL: _____

INSTRUMENTS
TEMPERATURE: _____
CONDUCTIVITY: _____
pH: _____
OTHER: _____

GENERAL: SAMPLE POINT						
WATER TYPE						
DATE						
CLOCK TIME						
WATER ELEVATION						
MEASURED WELL DEPTH						
PURGE VOL/CASING VOL(g)						
DEPTH SAMPLE TAKEN						
SAMPLING DEVICE						
FIELD TEMPERATURE (C)						
ELEC. COND. (umhos/cm)	MEASURED					
	AT 25 C					
pH						
ALKALINITY						
COLOR						
ODOR						
CLARITY						
SAMPLING PARAMETERS	# OF CONTAINERS & CONT. VOLUME; CONTAINER TYPE (A=AMBER GLASS; G=GLASS; P=PLASTIC); PRESERVATIVE TYPE - (L=LAB ADDED; F=FIELD ADDED) OR NEUTRAL; FILTERED (YES OR NO)					
LABORATORY: SENT TO: DATE SENT:						
SAMPLED BY:						

96000 DECONTAMINATION PROCEDURES

1.0 Bailers

Dedicated bailers will be provided for each well to be purged and sampled using a bailer. The bailers will be supplied contaminant-free and sealed in plastic. Prior to use, the bailers will be triple-rinsed with distilled water. Following use, the bailer will be suspended from the well cap inside the well for storage until the next sampling round. The possibility of introduction of additional external contaminants will thus be reduced. Prior to use during future sampling rounds, the bailers will again be triple-rinsed with distilled water.

2.0 Dedicated Sampling Pumps

Dedicated sampling pumps and related equipment will remain in the well at all times to avoid introduction of external contaminants. No decontamination procedures are required for sampling with the dedicated pumps.

3.0 Other Equipment

Disposable filters will be used to filter samples collected for analysis of metals. No decontamination procedures will be required. For any remaining equipment, including the peristaltic pump, decontamination will consist of an initial wash with Alconox and triple-rinsing with distilled water.

APPENDIX A
SIMON HYDRO-SEARCH
STANDARD OPERATING PROCEDURES

SIMON HYDRO-SEARCH

40500 CHAIN-OF-CUSTODY PROCEDURES

1.0 Purpose

Chain-of-custody procedures are established to provide sample integrity. Sample custody protocols will be based on procedures as described in "NEIC Policies and Procedures", EPA-330/9-78-DD1-R, Revised June, 1985. This custody is in two parts: sample collection and laboratory analysis. A sample is under a person's custody if it meets the following requirements:

- It is in the person's possession;
- It is in the person's view, after being in the person's possession;
- It was in the person's possession and it was placed in a secured location; or
- It is in a designated secure area.

2.0 Field Specific Custody Procedures

The sample packaging and shipment procedures summarized below will assure that the samples will arrive at the laboratory with the chain-of-custody intact.

Field procedures are as follows:

(a) The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

(b) All bottles should be tagged with sample numbers and locations.

(c) Sample tags should be filled out using waterproof ink for each sample.

(d) The Project Manager should review all field activities to determine whether proper custody procedures were followed during the field work and decide if additional samples are required.

Transfer of Custody and Shipment Procedures are as follows:

(a) Samples should be accompanied by a properly completed chain-of-custody form (Attachment A). The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage area.

(b) Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be locked and secured with strapping tape in at least two locations for shipment to the laboratory. Custody seals will be used for samples shipped to laboratories. When custody seals are used, two printed, numbered custody seals will be placed on each cooler and the numbers will also appear on the chain-of-custody forms, or two signed and dated seals will be placed on the cooler. Clear tape will be placed over the seals.

(c) Whenever samples are split with a source or government agency, a separate Sample Receipt is prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency should request the representative's signature

acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the "Received By" space.

(d) If the samples are sent by common carrier, a bill of lading should be used. Receipts of bills of lading will be retained as part of the permanent documentation. If sent by mail, the package will be registered with return receipt requested. Commercial carriers are not required to sign off on the custody form as long as the custody forms are sealed inside the sample cooler. Air bill information will be recorded on chain-of-custody forms.

SIMON HYDRO-SEARCH

CHAIN-OF-CUSTODY RECORD

Project No.:	Samplers: (Signature)

Station Number	Station Location	Date	Time	Sample Type Water		No. of Containers	Analysis Required
				Comp.	Grab		

SIGNATURES:

Relinquished by:	Received by:	Date/Time
Relinquished by:	Received by:	Date/Time
Relinquished by:	Received by:	Date/Time
Relinquished by:	Received by Mobile Laboratory for Field Analysis:	Date/Time
Dispatched by: Date/Time	Received for Laboratory by:	Date/Time
Method of Shipment:		

REMARKS: _____

SIMON HYDRO-SEARCH

50350 COLE-PARMER DIGITAL HANDHELD pH METER

1.0 Purpose

The pH meter is used to determine the negative log of the hydrogen ion activity concentration within a solution by measuring its acidity or alkalinity. Field pH measurements are performed on water samples. Soil pH values are determined in the laboratory. The units measured are standard units and fall on a scale of one to 14. A neutral value is 7, while acidic values are below 7, and alkaline values are above 7. The accuracy of the Cole-Parmer Digital pH Meter, which is generally used for Simon Hydro-Search field work, is ±0.1% of full scale (or ±1 digit). The accuracy of the temperature measurement is ±0.5°C.

Measurements of pH are routinely performed as part of well development and water quality sampling and analysis. The pH meter is used in well development and sampling as an indicator that stagnant ground water has been removed from the well. When replicate pH measurements stabilize and four well casing volumes have been removed, the well is considered adequately purged for sampling.

2.0 Calibration Procedure

Buffers must be kept clean and replaced prior to expiration. It is also recommended that buffers be kept at the same temperature as the samples to be measured. For a more detailed description of calibration procedures, refer to the operation manual for the Cole-Parmer Digital pH meter (Model 05669-00).

1. Connect the pH electrode (bottom terminal) and the ATC/Temperature probe (adjacent terminal) to the meter.

2. Rinse electrodes with distilled water, dry, and repeat distilled water rinse.

3. Turn the pH meter on by pressing the ON/OFF key. If the LO BAT annunciator starts to flash, the batteries must be recharged before operating the meter to avoid measurement errors. To recharge the meter, connect the adapter/recharger (right-side terminal when viewing keypad) to an AC power source. Make sure the AC line voltage is correct. The meter will continue to operate while the batteries are being charged. Press the CLEAR key.

4. While in the AUTOLOCK mode, press the MODE key until the AUTOLOCK annunciator lights and the display indicate pH.

5. Immerse the electrodes in pH 7 buffer. The display should indicate a buffer temperature. This value must be less than 60.4°C.

6. Swirl the buffer with the electrodes for several seconds and then press the STAND key. The STAND annunciator lights and the WAIT annunciator will flash, indicating that a stable reading has not been reached yet. When a stable reading is reached, the WAIT annunciator will go off. At this time, the SLOPE annunciator will flash.

7. Remove the pH and ATC probes from the pH 7 buffer, rinse with distilled water, and immerse in buffer 4 or 10. Swirl the buffer with the electrodes for several seconds.

8. Press the SLOPE key. The SLOPE annunciator will begin to flash. When a stable reading is reached, the WAIT annunciator will go off. The instrument is now dual-point calibrated and is ready to take measurements.

9. The meter will retain the calibration if turned off. Press the CLEAR key if recalibration is desired.

3.0 Measurement Procedure

The procedure for use of the digital pH meter is given below. The meter must be calibrated prior to use. Refer to the operation manual for a more detailed description of use.

1. Connect the pH and temperature electrodes to the meter.

2. Press the ON/OFF key to turn meter on. Make sure the battery is properly charged.

3. While in the AUTOLOCK mode, press the MODE key until the display indicates pH.

4. Rinse the pH and temperature electrodes with distilled water and immerse them in the sample to be measured.

5. Press the MEASURE key. The WAIT annunciator will flash until a stable reading is obtained.

6. Record the pH and temperature reading when the display reads locked.

4.0 Quality Assurance

4.1 Replicates

For water quality sampling, duplicate pH measurements will be made after every 10 sample measurements if sufficient sample is available. For well development and packer testing,

frequent pH measurements are required; therefore, no replicate measurements will be necessary.

4.2 Calibration Checks

Calibration will be performed prior to field measurements, and checked after every ten measurements using the pH 7, pH 10, or pH u4 buffer solutions. During ground-water sample collection, the calibration procedure will be performed prior to and following sampling at each well.

5.0 Data Recording

Data from pH measurements will be recorded in the field notebook and on appropriate field forms, including Well Development/Purge Summary forms and Water Quality Sampling and Analysis Forms (attached). In addition to data measurements, calibration frequency and results will be recorded.

WELL DEVELOPMENT/PURGE SUMMARY

Well _____

PROJECT: _____
PROJECT #: _____
LOCATION: _____
PERSONNEL: _____

WELL COORDINATES: _____
PVC RISER ELEVATION: _____
GROUND LEVEL ELEVATION: _____
CONSTRUCTED WELL DEPTH: _____
WELL CASING INSIDE DIAMETER: _____

INSTRUMENTS
TEMPERATURE: _____
CONDUCTIVITY: _____
pH METER: _____
WATER LEVEL PROBE: _____
OTHER: _____

Date	Time	Method	Water Level* (ft.msl)	Measured Well Depth (ft.msl)	Volume Purged** (gallons)	Appearance Color / Odor / Clarity	pH (s.u.)	T (C)	Elec. Cond. (umhos/cm) Measured	Elec. Cond. (umhos/cm) at 25C	Comments

* Record both initial and final measurements when using as Well Development Summary.
** Purge four borehole volumes, if possible, prior to sampling.

SIMON HYDRO-SEARCH

FIELD WATER QUALITY SAMPLING AND ANALYSIS

PROJECT: _____
PROJECT #: _____
LOCATION: _____
PERSONNEL: _____

INSTRUMENTS
TEMPERATURE: _____
CONDUCTIVITY: _____
pH: _____
OTHER: _____

GENERAL: SAMPLE POINT						
WATER TYPE						
DATE						
CLOCK TIME						
DEPTH TO WATER*						
MEASURED WELL DEPTH						
PURGE VOL/CASING VOL(g)						
DEPTH SAMPLE TAKEN						
SAMPLING DEVICE						
FIELD TEMPERATURE (°C)						
ELEC. COND. (umhos/cm)	MEASURED					
	AT 25°C					
pH						
ALKALINITY						
COLOR						
ODOR						
CLARITY						

SAMPLING PARAMETERS	# OF CONTAINERS & CONT. VOLUME; CONTAINER TYPE (A=AMBER GLASS; G=GLASS; P=PLASTIC); PRESERVATIVE TYPE - (L=LAB ADDED; F=FIELD ADDED) OR NEUTRAL; FILTERED (YES OR NO)				
LABORATORY: SENT TO: DATE SENT:					
SAMPLED BY:					

*Measured from top of well riser.

SIMON HYDRO-SEARCH

50400 SPECIFIC CONDUCTANCE METER (YSI MODEL 33)

1.0 Purpose

Specific conductance measurements are routinely performed during water quality sampling and during well development to determine general water quality. Specific conductance is directly dependent upon the total ionic constituents in a solution. The specific conductance of the solution is measured by sending an electric charge between two sensors in the probe. The greater the concentration of ionic constituents in the sample, the greater the ability to transmit a charge and the higher the measured conductivity.

The specific conductance meter (S-C meter) provides a semi-quantitative measurement of the total ionic content of water samples. Specific conductance is loosely related to the total dissolved solids (TDS) because generally an increase in TDS causes an increase in the concentration of ionic species, which, in turn, directly affects the conductance of the solution. The readout unit is in micromhos/centimeter (umhos/cm).

Specific conductance is temperature dependent, so a temperature measurement must be made at the time of the specific conductance measurement. A temperature compensation adjustment can then be made to allow comparison of conductivity values. Conductivity values are universally corrected to 25°C. Table 1 presents temperature compensation factors for common ground water temperature ranges. According to the manufacturer, the obtained conductivity values are reportedly accurate to ±2.5%.

2.0 Calibration Procedure

The calibration procedure is as follows:

1) Note if the needle on the unit display aligns with the "0" on the meter. If it does not, use a screwdriver and adjust the needle to "0" by turning the screw located directly below the words "S-C-T meter" on the unit display.

Table 1. Multiplication Factors for Converting Specific Conductance of Water to Values at 25°C (based on 0.01M KC1 and 0.01M $NaNO_3$ solutions)

°C	Factor	°C	Factor	°C	Factor
32	0.89	21	1.08	10	1.36
31	0.90	20	1.10	9	1.39
30	0.92	19	1.12	8	1.42
29	0.93	18	1.14	7	1.46
28	0.95	17	1.16	6	1.50
27	0.97	16	1.19	5	1.54
26	0.98	15	1.21	4	1.58
25	1.00	14	1.24	3	1.62
24	1.02	13	1.27	2	1.66
23	1.04	12	1.30	1	1.70
22	1.06	11	1.33	0	1.74
				-1	1.78

2) Plug probe into the probe jack on the side of control box.

3) Turn mode switch to "RED LINE."

4) Adjust needle using the knob labeled "RED LINE" until the needle covers the red line on the meter display.

5) If the unit will not red line, replace batteries, or try to diagnose the problem.

Calibration should be performed before every use.

3.0 Measurement Procedure

1) Plug the probe into the probe jack on the control box.

2) Calibrate the unit as described in Section 2.0.

3) Obtain a water sample in a 500 ml beaker or other container.

4) Immerse the probe in the solution.

5) Immerse thermometer in the beaker.

6) Turn the Mode switch to the setting for which the instrument needle is on scale. The greatest accuracy is obtained when the needle records in the middle of the display.

7) Allow the reading to stabilize for approximately 15 to 20 seconds.

8) Read and record the measured conductivity. Use the black scale on top of the meter gauge. If mode is set to the 10x or 100x scale, multiply value by 10 or 100. Readings are made by lining up the needle over the reflective mirror backing. Readings are in micromhos/centimeter (umhos/cm).

9) Read and record the temperature of the sample using the thermometer. Compare thermometer value to the temperature mode on the conductivity meter.

10) Turn unit off and remove the thermometer from the sample.

11) Clean the conductivity meter electrode and the thermometer by rinsing with distilled water.

12) Adjust the measured field conductivity value to the standard 25°C conductivity value.

4.0 Quality Assurance

4.1 Replicates

For water quality sampling, conductivity measurements will be made in duplicate after every ten sample measurements if sufficient sample is available. For well development and packer testing, frequent conductivity measurements are made; and therefore, no replicate measurements should be necessary.

4.2 Blanks

A distilled, deionized water blank will be kept with the S-C meter, and a "blank" measurement will be taken twice daily during meter use; prior to beginning field measurements and subsequent to all field measurements. In addition, a blank measurement will be made if field personnel suspect the S-C meter is not functioning properly.

5.0 Data Recording

Specific conductance measurement data, including blank and replicate measurements, will be recorded in the field notebook and on appropriate field forms, including Well Development/Purge Summary forms and Water Quality Sampling and Analysis forms as shown. In addition to data reading, any maintenance or measurement problems noted during field work will be recorded.

State of Wisconsin
Department of Natural Resources

MONITORING WELL DEVELOPMENT

Form 4400-113B Rev. 4-90

Route to: Solid Waste ☐ Haz. Waste ☐ Wastewater ☐
Env. Response & Repair ☐ Underground Tanks ☐ Other ☐ _____

Facility/Project Name	County Name	Well Name

Facility License, Permit or Monitoring Number	County Code	Wis. Unique Well Number	DNR Well Number
_ _ _ _ _ _ _	_ _	_ _ _ _ _ _ _ _ _ _	_ _ _ _

1. Can this well be purged dry? ☐ Yes ☐ No

2. Well development method

surged with bailer and bailed	☐	41
surged with bailer and pumped	☐	61
surged with block and bailed	☐	42
surged with block and pumped	☐	62
surged with block, bailed and pumped	☐	70
compressed air	☐	20
bailed only	☐	10
pumped only	☐	51
pumped slowly	☐	50
Other _____	☐	_ _

3. Time spent developing well _ _ _ _ min.

4. Depth of well (from top of well casisng) _ _ _ _ . _ ft

5. Inside diameter of well _ _ . _ _ in.

6. Volume of water in filter pack and well casing _ _ _ _ . _ gal.

7. Volume of water removed from well _ _ _ _ . _ gal.

8. Volume of water added (if any) _ _ _ _ . _ gal.

9. Source of water added _____

10. Analysis performed on water added? ☐ Yes ☐ No
(If yes, attach results)

	Before Development	After Development
11. Depth to Water (from top of well casing)	a. _ _ _ _ . _ _ ft.	_ _ _ _ . _ _ ft.
Date	b. _ _ / _ _ / _ _ m m d d y y	_ _ / _ _ / _ _ m m d d y y
Time	☐ a.m. c. _ _ : _ _ ☐ p.m.	☐ a.m. _ _ : _ _ ☐ p.m.
12. Sediment in well bottom	_ _ . _ inches	_ _ . _ inches
13. Water clarity	Clear ☐ 10 Turbid ☐ 15 (Describe)	Clear ☐ 20 Turbid ☐ 25 (Describe)

Fill in if drilling fluids were used and well is at solid waste facility:

14. Total suspended solids	_ _ _ _ _ . _ mg/l	_ _ _ _ _ . _ mg/l
15. COD	_ _ _ _ _ . _ mg/l	_ _ _ _ _ . _ mg/l

16. Additional comments on development

Well developed by: Person's Name and Firm

Name: _____

Firm: _____

I hereby certify that the above information is true and correct to the best of my knowledge.

Signature: _____

Print Initials: _ _ _

Firm: _____

NOTE: Shaded areas are for DNR use only. See instructions for more information including a list of county codes.

WELL DEVELOPMENT/PURGE SUMMARY

Well _____

PROJECT: _____
PROJECT #: _____
LOCATION: _____
PERSONNEL: _____

WELL COORDINATES: _____
PVC RISER ELEVATION: _____
GROUND LEVEL ELEVATION: _____
CONSTRUCTED WELL DEPTH: _____
WELL CASING INSIDE DIAMETER: _____

INSTRUMENTS
TEMPERATURE: _____
CONDUCTIVITY: _____
pH METER: _____
WATER LEVEL PROBE: _____
OTHER: _____

Date	Time	Method	Water Level* (ft.msl)	Measured Well Depth (ft.msl)	Volume Purged** (gallons)	Appearance Color / Odor / Clarity	pH (s.u.)	T (C)	Elec. Cond. (umhos/cm) Measured	Elec. Cond. (umhos/cm) at 25C	Comments

* Record both initial and final measurements when using as Well Development Summary.
** Purge four borehole volumes, if possible, prior to sampling.

SIMON HYDRO-SEARCH

FIELD WATER QUALITY SAMPLING AND ANALYSIS

PROJECT: _____
PROJECT #: _____
LOCATION: _____
PERSONNEL: _____

INSTRUMENTS
TEMPERATURE: _____
CONDUCTIVITY: _____
pH: _____
OTHER: _____

GENERAL: SAMPLE POINT						
WATER TYPE						
DATE						
CLOCK TIME						
DEPTH TO WATER*						
MEASURED WELL DEPTH						
PURGE VOL/CASING VOL(g)						
DEPTH SAMPLE TAKEN						
SAMPLING DEVICE						
FIELD TEMPERATURE (°C)						
ELEC. COND. (umhos/cm)	MEASURED					
	AT 25°C					
pH						
ALKALINITY						
COLOR						
ODOR						
CLARITY						
SAMPLING PARAMETERS	# OF CONTAINERS & CONT. VOLUME; CONTAINER TYPE (A=AMBER GLASS; G=GLASS; P=PLASTIC); PRESERVATIVE TYPE - (L=LAB ADDED; F=FIELD ADDED) OR NEUTRAL; FILTERED (YES OR NO)					
LABORATORY: SENT TO: DATE SENT:						
SAMPLED BY:						

*Measured from top of well riser.

SIMON HYDRO-SEARCH

91000 GROUND-WATER SAMPLING

1.0 Purpose

This manual contains detailed procedures for sampling ground water. Following these procedures will provide samples of ground water that are as representative as possible, the subsequent analysis of which will provide analytical data that is of the highest quality and fully defensible. This manual is not only intended to be used in training personnel involved in sampling, but as a reference to the proper procedures to be followed even by experienced samplers.

The objective of a ground-water monitoring program is to determine to what extent contaminants from a site are impacting the ground water. Federal, state, and local regulatory bodies have established criteria that must be met for clean up standards.

This manual provides the procedures necessary to carry out the first and most critical element in a ground-water monitoring program--the sampling. Other elements of a ground-water monitoring program can be found in the site specific Work Plan, or Quality Assurance Project Plan (QAPP), whichever is applicable.

Field forms are used to document each sampling event. Copies of all forms must be maintained in the project files. The required forms are discussed in ~~Work Plan or the Data Management Plan~~. Ref: QAAP or appendices

2.0 Preliminary Procedures

Prior to any sampling at a site, a number of preliminary tasks must be accomplished. These preliminary procedures may be done infrequently; but if done properly the first time, can insure that the subsequent sampling events are carried out smoothly and cost effectively.

3.0 Coordination with the Analytical Laboratory

For a scheduled sampling event, the analytical laboratory should be notified a minimum of one week prior to sampling. Sample bottles and shuttles are typically sent via courier, which requires approximately 7 days for delivery. For rapid response projects, designated by the Project Manager, shuttles and bottles can be sent express (overnight) or delivered by the lab. To minimize the need for express shipments, a limited amount of sample bottles and supplies may be stored at local labs, or at the site if storage space is available. However, short notice of a project tends to increase project costs. As much notice as possible should be given on any project.

The information described in the following paragraphs is to be defined with the laboratory or other supplier in placing an order for sample bottles.

3.1 Number of Samples and Matrix

The number of samples to be collected and analyzed including field and trip blanks, sample types and matrices (i.e., water, soil, etc.) are to be defined. It is important to identify samples which may have a complex matrix or potential interferences, such as high sulfide or chloride concentrations. These samples may require special cleanup procedures prior to analysis. The number, size, and type of sample bottles required should be determined in conjunction with the analytical laboratory prior to ordering sample bottles and preservatives.

3.2 Sample Point IDs

Sample point designations must be standardized to avoid confusion. Sample point designations are to be alpha-numeric characters. For samples which are field duplicates, the appropriate source code with the ID code is to be used.

3.3 Sampling Date(s)/Schedule

Specific dates for sample collection are to be scheduled as soon as possible. Anticipated dates for sample shuttle arrival at the laboratory(s) are identified so the laboratory manager may schedule work and reserve laboratory capacity for the project.

3.4 Turnaround

Standard turnaround times for analytical results should be within 28 days from receipt of sample by the laboratory. Exception to this may be required for unusual detection limits, odd matrices, or special compounds. Express or emergency turnaround, when required, must be identified.

3.5 Parameters to be Analyzed/Reporting Requirements

The parameters to be analyzed are to be listed by sample on the Chain-of-Custody form. Special detection limits or methodologies required must be defined under special instructions. In all cases, the Chain-of-Custody form will identify the specific U.S. EPA approved method of analysis to be performed on each sample.

3.6 Special Comments

Special instructions must also be noted. For example:

1. For rapid response projects, frozen ice packs may be received with delivery of the shuttles to the site. This must be specified;

2. Special packing requirements should be noted, e.g., bottles required for splits;

3. Special report requirements (i.e., state reporting forms, distribution of results to an attorney).

4. Known interferences or known high levels of a compound from a specified sample point should be identified so that special analytical procedures can be undertaken. For example, petroleum hydrocarbon samples should identify, if known, the type of hydrocarbon present (i.e. gasoline, fuel oil #2 etc).

5. Sample filtering procedures which are to be used in the field should be noted on the form.

4.0 Pre-Sampling Procedures

Once the wells have been located and the order placed, preplanning must be done to reduce the chance of errors and/or delays. These pre-sampling procedures include the procurement and calibration of equipment, checking sample shuttle, filling out field form, and purging the well. Each of these procedures is addressed in the following paragraphs. It is suggested that preparation for a sample event begin at least one day before the event is to take place to ensure time to accomplish all of the procedures and to leave time to correct any problems that arise.

4.1 Organizing Equipment and Materials

All equipment necessary for a sampling event should be cleaned, checked, and, if necessary, calibrated prior to going into the field. As much preparation as possible should be done ahead of time since neither the facilities nor the material required for equipment cleaning and calibration may be available at the site.

The following is a check list of equipment that may be required for a sampling event. In any case, it is a good place to start in preparing and assembling the required equipment for a sampling event.

EQUIPMENT LIST/CHECK-LIST

___ 1) Bailers:

	PVC	Stainless	Teflon
3/4"	___	___	___
1-1/2"	___	___	___
3"	___	___	___

___ 2) Dedicated pump equipment (two sets minimum): Hose
Compressor
Depth Indicator

___ 3) Pumps

___ 4) Spare parts for wells: ___pump
___hose
___rope (nylon braided)
___bailers (see above)

___ 5) Dedicated pump maintenance kit

___ 6) Field Meters: ___pH and extra electrode ___calibrated
___specific conductivity ___calibrated
___temperature ___calibrated
___batteries for meters

___ 7) Site map with well locations

___ 8) Keys for wells and gates

___ 9) Personal Protective Equipment

___ 10) Distilled Water

___ 11) Chain-of-Custody Forms, Custody Seals, if applicable, and Field Parameter Forms

___ 12) Sample shuttles and/or other packing material such as ziplock bags, bubble wrap and vermiculite

___ 13) Sample bottles

___ 14) Extra bottles including pre-filtration bottles

___ 15) Ice or ice packs

___ 16) Preservative kit,

___ 17) Pipe wrenches and tool chest

___ 18) Weighted tape

___ 19) Tape measure

___ 20) Large plastic bags (to provide clean work area)

___ 21) Watch with second hand

___ 22) Bailer retriever

___ 23) Calibrated 5 gallon bucket

___ 24) Filtering equipment

___ 25) Hand soap--to preserve sample integrity

___ 26) Disposable Latex or PVC gloves (without powder)

___ 27) Paper towels

___ 28) Tape

___ 29) Calculator

___ 30) Camera

___ 31) Conversion Chart

___ 32) Markers and pens

___ 33) Vinyl notebook with clipboard

___ 34) Required filtration list

___ 35) Field meter log books for calibration

___ 36) pH buffers - 4, 7, 10

___ 37) Specific conductivity standards

___ 38) Extension cord (if required)

___ 39) Air source and regulator (if required)

___ 40) Clean vehicle (inside and out)

___ 41) Gasoline and oil - for pump or generator if required.
Do not store near sampling equipment!

4.2 Bailers

Dedicated PVC bailers are preferable when monitoring for organics, and are appropriate for sampling all required RCRA parameters. Teflon or stainless steel bailers are the second choice. Non-dedicated bailers must be washed with a phosphate-free detergent and triple-rinsed with distilled water between wells. Dedicated bailers require no rinsing unless they are visibly contaminated by LNAPLs, in which case they should be completely decontaminated before use.

4.3 Pumps

The selection of pumps should be geared to the nature of the parameters. There are several advantages and disadvantages to each type of pump. Use of suction lift pumps may result in degassing and loss of volatile components. Portable submersible pumps are not suitable when sampling for organics if lubricants are used in the pump. Gas stripping of volatile compounds may occur with air-lift samplers and are generally not suited for pH sensitive parameters such as metals. Well Wizards or similar brands (air actuated, peristaltic pumps, constructed of PVC, stainless steel, or teflon), therefore, are the preferable equipment when pumps are needed.

When non-dedicated pumps are used, stringent cleaning procedures must be followed between sites. Before purging wells at the next site, sufficient amounts of distilled water must be flushed through the pump and tubing.

The cleaning procedures should be performed in a clean room/laboratory environment. The non-dedicated pump should be placed in a standpipe (PVC or stainless steel) filled with distilled water. (NOTE: A continual supply of distilled water must be added to the standpipe.)

Initial specific conductance and amount of distilled water used should be accurately measured and recorded in the field notebook. Pump and tubing should continue to be flushed until the specific conductance of the discharged distilled water is within ± 10 (um/cm at 25°C) of the initial measurement. Once this is achieved, the pumps and tubing should be properly stored and will be ready for use at the next site.

Decon procedures at the sample locations are equally important. To ensure the integrity of the non-dedicated pump between wells, a minimum of 3-gallons of distilled water should be used to thoroughly flush the pump and tubing before and after use in the well.

4.4 Shuttles and Sample Bottles

The sampler will be responsible for checking all sample bottles and shuttles as soon as they are received, and for preparing ice packs prior to the sampling event. They are to notify the laboratory immediately as to any problems or questions. If the sample shuttles are not shipped to the office, (i.e. the samples shuttles are shipped to the site, local laboratory, or subcontract samplers), coordination with the site is necessary to confirm arrival of the shuttles and to arrange the checking of equipment and supplies.

The Simon Hydro-Search staff person conducting the sampling should ask that the laboratory or bottle supplier notify the sampler as to delivery arrangements and correct content of all containers.

The Chain-of-Custody forms should be included with the sample shuttle and should be carefully examined. The Chain-of-Custody form must be filled out and returned with the samples.

If sample bottles are received in a shuttle, note the arrangement of the bottles and ice packs prior to removing equipment from the shuttle in order to re-pack them. Shuttles are packed for economy of space and often, unless special attention is given, it may be difficult to fit everything back into them.

An inventory of the bottles and their condition must be taken. A bottle list as well as analyses required and preservation requirements are noted on the Chain-of-Custody form in the "Sample Bottle" section. Each sample bottle is to be labelled with the Simon Hydro-Search project number.

Properly cleaned, new sample bottles must be used. The type of bottle will vary depending on the analysis required. For samples requiring preservatives, pre-measured amounts of preservatives should be included with the bottles or contained in the bottle prior to mobilization. Each bottle must be labeled to identify the preservatives which are required. Preservatives must not be introduced into bottles which do not require them. A list of sample bottles (type and size) and preservatives required for each analysis is attached.

Each shuttle which includes bottles for volatile organic analysis must also include the same volume of trip blanks as the investigative sample (usually three 40 ml vials filled with reagent free water). Each vial must be checked to ensure that the blank has no air bubbles. On occasion, due to pressure and temperature changes, small bubbles will appear in the blank. Condition of the blanks as well as any relevant information concerning condition of the shuttle should be noted on the Chain-of-Custody form.

For field blank analyses, the shuttle must include the bottles for preparing field blanks. Deionized water, used by the sampling team in the field, will be used for these samples.

Ice packs must be contained within the shuttle to help maintain the temperature as required by U.S. EPA protocol. The sampling period must be planned so that there will be adequate time to allow freezing of the ice packs. Usually a 24-hour period is required to assure that the ice pack will be frozen solid.

4.5 Equipment Storage

After all shuttles, containers, and equipment are checked or packed, they must be stored prior to the sampling event in a designated, contaminant free area.

On occasion, not all bottles and containers will be used (i.e., the well was dry and no sample was obtained). Unused shuttles and/or bottles should be returned to the laboratory they came from, if applicable, at the completion of the sampling event. The laboratory must be notified regarding the return of unused shuttles.

4.6 Calibration and Use of Meters

Field measurements along with proper documentation are integral parts of the monitoring program. Before the actual trip to the field, all equipment must be checked for possible malfunctions and cleaned.

Prior to use in the field, all meters must be calibrated by the sampling team to ensure proper working order and to render integrity to the measured values. Calibration procedures provided by the manufacturer are to be followed.

Calibration of the pH meter should be made with pH 7 and pH 10 buffers, and a pH 4 buffer as a check, or with pH 7 and pH 4 buffers, and a pH 10 buffer as a check, depending on the average expected pH values of the samples. Please note the actual pH of your buffers at the temperature used for calibration. (A chart for this is usually provided on the buffer container.) You may need to calibrate the 7 buffer to 6.95 or 7.03 or some point in between, depending on the temperature of your buffers. The measured value for the check buffer must be within the recalibration limits listed at the bottom of the page. If not, the meter must be recalibrated.

Calibration of the specific conductivity meter should be made with a standard of approximately the same conductivity as those expected at the site, and should be measured at (or converted to) 25°C. At least one additional standard must also be checked. This standard should be of the same conductivity as the original standard, but should be cooled below room temperature (refrigerated). In checking the conductivity of this cooled standard, a verification will also be made of the automatic temperature compensation of the meter (or conversion calculation). The calibration check limit for this second standard should be within $\pm 1\%$ of the expected value. An additional (third) standard may also be used (if desired). In this case, a standard of higher or lower conductivity than the original standard should be used. The calibration check limit for this third standard should be within $\pm 5\%$ of the expected value.

When rechecking the calibration of the field meters, the pH reading must be within ± 0.1 pH unit of the expected value (i.e., pH 4 buffer, calibrated to within pH 3.90-4.10). The specific conductivity value must be within $\pm 5\%$ of the expected value (i.e., 1,413 μmhos/cm standard, calibrated to within 1,342-1,484). If the recheck of the calibration of the instrument does not fall within these limits, the instrument must be recalibrated. The calibration of the field instruments must be checked every 4 hours and at the end of the day. If the calibration check is not within the limits listed above, the meter must be recalibrated.

The specific conductance of the deionized (DI) water being used in the field is measured and recorded each morning. The daily conductivity values are placed in the log book of the meter which is used (field or laboratory). If the specific conductance of the DI water is greater than 50 μmhos/cm at 25°C, the project manager should be contacted immediately. The DI water should not be used. DI water should then be obtained from an alternative source (local laboratory, etc.) until the problem can be corrected.

Thermometers will be checked before each sampling event for accuracy against a National Bureau of Standards (NBS) calibrated thermometer, and recorded in the field meter log.

5.0 Field Records

Improper documentation or inadequate information regarding the circumstances of collection and/or subsequent disposition of the samples (i.e., Chain-of-Custody) may render any resulting data useless. Proper Chain-of-Custody documentation is crucial as part of the QA/QC program. Comprehensive, consistent, and accurate documentation of field tests, measurements, and field observations is also extremely important.

Two forms must be filled out by the sampler during a sampling event. A Chain-of-Custody form and Well Purge form are maintained for each sample. The original Chain-of-Custody must be sent with the samples to the laboratory. Under no circumstances will samples be analyzed without these forms. These forms must be completed with ink only. Pencils/felt-tip pens should not be used. Appropriate forms may include consultants' forms, state forms, and/or federal forms. Copies of all completed forms are to be maintained in the Project Master File for easy reference. Analytical data must also be maintained in the project files.

5.1 Chain-of-Custody Form

In order to maintain the integrity of the samples, strict Chain-of-Custody procedures are necessary to ensure that tampering with the samples has not occurred.

From the time the sample bottles leave the laboratory until the issuing of the analytical laboratory results, the samples and/or sample containers must be in the custody of assigned Simon Hydro-Search personnel. Chain-of-Custody is discussed in more detail in the site specific Work Plans or the QAPP. Failure to complete the Chain-of-Custody form will render the data useless.

5.2 Well Purge Form

The Well Purge form contains information regarding site and well conditions, sampling and purging procedures used, and field measurements. The Well Purge form must be filled out by the sample collector for each sample point and placed in the project master file.

Sample Point

The sample point ID are contained on the Chain-of-Custody form for the sample. All sample point ID's must be identical to the codes in the Chain-of-Custody form.

Purging Information

This section should be completed if the sample points are wells. All wells must be purged prior to sampling. The date and time the well was purged, the elapsed time for purging, the volume of water in the casing (gallons), and the volume purged (number of gallons) must be documented.

The field sampling and analysis form must document the purging data and indicate if the well was dry and if a sample was or was not collected.

Sampling Information

The types and materials of construction of equipment used for collection is to be documented. If Well Wizard or similar pumps are used, the tubing material must be documented. If a code number does not correspond to the actual material, then a written description must be provided.

Field Measurements

For ground-water sampling events, the ground-water elevation (depth to ground water adjusted to msl), temperature, pH, and specific conductance at 25°C are to be determined. Additional parameters, e.g., color, odor, and turbidity, may also be required. Space is provided for these additional parameters. The units and values of these measurements are to be noted. The site-specific sampling plan may require additional field parameters which should also be noted.

Field Comments

The section on field comments should include field observations such as:

- Condition of the well and dedicated equipment
- Weather condition--wind direction and speed, upwind activities, rain, snow, temperature, cloud cover, barometric pressure (where required per regulatory requirements), etc.

- Sample appearance - odor, color, turbidity

  Odor: Rotten eggs, earthy, strong, moderate, slight, metallic

  Color: True "color" is the color after the turbidity has been removed. The color observed after sampling is an "apparent color", influenced by sediment in the sample. True color may be caused by metallic ions, humus, peat, industrial chemicals. Hold the sample up to the light and describe the color as well as possible. Observations may include: no color (clear), brown, gray, yellow etc.

  Turbidity: None--sample is clear.

  Trace: Sediment only slightly clouds or colors the sample. Sediment does not accumulate at bottom of bottle.

  Moderate: Definite cloudiness/color. Sediment accumulates at bottom of sample bottle.

  High: Muddy appearance.

- Reference point for well measurements.

- Well ID where field blank is prepared.

- All calculations for purge volumes and temperature conversions, as well as if well was purged dry, or an explanation when less than 4 casing volumes are removed.

- Duplicate field measurement results.

- Other conditions, such as sample splits with regulatory agencies, potential safety or health hazards (i.e., fire ants, dry well etc.).

  NOTE: When samples are split with regulatory agencies, note the condition of the bottles, preservatives used, etc., by the agency on the summary sheet.

6.0 Well Observations and Measurements

It is very important during each sampling event that various observations concerning the condition of the well be made. Also required are specific measurements during a sampling event such as purge volume, water level, and depth of well. These observations and measurements are all documented on the well purge form.

6.1 Observe Maintenance Conditions at Well

The conditions of the well and its surrounding area are observed and recorded on the Well Purge form upon arrival at the well location. The following information should be noted:

- The presence and condition of the well's identification sign.

- Was the well recently painted?

- Is the well locked and does the key work?

- Well integrity.

- Physical surroundings (high weeds, standing water, cleanliness, activities nearby).
- Condition of dedicated pump or dedicated bailer?
- Obstructions or kinks in well casing?
- Condition of cement footing--cracked, raised?
- Water in annular space?
- Grease around top of well on threaded caps?
- Weather conditions: include wind direction for volatiles and note if sampling was performed downwind.
- Evidence of contamination: animal or insect parts in well, etc.
- Well guard post's condition.

6.2 Measurements to Determine Purge Volume

The elevation of the ground water at each monitoring well is determined for each sampling event. Measurement of the static water level is taken prior to well purging and sample withdrawal. The elevation of the ground water is then determined by the following equation:

Ground-Water Elevation (msl) =

Elevation at top of casing (ft msl) - Depth to water (ft)

Note: All well measurements must be made from the point at which the elevation was measured (i.e., top of well casing). This point must be noted in the comments section of the well purge form.

Static Water Level Measurements

If wells have not been equipped with dedicated systems which contain static head sensors to measure depth, a water level or slope indicator (or similar device), is used to determine the static level of water in the well, as well as the total depth of the well. Water level indicators with lead weights should not be used.

A slope indicator works on a conductivity principle -- an alarm sounds and a red light is illuminated when the probe comes in contact with the water. The cable is permanently marked in increments of 0.02 foot (0-150 feet). To measure the static water level with a slope indicator, the procedure below should be followed:

1) Rinse the slope indicator cable off with distilled water. Shake all excess water.

2) Switch the sensitivity dial to high. Depress the red button. The red light should be illuminated and a buzzing should be heard. This will ensure that the meter is working.

3) Slowly unreel the cable in the well until the buzzing sound can be heard and the illuminated red light on the meter is observed.

4) Slowly raise and lower the cable to a point when the buzzer and light (together) just begin. This indicates the static water level.

5) Using the thumb and an index finger, mark this position on the cable--using as a reference point, the point at which the elevation has been measured.

6) Record the measurement to the nearest 0.01 feet on the field parameter form.

7) Rinse the slope indicator off with distilled water after reeling the cable back onto the spool.

8) Shake off all excess water.

Depth of Well Measurements

This measurement is required. Wells with dedicated pumps installed are exempt from this measurement. The depth of well, when not measured, should be obtained from the Well Construction Log and noted on the Well Purge form and also noted in the comments section, "from Well Construction Log."

Use of slope indicator for measuring the depth of the well is not as accurate as the water level measurement, as the bottom is determined entirely by "feel". This measurement should be reported to the nearest 0.1 foot and is used to calculate the volume of water in the casing for purging operations.

1) After a recording of the static water level, unreel the cable or tape, until it hits the bottom of the well.

2) Slowly pull up the slack until slight tension is felt on the cable.

3) Slowly raise up and down until a feel for the bottom is obtained.

4) Using as a reference point the point at which the elevation has been measured, mark the cable using a finger, and measure as for the water level.

5) Reel the cable back on the spool, rinse with distilled water, and shake off all excess water.

6) Record measurement on Field Parameter form.

6.3 Detection of Immiscible Layers

If a light or dense immiscible layer is encountered or suspected to be encountered in a well, the well will be tested for the presence of immiscible layers using an interface probe. The interface probe will be lowered into the well to the static fluid level as determined by the probe. The interface probe will then be slowly lowered into the fluid to complete an electrical connection. The probe indicates an organic compound by one type of tone or light, and water by a different tone or light. The interface probe is slowly lowered to the base of the well or piezometer to determine if a dense immiscible phase is present, and to determine the total well depth. By measuring the length of cable in the well at each interface, the thickness and elevation of each layer can be determined.

6.4 Additional Field Measurements

At this time, stick-up and casing size are measured and recorded on the Well Purge form. Additional sampling and purging information, as listed on this form, should also be recorded (i.e., sampler type, material, etc.)

7.0 Purging the Well

7.1 General

Monitoring wells should be pumped or bailed prior to sample withdrawal to safeguard against collecting non-representative stagnant water in a sample. As a general rule, pump or bail a minimum volume of 4 times the volume of water standing in the well (for moderate to high yield formations) and at least one casing volume for low yield formations (those with slow recharge). Well purging should be sufficient to ensure that water which is representative of the ground water has entered the well.

If a monitoring well is a very low yield well, bail the volume of water standing in the well and allow the well to recharge for 24 hours. If there is insufficient water for sampling any parameter, then the well is considered dry for the sampling event. If the volume of water available is insufficient for filling all of the sample containers, portions of the sample are to be collected (unless otherwise specified by the regulatory agency or the Project Manager). In all of these situations, notify the Project Manager immediately.

NOTE: Clay till wells may be allowed to recharge for three (3) days, or as otherwise specified by the Site Specific Sampling Plan.

7.2 Calculating Purge Volume

To determine the volume of water to be purged, calculate:

h = # of feet in water column = total well depth (ft)* - depth to water (ft)

1 Casing Volume = $\pi r^2 h$ = π (1/2 well ID)^{2}h*

Purge volume = 4 casing volumes

* From the Well ID chart, or as measured.

NOTE: Purge volume calculation must be made in equivalent units, so if feet of water is used for h, well diameter must be converted to feet (i.e., 2" ID well = 1" radius = 0.083' radius; therefore r^2 for 2" ID well = 0.0069', and for each 1-foot of water in a well $\pi r^2(1)$ = 0.022 ft^3 (7.48 gal/ft^3) = 0.16 gal).

Example:

FIELD MEASUREMENTS

Well Elevation (ft/msl)	48.56	Well Depth (ft) 27.0*
Depth to Ground Water	3.63	
Ground-Water Elevation (ft/msl)	44.93	*From Well Construction Log

FIELD COMMENTS

2" well casing

h = 27.0 - 3.63 = 23.37 feet of water in column

1 well volume = $\pi\{(1/2 \times 2 \text{ in.})\ (1 \text{ ft}/12 \text{ in.})]^2\ (23.37 \text{ ft.})\ (7.48 \text{ gal}/\text{ft}^3)$

= 3.8 or approximately 4 gallons

Purge volume = 4 well volumes = 16 gallons

The recovery time may be noted on the Well Purge form in the "other" section. This should initially be determined during development of a newly installed well.

7.3 Purging the Well

After necessary field measurements are made and the volume of water to be purged is determined, the purging process is begun.

The single most important objective while purging a well is minimizing contamination. Equipment should never touch the ground or any other possible contamination sources. For example, a fiber drum lined with a new plastic bag may be used to collect the rope in when using a bailer. Purged water should be discarded away from the well footing or in the manner described in the site specific work plan. This will prevent the possibility of contamination due to the formation of mud.

To measure the volume of water being removed from the well, a calibrated 5-gallon bucket or a known volume container may be used to collect water.

Procedure Using Bailers

When using a bailer for purging, the largest available bailer that will fit into the well should be used in order to minimize purge time.

Nylon rope, preferably braided, is to be used. It is imperative that new rope be utilized. In addition, the rope should be of adequate length and strength--thicker rope is easier to grip. The rope should be fastened to the well cap. Where this is not possible, the rope should be secured to a large spool to prevent loss of the rope and bailer in the well.

If a non-dedicated bailer is used, the bailer must be washed with a non-phosphate detergent and triple rinsed inside and out with distilled water before purging. Additionally, the people handling the bailer should wash their hands before purging the well. Disposable PVC or latex powderless gloves must be worn (the powder contains phthalates which can contaminate samples). New gloves should be used at each well or possibly changed more frequently (e.g., dirty, torn, etc.). The rope should be tied onto the bailer securely and checked with each bail during the purging process.

The purging of the well is accomplished by a repetitive lowering, raising, and dumping of the bailer.

1) Slowly lower the bailer into the well until the bailer contacts the water.

2) Allow the bailer to fill with water. The bailer will "gulp" when it is full and increased tension will be felt on the rope.

3) Pull the bailer out of the well while coiling the rope and dropping it in the plastic bag lined fiber drum.

4) Pour out the water from the bailer, into a calibrated bucket, and observe water characteristics.

5) Repeat the process until the appropriate volume of water has been purged from the well.

Suggested precautions while purging a well:

1) Lower the bailer slowly into the well;
   - ♦ so as to prevent contamination from rust or the sediment which may accumulate around the top of the well casing.
   - ♦ to minimize the upwelling of bottom sediment.
   - ♦ to minimize the possibility of the bailer becoming lodged in the well due to a kink in the well casing.
   - ♦ to minimize the chance of the rope becoming untied from the bailer.

2) Never allow the bailer to come in contact with any surface other than your gloves and the inside of the well.

3) Always be conscious of possible contamination sources (i.e., grease on well cap, etc.).

Procedure Using Non-Dedicated Pumps

Non-dedicated pumps are most often used for purging when large volumes of water must be removed from the well prior to sampling. The best, and most commonly used pumps are submersible, centrifugal pumps.

All of the equipment must be thoroughly washed using a non-phosphate detergent and rinsed with tap water followed by a distilled water rinse and air dried before using. The samplers should wash their hands before purging the well. Disposable PVC or latex powderless gloves must be worn. New gloves should be used at each well or possibly changed more frequently (e.g., dirty, torn, etc.).

Purging of the well basically involves the correct placement of the pump and turning it on.

1) Slowly lower the equipment (pump, hose, rope) into the well. All of the equipment must be lowered simultaneously to prevent possible jamming of the equipment in the well.

2) Place the pump well below the static water level head, (above the well screen in piezometers) as damage to the pump may occur if the pump is run dry for even a few seconds.

3) Turn on the pump. Purge the required volume of water.

4) Turn pump off.

5) Remove equipment from the well when purging is complete. All equipment must be removed simultaneously to prevent possible jamming of the equipment in the well.

6) Decontaminate all equipment before reusing, per the procedure for cleaning discussed above.

Dedicated Pump Procedure

Dedicated pumps involve the connection of the dedicated pump to its power source and turning it on. Electrical power sources (where possible) are preferred in order to minimize possible contamination sources.

8.0 Sampling the Well

Ground-water samples should be collected in the shortest possible time while maintaining sampling integrity.

Field Measurements

At a minimum, three field measurements must be conducted on each sample point after purging: pH, specific conductivity, and temperature. A separate bottle or beaker should be used for these measurements. These bottles may be reused, if thoroughly rinsed with distilled water before use. A phosphate detergent wash followed by a distilled water rinse may be required if the sampled waters are significantly contaminated. All results must be recorded on the Field Parameter form, noting units to three (3) significant figures.

(All pH meters must be able to provide a reading to the hundredths place [i.e., 7.14]).

When field measurements appear to be in error, all data must be discarded, new sample taken, and all new measurements made. Errors should be crossed out with one line, initialed, and the reason for the error noted. Instruments which appear to have erroneous readings should be recalibrated.

Duplicate field measurements must be taken for 1 out of every 10 samples, or at least once per day. The duplicate field measurements are recorded on the Well Purge form in the comments section.

If the values obtained are not within the normal ranges, notify the Project Manager immediately. Do not discard this sample, as regulatory requirements specify that analysis be performed on it. Additional samples may be requested by the Project Manager to ascertain the cause of abnormal readings.

For RCRA sampling, pH and conductivity measurements must be done in quadruplicate. Four measurements are to be made from one sample container. Between measurements, the instrument should be turned off, rinsed, and dried.

8.1 When Not to Sample

During a sampling event, all wells must be sampled, except in the following cases:

- Well has been destroyed or otherwise rendered useless (i.e., casing broken off or severely bent so as to preclude sampling).

- Well is dry (i.e., no water can be pumped within 24 hours of purging, or bailed without dropping the bailer all the way to the silt at the bottom of the well to obtain a partial bailer full of water, unless regulatory requirements

dictate awaiting a longer recharge time or as specified by the Project Manager).

- Well is new and has not been properly developed (pH and specific conductivity must be stabilized).

- The Project Manager states that the sampling should not be done.

8.2 Sampling

The method to be used for sampling is usually the same as that used for purging, unless otherwise specified by the Project Manager.

Procedures for sampling include the same steps as those for purging with the exception that the water removed from the well is placed in the sample bottles rather than being discharged.

8.3 Filling Sample Bottles

Sample bottles should be filled directly from the bailer or pump with a minimal amount of air contact. Volatile organics bottles should be headspace-free and are never field-filtered. Samples which require field filtration should be filtered in-line, if possible. Where in-line filtration is not available, laboratory-quality pre-filtration bottles should be used to collect samples. This is to assure that no sediment will be introduced into the filtered sample which could cause possible analytical errors. Pre-filtration bottles must be laboratory quality. Plastic containers should be used for inorganic parameters only.

When filling the sample bottles, these important procedures and precautions must be followed:

1) Bottle caps should be removed carefully so that the inside of the cap is not touched. Caps should never be put on the ground. Caps for VOA vials contain a teflon lined septum. The teflon side of the septum must be facing the sample to prevent contamination of the sample through the septum.

   Sample bottles and pre-filtration bottles must be laboratory-quality.

2) The sample bottles should be filled with a minimal amount of air contact, and without allowing the sampling equipment or personnel to contact the inside of the bottles. Tubing or hoses from pumps must not be placed into the sample bottles.

3) Samples which are to be filtered and preserved, should be placed in pre-filtration bottles and filled completely full to allow for any loss of water from sediment during filtering. Once filtered, sufficient space should be available in the sample bottles for the addition of required preservatives. The bottle caps should then be replaced tightly.

4) Samples which are not to be filtered and which have preservatives in the bottles when received should be completely filled with the sample with as little overflow as possible and bottle caps replaced tightly. If required preservatives have not been received in the bottles, the bottles should be filled with adequate space available in the bottles for the preservative to be added.

5) VOA vials must be filled so that they are "headspace free" (i.e., no air bubbles in the sample bottle). These sample bottles, therefore, need to be over-filled (water tension will maintain a convex water surface in the bottle). The caps for these bottles should be replaced gently, so as to eliminate any air bubbles in the sample. These bottles must then be checked, by inverting the bottles

and snapping them sharply with a finger. If any air bubbles appear, open the bottle, add more water, and repeat this process until all air bubbles are absent. Do not empty the bottle and refill.

6) All sample bottles, once filtered, filled, and preserved as required, must be placed into a refrigerator or cooler with ice until ready to be shipped. Samples must be shipped to the laboratory no longer than 24 hours after they are collected. Therefore, allow time a the end of the day to get the collected samples to the courier. Other samples which have shorter holding times or which are on short-turn around time should be shipped or delivered to the laboratory at the end of the sampling day.

7) Never place VOA vials in direct contact with ice packs as they may cause the sample to freeze and break the vial.

8) Sample bottles, caps, or septums which fall on the ground before filling should be thoroughly rinsed with sample water before being used.

8.4 Blanks

Field and trip blanks are used as control or external QA/QC samples to detect contamination that may be introduced in the field (either atmospheric or from sampling equipment), in transit to or from the sampling site, or in the bottle preparation, sample log-in, or sample storage sites within the laboratory. The blanks will also reflect any contamination that may occur during the analytical process.

Trip blanks are samples of reagent free water which are prepared in a controlled environment prior to field mobilization. Trip blanks must be used for samples intended for VOC analysis and are analyzed for VOCs only. Trip blanks remain with the sample bottles

while in transit to the site, during sampling, and during the return trip to the laboratory. At no time during these procedures are they opened. Upon return to the laboratory, they are analyzed as if they were another sample, receiving the same QA/QC procedures as ordinary field samples. If these samples are accidentally opened, note that on the Chain-of-Custody form and if extra trip blanks are available, discard the opened vial.

Field blanks are used to determine if decontamination procedures are being carried out properly and there is no "carryover" from one aqueous sample to another. When sample bottles are filled directly and do not come in contact with sampling or filtering apparatus, field blanks are not required.

Field blanks are prepared in the field (at the sampling site) using empty bottles and distilled water used for cleaning sampling equipment. Procedures may vary from site to site. Check with the Project Manager prior to sampling, and note on the Well Purge form if procedures other than those listed below are followed. The well at which the field blank is prepared must be noted in the comments section of the Well Purge form.

For non-dedicated sampling equipment, the deionized water is purged into the sampling device (e.g., bailer) after it has been cleaned in preparation for the next sample point. If the parameter of the field blank would normally be filtered, this water should then be placed into a pre-filtration bottle and then filtered. This water, or the unfiltered water, should then be placed into the field blank bottles and the proper preservative added if required.

For new dedicated sampling equipment such as dedicated bailers, the deionized water is purged into the sampling device, transferred to the field blank bottles, and the proper preservative added if required. This is done prior to sampling to ascertain if the sampling device was clean to begin with. Field blanks will be analyzed for all parameters that the field samples are analyzed for.

Field and trip blanks are used to detect contamination which may have been introduced during field and analytical steps and to assess the performance of the analytical procedures. Field and trip blanks are required as part of the QA/QC procedures for the overall sampling and analytical program. One field blank is required for every ten samples and one trip blank is required for each sample shipment cooler or shuttle containing aqueous or gas samples for VOC analysis.

8.5 Duplicate Samples

The sampling personnel are responsible for submitting one duplicate sample for every ten or fewer samples collected for each matrix. Duplicate samples will be collected at the same time and in the same manner as the normal investigative samples.

8.6 Filtration

State guidelines may vary regarding filtration of samples in the field. However, samples which must be filtered should be filtered through a 0.45 micron membrane pressure filter as described in the following pages.

Standard Procedures Not Requiring Field Filtering

- Alkalinity
- Turbidity
- Total Suspended Solids TSS
- Total Solids
- Volatile Organics, VOA's
- Cyanide
- PCBs and Pesticides
- Semi-volatiles
- Total Organic Halogen, TOX

- Total Heavy Metals
- Any Other Parameters Listed as Total (excluding TOC) refers to unfiltered samples (If it does not say Total, assume Dissolved)
- Coliform
- pH
- Specific Conductance
- Oil and Grease

Site-specific requirements must be noted on the Water Quality Sampling and Analysis form. Filtering is used in order to sample the ions and compounds that are dissolved in solution in the ground water. Monitoring wells are not as fully developed as drinking water wells and often contain silts and sediment that need to be removed by filtration. If the water is not filtered, the ions and compounds that are naturally present in, or absorbed on, the suspended particles may be released when samples are preserved and analyzed. This would result in false data for the constituents that actually are present in dissolved phase in the ground water only.

Filtration and preservation of ground-water samples is an integral part of the monitoring program. Improper techniques during this process can affect the integrity of the sample. Therefore, all possible precautions should be taken to ensure that no contamination sources are introduced during filtration or preservation.

NOTES:

- Filtering should be performed immediately upon collection of the samples. Filtration should be done in the field. Where this is not possible, it should be completed as soon as possible after the sample has been taken and should be done under the most sanitary conditions available.

- Any sample which is suspected or known to contain high contamination levels (as identified by the Project Manager), are to be filtered last to minimize the potential for possible cross-contamination.

- Surface water, private wells, and leachate samples are never filtered.

- Pre-filtration bottles are not to be reused. The use of pre-filtration bottles and bottle type (glass, plastic) must be noted on the Water Quality Sampling and Analysis form.

Filtration Equipment and Procedures

Following is a list of equipment/requirements necessary for properly filtering and preserving ground-water samples:

- 0.45 micron disposable in line filters
- Distilled water
- Pre-filtration bottles
- Peristaltic pump, if well is not equipped with dedicated pump
- Misc. supplies (paper towels, tools, markers, etc,)
- Parameter checklist as listed on the Chain-of-Custody form to ensure that there is a proper pre-filtration bottle for each analysis or series of analyses that is required for that particular sample
- Knowledge of which samples are to be filtered for each sample point
- Proper use of preservatives (type and amount)

Following is a step by step procedure for filtering and preserving a typical monitoring well sample:

1) Filters and pre-filtration bottles are dedicated to the sample point and should arrive at the site ready for use requiring no decontamination. The peristaltic pump hose may be dedicated or may be decontaminated between locations depending on site conditions.

2) Position the new bottle under the outlet valve of the disposable filter.

3) Place inlet end of the peristaltic pump hose into the full pre-filtration bottle. Pump the water from the pre-filtration bottle through the filter via the hose. A minimum of three (3) pump cycles of water must be allowed to pass through the filter before obtaining a sample.

4) When the sample bottle is full, turn the pump off.

5) Add the proper preservative, which is attached to the bottle or the filtered sample (as stated on the Chain-of-Custody form) and recap the bottle. Invert the bottle several times to mix the sample.

6) Record the necessary information on the Field Parameter form and Chain-of-Custody form after every filter change.

7) Between samples, disassemble the peristaltic pump and its hose and wash the hose with non-phosphate detergent and thoroughly rinse (a minimum of 3 times) with distilled water. Air dry.

8) Reassemble the filter apparatus and repeat steps 1 through 8 for the next sample.

It is imperative that the proper filtration and preservation techniques be strictly followed. This precise care is necessary since many parameters are measured in the 0-10 ppb range.

9.0 Sample Preservation, Storage and Shipment

For samples designated for CRL/CLP analysis, appropriate U.S. EPA protocol will be followed for sample preservation, storage, and shipment. The following sections serve as general guidelines to be followed for all samples.

9.1 Sample Preservation

Samples are to be preserved, if necessary, immediately after filtering or immediately after sample collection if not filtered. VOCs which require zero headspace (no air bubbles trapped in the sample) may have preservative included in the sample bottle prior to mobilization. During filling, do not allow this bottle to overflow any more than necessary to eliminate headspace.

Pre-measured amounts of preserving reagents should be added to the sample bottle after the bottle has been filled unless a pre-measured amount has been added to the sample bottle prior to sampling. Bottles must not be overfilled (with the exception of VOCs), and should be inverted (once capped) to mix the preservative and sample. Bottle lids must not be placed on the ground or interchanged between sample bottles. Empty preservative ampules should be returned to the shuttle with the sample bottles.

A listing of preservatives, by analysis, are included as an attachment to this SOP.

Temperature Control

Sample temperature should be maintained at 4°C from the time the sample is taken until they arrive at the laboratory. Samples should be maintained in temperature regulated refrigerators, in coolers, or shuttles containing frozen ice packs. Provisions must be made beforehand for facilities to freeze the ice packs. The recommended method is to bring coolers and ice and/or dry ice to the site.

9.2 Sample Packing and Storage

Checking Sample Codes and Numbers

The sampler must record the sample code (well ID#) in the appropriate blanks of the Chain-of-Custody, Water Quality Sampling and Analysis, and Well Purge forms, as necessary. These codes should be double checked prior to sealing the sample shuttle. In addition, Simon Hydro-Search project numbers, if assigned, must be indicated on all bottles and forms, including those from the laboratory.

ALL BOTTLES AND CORRESPONDING CHAIN-OF-CUSTODY AND FIELD PARAMETER FORMS MUST HAVE THE SAME SAMPLE POINT ID NUMBER AND SIMON HYDRO-SEARCH PROJECT NUMBER.

All bottles filled from the same sample point at the same time must have identical sample codes and sample numbers unless used for duplicate analysis, in which case a different number will be used. Bottle tags should be double checked for consistency. Samples which are split with regulatory agencies should also be checked for consistent sample point ID numbers and for other methods of identification if used by the agency.

Sample Packing

After collection of the sample and addition of the preservatives (when applicable), the bottles are sealed, tagged, and then placed into the shuttle. The frozen ice packs are then placed into the shuttle. The Chain-of-Custody form must be completed and placed into a zip-locked plastic bag and taped to the inside lid of the cooler/shuttle.

All bottles should be wiped clean prior to placement in the sample shuttle or cooler. VOA bottles should never be placed directly on the ice packs. The shuttle or cooler must be maintained as clean as possible to minimize the potential for contamination. All bottle caps should be checked to ensure they are tight and that they do not become loose upon inserting them into the shuttle. Sample tags should be taped only if they are loose.

The shipment of samples necessitates the use of containers and packing material designed to prevent breakage and spills. Tight packing materials are provided around each sample bottle. The shuttles must never be shipped without the ice packs. The packing material should be absorbent (vermiculite) and the packed cooler/shuttle should be sealed such that tampering would be evident. These will provide for Chain-of-Custody procedures.

There are three important reminders for packing the coolers/shuttles:

1) Glass should not be packed in contact with glass. Ice packs or packing sleeves should be between these bottles.
2) It may not be necessary to freeze, or freeze completely, all of the ice packs. In very cold weather for example, the ice packs should be unfrozen or slushy.
3) If the ice packs appear to be leaking, they should be sealed in a zip-lock bag.

Sample Storage

Samples should be stored at 4°C in an enclosed cooler or darkened refrigerator prior to shipment to the laboratory for analysis. Samples should be shipped daily to the laboratory, if possible, to ensure proper temperature control and to avoid exceeding holding times for samples.

9.3 Sample Shipment

Transportation Arrangements

A member of the sampling team must be designated to arrange sample pickup and transportation to the laboratory. Sampling schedules should avoid shipment of samples to the local laboratory on a Friday if at all possible, as holding times may be exceeded over a weekend. Delivery requested on the weekend must be noted on the shipping/packing label for the courier.

Samples should be shipped by overnight courier. When contacting the courier for sample transport, provide information as to the shuttle contents. Alert the courier as to potential problems of freezing of samples in the winter and of melting of ice packs in the summer and note this on the shipping/packing label. The courier must take extra steps to minimize exposure of the shuttles to temperature extremes. The shuttle must be received at the laboratory within 48 hours or less of the time the frozen ice packs were placed into the shuttle. Documentation is required for verification of the time lags.

Laboratory Sample Receipt

The laboratory will receive and log-in samples and continue to maintain the Chain-of-Custody procedures until the analyses are completed and reported.

Each laboratory, upon receipt of any sample, will record the following information on the Sample Receipt Log:

- Presence/absence of custody seal (s);
- Condition of custody seal (intact, broken);
- Presence/absence of Chain-of-Custody forms;
- Presence/absence of air bills and/or bills of lading documentation for shipment of samples.
- Condition of samples (intact, broken, obvious movement during shipment, bubbles in VOA samples or trip blanks, OK, etc.);
- Presence/absence of sample point ID numbers, where applicable, job numbers on bottles, Chain-of-Custody forms and Field Parameter forms;
- Notation of discrepancies between numbers on bottles received and those listed on the Chain-of-Custody form;
- Temperature measurement of shuttle;
- Description of preservation procedures; and
- Any problems encountered that might affect analysis.

The laboratory will contact the sampler and/or Project Manager to resolve any deficiencies. It is essential to respond quickly since analyses could be delayed beyond the allowable holding time. Complete documentation and detailed filing procedures are utilized at the sites in order to resolve these problems quickly. Sample results may be delayed by incomplete shipments which do not include all paper work. All Chain-of-Custody Forms must accompany samples.

If all samples recorded on the Chain-of-Custody form were received by the laboratory and there are no problems observed with the sample shipment, laboratory personnel will sign the Chain-of-Custody form in the "received for laboratory by" box with the date and time. If problems are noted, these will be recorded on the Chain-of-Custody form under

Laboratory Observations, and detailed on the sample receipt log in addition to the normal sign-in procedures.

The following sample information is also documented on the sample log:

- date received;
- sample matrix;
- sample volume; and
- Client sample ID with appropriate order information.

Laboratory personnel will provide feedback on the condition of the samples, field information and completeness of paperwork.

9.4 Resampling

Resampling of wells between regularly scheduled sampling events should be kept to a minimum. The decision to resample, based on the analytical results, should always be reviewed with the Project Manager. However, in cases where well samples are received broken, samples are missing, etc., the wells should generally be resampled as soon as possible.

QAPP Table 4-1. Sample Quantities, Containers, Preservatives, and Packaging

Matrix	Analysis	Container	Preservation	Holding Time	Volume of Samples	Shipping	Normal Packaging
AQUEOUS	Semi-volatiles Low levels*	Two 1-liter amber	Iced to 4°C	5 days until extraction, analyze within 40 days	Fill bottle to neck	Federal Express Priority 1	Foam liner or vermiculite
	Pesticides and Aroclors Low levels*	Two 1-liter amber	Iced to 4°C	7 days until extraction, analyze within 40 days	Fill to shoulder of bottle	Federal Express Priority 1	Foam liner or vermiculite
	Metals Low levels*	One 1-liter HDPE bottle	Filter through 45 cm filter** HNO_3, to pH <2 iced to 4°C	6 months (28 days Hg)	Fill to shoulder of bottle	Federal Express Priority 1	Foam liner or vermiculite
	Cyanide Low levels*	Two 500-ml high density polyethylene bottles	NaOH to pH >12 Iced to 4°C	14 days	Fill to shoulder of bottle	Federal Express Priority 1	Foam liner or vermiculite

* Detection limits appropriate for drinking water

** Only ground water from monitor wells is field filtered

91200 SAMPLING WITH QED WELL WIZARD™ SYSTEMS

1.0 System Description

The Well Wizard™ system is based on dedicating the water-contacting components to each well. Only the portable control elements need be transported from well to well. The Well Wizard™ system is comprised of the dedicated and portable components detailed below.

1.1 Dedicated Components

1.1.1 Pump

The Well Wizard™ pump is an air-actuated bladder pump which is permanently positioned at the desired level in the well; its intake is normally midway in the well screen section. The pump is suspended by two tubes which supply air to the pump the convey the water sample to the well cap. The pumps consist of four major components: upper and lower and check valve assemblies (one each), a bladder cartridge, and a pump body. The pump may be totally disassembled without tools by unscrewing each end cap and pushing the bladder cartridge out of the pump body. The water discharge fitting has a small diameter orifice to aid cold weather operation by allowing the water discharge line to drain after use.

The use of a bladder mechanism prevents the drive air from contacting the sample. In alternating cycles, drive air squeezes the bladder, moving water out through the top of the pump, followed by a vent cycle in which fresh water enters through the bottom of the pump. The Well Wizard™ pump may be operated dry without damage.

1.1.2 Well Cap

The well cap is fitted to the top of the well casing to protect the well from contamination. There are two terminal fittings inside the well cap plus a third optional fitting for the integral standing water level measurement. These fittings are:

1. A 1/2 inch I.D. brass compression through fitting for the water delivery line,

2. A short brass quick-connect nipple for the pump air supply line, and

3. A compression fitting with tub e stub for the static head air supply line (optional).

1.1.3 Purge Aid Devices (Optional)

Purge aid devices, such as Purge Mizers for 2 inch and 4 inch wells and Purge Master purge pumps for 2 inch and larger wells, may be installed in conjunction with dedicated Well Wizard™ sampling pumps to shorten well purge times.

1.2 Portable Components

1.2.1 Controller

The Well Wizard™ cycle controller regulates the air flow from a compressed gas source to the pump. The cycle controller alternately vents and pressurizes the pump supply air line, allowing the pump to fill with water then discharge. The duration of the pumping cycles and the rate of sample flow can be adjusted separately. Controller/driver models include an oilless compressor to power the Well Wizard™ system.

1.2.1.1 Model 3013H Automatic Controller Description

The Model 3013H automatic controller controls operation of the Well Wizard™ pump. When connected to an appropriate compressed gas source, the Model 3013H controller alternatively pressurizes then vents the air supply line to the pump. The unit is pneumatically operated and requires no electrical power supply. The duration of the pressurization and vent cycles can be adjusted to optimize the pumping rate. Figure 1 shows the control panel of the Model 3013H automatic controller and identifies the components.

It is recommended that the compressed gas source be of high quality, such as breathing air or from a oilless compressor of the type offered in the Well Wizard™ product line.

WARNING: Pressure applied to the controller must not exceed 300 psi. Higher pressures may create hazardous conditions and will void system warranties. To avoid injury, do not disconnect air connections while pressurized. Vent pressure to atmosphere before disconnection.

1.2.2 Water Level Meters

An electric water level with a conductivity probe attached to a calibrated tape will be used. A light and buzzer are activated when the probe touches the water surface.

2.0 Operating Instructions

2.1 Well Purging and Sampling

1. Attach the compressed gas source to the long quick-connect nipple labelled "pump pressure inlet" on the face of the controller panel (Figure 1) using the female portion of the coupling supplied.

2. Connect either end of the black controller air hose to the short brass quick-connect nipple labelled "pump supply" on the right side of the control panel (Figure 1). Connect the other end of the controller air hose to the same type of quick-connect nipple located in the well cap assembly.

3. To begin operation of the Well Wizard™ pump, actuate the supply of compressed gas connected to the controller. Five to 15 pumping cycles are required to purge the air from the pump and tubing. Full water flow from the sample supply tube should then begin.

4. To reduce the water flow rate during sample collection, turn the throttle control on the left side of the control panel in the counter-clockwise direction (Figure 1). For increased flow rate during well purging, turn the throttle control clockwise.

5. Position the refill and discharge control knobs at the "B" or "C" position for average well depths with refill and discharge cycle times of 10 to 12 seconds each. To optimize pumping efficiency for a specific well depth, the following three-step procedures can be followed:

   a. Adjust the refill and discharge cycles to 15 to 20 seconds each. Measure the water volume discharged in a single discharge cycle. For 1100 series pumps,

the volume should be 250 to 350 ml. Increase the refill cycle time if this volume is not achieved.

b. Shorten the discharge cycle period (by counter-clockwise knob adjustment) until the end of the discharge cycle just begins to coincide with the end of water flow from the Well Wizard™ pump outlet tube.

c. Shorten the refill cycle period until the water volume per discharge cycle decreases 10 to 25% from the maximum value measured in step a.

6. Operating Guidelines

a. Deeper wells require both the refill and discharge cycles to be lengthened by turning the control knobs clockwise.

b. The compressed gas source is applied to the Well Wizard™ pump to discharge water during the discharge cycle. The pump is vented to atmosphere to refill during the refill cycle.

c. If the controller does not sound as if it is alternating between cycles (pressurizing and venting), the control knobs are adjusted for excessively long-cycle times and should be adjusted counter-clockwise.

d. The full range of useful refill and discharge cycle lengths is 3 to 20 seconds each.

e. Higher compressed gas pressure levels provided higher pumping rates. Lower compressed gas pressure levels pump more water per unit volume of gas.

f. If the pumping rate is unsatisfactory, recheck the cycle lengths according to the three-step procedure. If the pumping rate is still unsatisfactory, check all air fitting connections for leaks.

g. Please note that a slight air leaking sound will accompany controller operation. This is a normal condition for the controller unit.

7. Maintenance

Maintenance of the controller is limited to periodic draining of the internal accumulator filter bowl. The bowl is drained by depressing the silver button on the controller panel as shown in Figure 1. It is recommended that the bowl be drained after every 1/2 hour of controller operation, especially in humid conditions. The button should be held down for five seconds while the controller is operating.

3.0 Flow Rate Optimization

The object of optimizing a purge pump is to create maximum flow rates at the pump's operating conditions. To accomplish this, both the discharge and refill times must be optimized.

To optimize the discharge and refill times, the following three steps can be followed using a controller.

1. Set the refill time long (about 15 seconds). Set the discharge time short (1 second for well depths under 50 feet; 3 seconds for well depths 50 to 100 feet; and 5 seconds for well depths over 100 feet). With these settings, it should take 5 to 15 cycles to purge the air from the discharge line depending on the pump depth. If liquid fails to discharge after 15 cycles, begin increasing the discharge times as discussed in Step

2. When liquid begins to flow from the discharge line, measure the amount of liquid being discharged per cycle. At this point, the volume measured is probably less than the internal volume of the pump being used. (Refer to Table 1 for the internal volume of your pump).

2. Now, increase the discharge time slightly (about 1/2-second increments) and allow the pump to cycle three to five times. Repeat this operation until air can be detected coming up through the discharge line in the form of bubbles. The amount of liquid being discharged per cycle should now be close to the internal volume of the pump being used. If air and water begin to burst out of the discharge line, it means that your discharge time is too long. Decrease the discharge time and repeat the initial procedures with smaller time increments (e.g.: 1/4 vs. 1/2 seconds). The discharge time of the pump should now be optimized.

3. Next, decrease the refill time slightly (about 1 second increments) and allow the pump to cycle three to five times. Repeat this operation until air can be detected coming up through the discharge line in the form of bubbles. The amount of liquid being discharged per cycle should still be close to the internal volume of the pump being used. If air and water begin to burst out hand, it means that your refill time is now too short. Lengthen the refill time and repeat the initial procedures with smaller time increments (e.g.: 1/2 vs. 1 second). Both the discharge and refill times should now be optimized.

4.0 Purge Mizer Operating Instructions

WARNING: Inflate Purge Mizer only when positioned at full depth within the well casing. Do not inflate Purge Mizer outside the well. Deflate after use.

1. Purge Mizer should be inflated after measuring water level, but before purging.

2. To inflate Purge Mizer, connect Model 4000 control unit to the mating fitting in the well cap (Figure 2). Next, connect the Model 4000 control unit to the pump supply hose of the Well Wizard™ controller.

3. Turn the pressure regulator knob on the Model 4000 control unit counter-clockwise to ensure initial inflation at low pressures (less than 30 psi).

4. Activate the compressed gas source and inflate the Purge Mizer while slowly increasing the pressure to recommended level (Table 2). Turning the control unit pressure regulator knob clockwise increases the inflation pressure. The Purge Mizer will be inflated during the controller discharge cycle which may be lengthened to speed inflation.

5. Proceed with purging and sampling. A proper performance of Purge Mizer is indicated by a steady pressure reading on the Purge Mizer control unit inflation gage.

6. After sampling is complete, fully deflate Purge Mizer by uncoupling the Model 4000 control unit.

TABLE 1

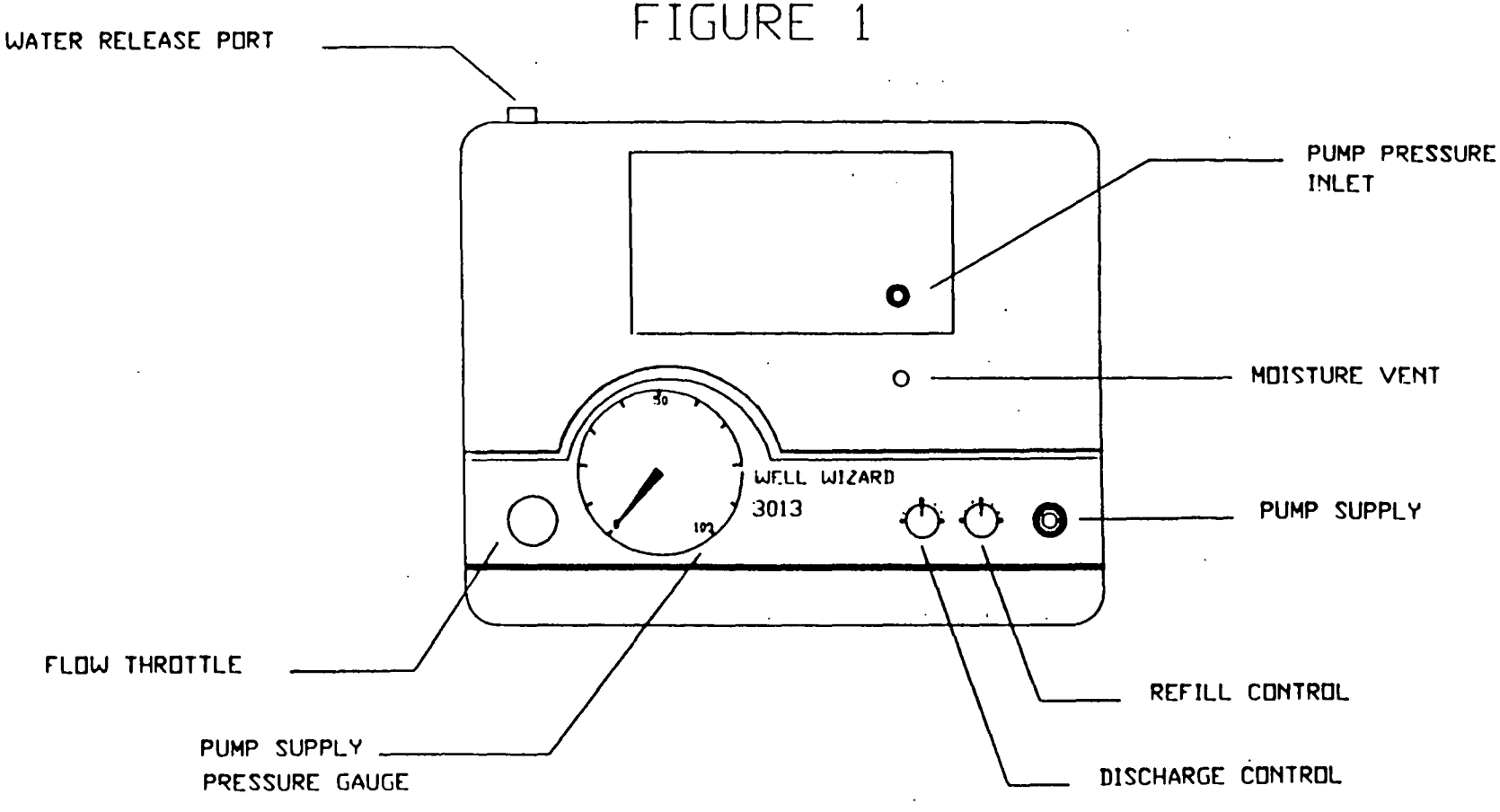
PUMP MODEL	INTERNAL VOLUME	
	LITERS	GALLONS
PULSE PUMPS		
LP1001	0.65	0.17
LP1201	0.65	0.17
LP1501	0.65	0.17
LP4600	3.50	0.92
LP1301	0.35	0.09
LP1401	0.35	0.09
PURGE PUMPS		
HR4100 (P)	1.70	0.45
HR4200 (P)	1.70	0.45
HR4500 (P)	3.50	0.92
HR4600 (P)	3.50	0.92
HR4700 (P)	3.50	9.02
WELL DEVELOPMENT PUMP		
HR4150D	1.15	0.30

Note: (P) indicates that portable pumps of the same model number are also included.

TABLE 2. PURGE MIZER INFLATION CHART

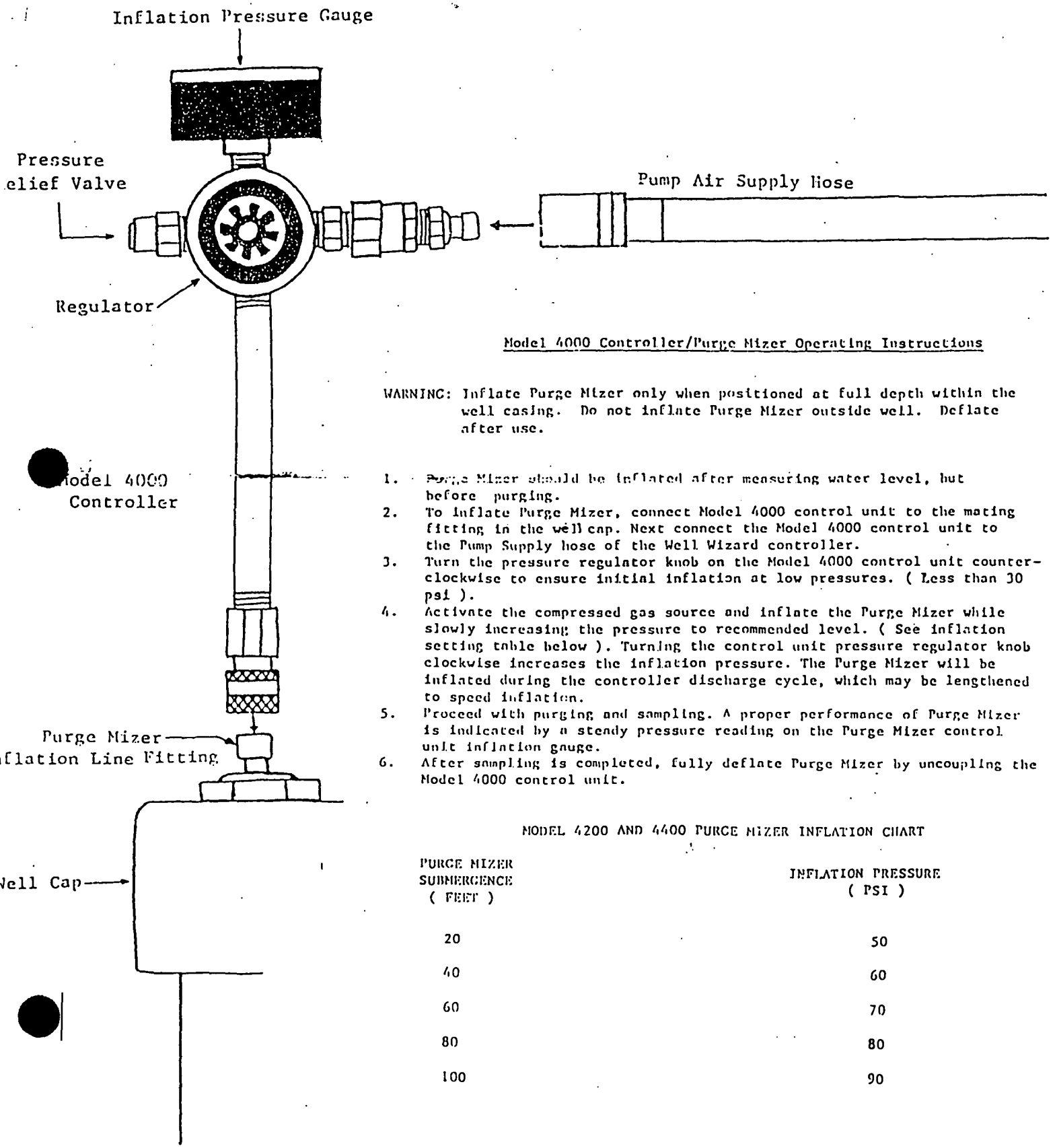
PURGE MIZER SUBMERGENCE (feet)	INFLATION PRESSURE (PSI)
20	50
40	60
60	70
80	80
100	90

FIGURE 1



Q.E.D. ENVIRONMENTAL SYSTEMS INC. 1254 N.MAIN ST.,ANN ARBOR, MI.			
TITLE: CONTROL PANEL DIAGRAM WELL WIZARD 3013 CONTOLLER			
SIZE	DATE 9/11/84	DWG. NO.	REV
SCALE N.T.S.			SHEET OF

FIGURE 2. Model 4000 Controller



Model 4000 Controller/Purge Mizer Operating Instructions

WARNING: Inflate Purge Mizer only when positioned at full depth within the well casing. Do not inflate Purge Mizer outside well. Deflate after use.

1. Purge Mizer should be inflated after measuring water level, but before purging.
2. To inflate Purge Mizer, connect Model 4000 control unit to the mating fitting in the well cap. Next connect the Model 4000 control unit to the Pump Supply hose of the Well Wizard controller.
3. Turn the pressure regulator knob on the Model 4000 control unit counter-clockwise to ensure initial inflation at low pressures. (Less than 30 psi).
4. Activate the compressed gas source and inflate the Purge Mizer while slowly increasing the pressure to recommended level. (See inflation setting table below). Turning the control unit pressure regulator knob clockwise increases the inflation pressure. The Purge Mizer will be inflated during the controller discharge cycle, which may be lengthened to speed inflation.
5. Proceed with purging and sampling. A proper performance of Purge Mizer is indicated by a steady pressure reading on the Purge Mizer control unit inflation gauge.
6. After sampling is completed, fully deflate Purge Mizer by uncoupling the Model 4000 control unit.

MODEL 4200 AND 4400 PURGE MIZER INFLATION CHART

PURGE MIZER SUBMERGENCE (FEET)	INFLATION PRESSURE (PSI)
20	50
40	60
60	70
80	80
100	90

92000 PRIVATE WELL SAMPLING AND ANALYSIS

1.0 Purpose

The following procedures will be used to collect samples from existing domestic water supplies. The primary objective of this technique is to collect a sample representative of the ground water supply and not standing water in the delivery system or well casing.

2.0 Introduction

In a non-pumped well, there will be little or no vertical mixing of the water and stratification may occur. Water in the screened section will mix with the ground water due to normal flow patterns, but the well water above the screened section will remain isolated and become stagnant. Stagnant water may contain foreign material inadvertently or deliberately introduced from the surface, resulting in nonrepresentative data and misleading interpretations.

In some cases, ground water samples from existing residential water supplies are obtained from taps or spigots on the existing delivery system. The installation of a new tap for sampling purposes is not usually warranted. Samples should be collected from the tap closest to the well as practical and upstream of any filtration or water treatment device.

In those instances where a tap or spigot is not available, the closest access point to the well head should be sampled. Notation shall be made where the closest access point for sampling involves non-pressurized piping which provides the opportunity for ground water to mix with air or where sample must be collected downstream of filtration/treatment systems.

Two separate operational steps are required to obtain a representative sample:

- Pre-sampling system purging; followed by
- Sample collection.

3.0 Pre-Sample Purging

Before any samples are collected, all standing (stagnant) water will be purged or removed from the delivery system. The volume of water contained in the well casing, pressure or holding tanks, and other plumbing and appurtenances (pipes, hoses, etc.) should be estimated.

For the purpose of this sampling program, tampering with domestic wells for the purpose of obtaining depth to water and well depth measurements shall not be performed. Well casing volumes will be determined based on drillers' logs of well depth and casing diameter and an assumed depth to ground water of 75 feet below ground surface. Water volumes contained in plumbing and appurtenances will be estimated in the field and added to the calculated well casing purge volumes.

The system shall then be purged with a minimum of three times the calculated purge volume before sampling commences. If no information regarding well depth is available, purging will be performed for 15 minutes prior to sampling. Care shall be exercised before pumping a well to preclude the possibility of overpumping. Excessive pumping can result in flow entering a well from outside the zone of interest. The purging necessary to obtain a sample representative of the ground water depends on a number of factors:

- Pump intake level;
- Specific capacity of the aquifer; and
- Well efficiency.

If the sampling tap or spigot has an aerator or filter, it shall be removed prior to purging and sampling, where possible. If the selected sampling tap is outside the home, garden hose may remain attached during purging due to possible owner concerns for water accumulation next to the house, but hoses shall be removed during sampling.

Provisions shall also be made to dispose of the pre-sample purge water. Domestic water supply purge waters shall be disposed at the nearest sump or drain available whenever possible. For most sampling, purge water may be discharged to the home septic sewer, septic field, or on the ground at least thirty feet from the well.

Concurrence with the well owner should be reached for the disposition of purged water if discharged to the ground surface to prevent icy conditions or damage on the property. Provisions shall be made to divert purge water at least 30 feet from the well head using plastic sheeting, irrigation pipe, or other appropriate means.

4.0 Infield Measurements

While the well is being purged, periodic measurements of pH, temperature, and specific conductance will be made along with observations on appearance and, if practical, odor, to obtain infield conditions of the water to be sampled.

5.0 Sampling and Analysis

After the required volume of water is purged from the delivery system, the sampling tap shall be shut off. Sample bottles with required preservatives shall then be brought to the sampling point. The tap will be turned on and the flow will be adjusted to about 100 ml/min. for the domestic wells. The sample bottles will be filled as required in order of decreasing volatility.

When sampling for volatiles, the 40 ml sample vials should have no headspace. To avoid aeration, the glass vial should be held at an angle so that the stream of water flows down the side. Fill the vial until it overflows to eliminate any air bubbles and replace the teflon-lined cap.

6.0 Post Sampling

Post sampling procedures should include reconnecting all filters, aerators and treatment system, completion of all field forms, labels, and chain-of-custody documents. All sampling equipment to be used at other sites should be decontaminated. The sampling site should be cleaned and the well covered before leaving the vicinity.

7.0 Data Recording

In addition to information normally recorded in field notebook, the following minimum information should be included:

- Resident's name;
- Address;
- Sampling location (specific tap or spigot);
- Filtering or treatment systems on delivery systems;
- Aerator or filter on sampling tap;
- Well casing diameter (ID);
- Water volume;
- Pressure on holding tank volume;
- Appurtenances and other plumbing volume;
- Total delivery system volume;
- Purge flow rate;
- Purge time; and

- Total purge volume.

The sampling log for (such as that included at the end of this section) shall be completed at each sampling location for private and monitoring wells.

SAMPLING LOG - PRIVATE WATER SUPPLY WELLS

Part I

WATER PURGING AND SAMPLE LOG SAMPLE NUMBER

Project No.: _____ Date: _____

Project Name: _____

Well Owner's Name: _____

Address: _____

Phone Number: _____

Well Use: _____ Domestic: _____ Irrigation: _____ Other: _____

Well Location on Property: _____

_____

_____

Weather Conditions: _____

Observations/Comments: _____

_____

_____

System Description

Filtering or Treatment Systems on Delivery System: _____

_____

Pressure Tank: No___ Yes___ Volume: _____gallons Pressure: _____ psi at start

_____ psi during sample collection

Sampling Location (Specific Tap or Spigot) _____

Diameter of Sampling Tap _____ inches

Aerator or Filter on Sampling Tap: No ____ Yes____

Aerator or Filter Removed Prior to Sampling: No ____ Yes ____

Purging Volume

Well Casing Diameter (ID): _____ inches

Water Level: _____ feet Measuring Point: _____

Water Depth: _____ feet Determined by: _____ Msmt. _____ Log _____ Est.

Calculated Well Volume: _____ gallons (a)

Pressure Tank Volume: _____ gallons (b)

Appurtenances and Other Plumbing Volume: _____ gallons (c)

Total Delivery System Volume (a+b+c) _____ gallons

Purge Time

Purge Flow Rate: _____ gallons/minute

SAMPLING LOG - PRIVATE WATER SUPPLY WELLS (Cont'd.)

Flow Rate Determination By: _____

Purge Time: _____ minutes

Total Purge Volumes: _____ gallons

Method of Purge Water Disposal: _____

Field Measurements

pH Meter No.: _____ Calibrated: _____

Specific Conductance Meter No.: _____ Calibrated: _____

Comments: _____

_____

Time	Discharge (Gallons)	pH	Temperature °C	Specific Conductance umhos/cm		Color	Odor	Turbidity
				Field	@ 25°C			

Time	Sample Number	Size/Preservative	Analysis/Holding Time	Laboratory

Collected By: _____

_____

_____

Shipped/Delivered By: _____

_____

Shipped To: _____

_____

Carrier: _____

Chain-of-Custody: _____ Yes _____ No

SAMPLING LOG - PRIVATE WATER SUPPLY WELLS (Cont'd.)

Part II

Resident Interview

Well Information:

Home Owner: _____ Renter _____ Commercial Property _____

Years at this address: _____ Original Owner: _____ Yes _____ No

Number of Residents at Address: Adults _____ Children _____

Sensitive Receptors: Elderly _____ Pregnant _____ Children _____

Well Information:

Drilled By: _____ Unknown _____

Date Installed: _____ 19_____ Unknown _____

Log Available: Yes _____ No _____ If yes, identify: _____

_____

Water Quality:

Comments on historical water quality (taste, odor, appearance): _____

_____

_____

_____

Has water been tested previously: Yes _____ No _____ If yes, explain why/by whom: _____

_____

_____

_____

_____

_____

_____

_____

_____

WELL DEVELOPMENT/PURGE SUMMARY

Well _____

PROJECT: _____
PROJECT #: _____
LOCATION: _____
PERSONNEL: _____

WELL COORDINATES: _____
PVC RISER ELEVATION: _____
GROUND LEVEL ELEVATION: _____
CONSTRUCTED WELL DEPTH: _____
WELL CASING INSIDE DIAMETER: _____

INSTRUMENTS
TEMPERATURE: _____
CONDUCTIVITY: _____
pH METER: _____
WATER LEVEL PROBE: _____
OTHER: _____

Date	Time	Method	Water Level* (ft.msl)	Measured Well Depth (ft.msl)	Volume Purged** (gallons)	Appearance Color / Odor / Clarity	pH (s.u.)	T (C)	Elec. Cond. (umhos/cm) Measured	Elec. Cond. (umhos/cm) at 25C	Comments

* Record both initial and final measurements when using as Well Development Summary.
** Purge four borehole volumes, if possible, prior to sampling.

SIMON HYDRO-SEARCH

95000 PURGE WATER DISPOSAL

1.0 Ground Water From Monitor Wells

Purge water known to have low (below NR140 Enforcement Standards) or no impacts based on previous sampling rounds will be discharged near the monitor well. Purge water known to be impacted or with unknown contaminant concentrations will be disposed of in the leachate tank at the landfill.

2.0 Private Wells

All purge water from private wells will be discharged to the sink or basement floor drains of the residence. In the case of samples collected from outside spigots, the purge water will be discharged to the ground surface outside the home.

96000 DECONTAMINATION PROCEDURES

1.0 Bailers

Dedicated bailers will be provided for each well to be purged and sampled using a bailer. The bailers will be supplied contaminant-free and sealed in plastic. Prior to use, the bailers will be triple-rinsed with distilled water. Following use, the bailer will be suspended from the well cap inside the well for storage until the next sampling round. The possibility of introduction of additional external contaminants will thus be reduced. Prior to use during future sampling rounds, the bailers will again be triple-rinsed with distilled water.

2.0 Dedicated Sampling Pumps

Dedicated sampling pumps and related equipment will remain in the well at all times to avoid introduction of external contaminants. No decontamination procedures are required for sampling with the dedicated pumps.

3.0 Other Equipment

Disposable filters will be used to filter samples collected for analysis of ~~inorganic~~ metals compounds. No decontamination procedures will be required. For any remaining equipment, including the peristaltic pump, decontamination will consist of an initial wash with Alconox and triple-rinsing with distilled water.

APPENDIX B

SOUTHWEST LABORATORY OF OKLAHOMA, INC. SOPS

CHAIN-OF-CUSTODY AND SAMPLE TRACKING

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

STANDARD OPERATING PROCEDURE FOR LABORATORY CHAIN-OF-CUSTODY

REV 1.1 — 8/11/92

A critical aspect of sound sample collection and analysis protocols is the maintenance of strict COC procedures. COC procedures include inventorying and documentation during sample collection, shipment, and laboratory processing. A sample is considered to be in an individual's custody if the sample is: (1) in the physical possession or view of the responsible party; (2) secured to prevent tampering; or (3) placed in a restricted area by the responsible party.

1 CHAIN-OF-CUSTODY

Sample Label

A label is attached to all sample containers at the time of collection. The label is written in indelible ink and contains the following information:

- Sample number/identification
- Date and time collected
- Purpose of the sample (analyte and sample group)
- Source/location and location of the sample
- Contract task number and title of project
- Preservative used (if any)
- Collector's name or initials

An example of a sample label is presented in Figure 3.1.

Chain-of-Custody Record

Sample custody is initiated with the detailed record keeping by the field sampling personnel. COC establishes the documentation and control necessary to identify and trace a sample from sample collection to final analysis. It includes field sample labeling to prevent mix-up, custody seals to prevent sample tampering, secure custody, and provide the recorded support information for potential litigation.

COC forms are used to document the integrity of all samples. To maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory,

a COC form will be filled out for each sample set at each sampling location. The COC form will contain the following information:

- Sample number (for each sample in shipment)
- Collection date (for each sample shipment)
- Time sample was obtained/or collected
- Number of containers of each sample
- Sample description (environmental matrix)
- Analyses required for each sample
- Shipment number
- Shipping address of the laboratory
- Date, time and method of shipment
- Spaces to be signed as custody is transferred.

The individual in charge of shipping samples to the laboratory is also responsible for completing the COC form. This individual will also inspect the form for completeness and accuracy. Any changes made to the COC form shall be initialed by the person making the change. An example of the COC form is presented in Figure 3.2.

Transfer of Custody and Shipment

Samples are to be accompanied by an approved COC record. When the possession of samples is transferred, the individual relinquishing the samples signs and records the date and time on the COC document. The individual receiving the samples repeats the procedure. This record represents the official documentation for all transference of the sample custody until the samples have arrived at the laboratory.

If samples are to be split with another laboratory facility or governmental agency, a separate COC record is prepared for those samples. This COC record indicates with whom the samples have been split and is appropriately signed and dated with the time of transfer of splits.

Laboratory Custody Procedures

The Sample Control program describes the laboratory custody procedures associated with sample receipt, storage, preparation, analysis and security. Sample control is maintained at SWLO through the use of several tracking systems designed to protect sample integrity. Tracking systems include the use of laboratory COC procedures, locked sample storage, sample request forms, and sample analysis requests (in the form of project sheet).

Laboratory COC procedures include sample inventory and record maintenance during sample collection, shipment and laboratory processing. The Sample Custodian (SC) manages and tracks the storage and distribution of samples after their arrival.

An overview of the sample tracking and COC procedure to be employed is presented in the Figure 3.3 flow diagram. It includes the following components:

1. Laboratory COC documentation is initiated by the SC when the sample is relinquished by the courier.

2. After sample shipment arrival, the SC begins sample inspection and log-in. All samples are inspected: comparisons are made between the clients paperwork and that paperwork supplied by the Project Officer (i.e., Sample booking Information, Figure 3.5). Anomalies are noted in the COC form and the Client/Lab Communication sheet (Figure 3.6) as the client is notified.

3. Each sample is assigned a unique SWLO laboratory identification number which is cross-coded with the client's identification. Sample identification information is entered into the computerized laboratory data base, and the assigned number is used to track sample locations and status throughout the analytical process.

   The following sample information is recorded into the computerized laboratory data base system:

   - Customer and project information
   - Date of receipt
   - Client identification
   - Date sampled
   - Matrix Type
   - Number of containers

- Analytical requirements
- Other pertinent comments

4. The SC logs in samples with the tests and test code information supplied by the project officer (figure 3.5 & 3.7)

5. The field COC document is completed and copies are returned to the appropriate party(s).

6. After the sample is logged in, a LIMS generated work sheet and an internal sample tracking form is generated (Figure 3.8).

7. The work sheet informs the analysts/departments of samples in-house.

8. This internal sample tracking sheet documents the movement of the sample from storage to sample preparation and back to sample storage.

9. While within the laboratory, sample integrity is maintained through the use of locked storage areas. Samples remain in locked storage areas except when being analyzed.

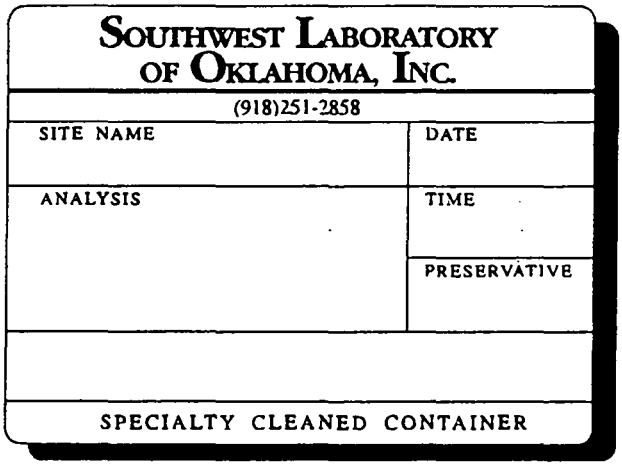
10. When the sample preparation is concluded, internal extract tracking documents are completed and filed in the appropriate project file.

11. Suffixes are assigned to sample IDs to indicate special treatment/analysis. These suffixes include the following:

    MS — Matrix Spike
    MSD — Matrix Spike Duplicate
    DL — Dilution
    RE — Reextraction/Analysis
    S — Spike (Inorganics)
    D — Duplicate (Inorganics)
    L — Serial Dilution (Inorganics)
    A — Post Digestion Spike (Inorganics)

12. Based on specific contract requirements, any remaining samples are either archived in locked storage areas or disposed of properly.

In addition to the internal and external COC documents, a computer-generated listing of the sample analysis parameters is used to control sample flow and facilitate tracking within the laboratory. Each laboratory unit is given the list of parameters and is responsible for maintaining sample integrity (holding time), fulfilling COC requirements, scheduling sample flow, and tracking sample status.



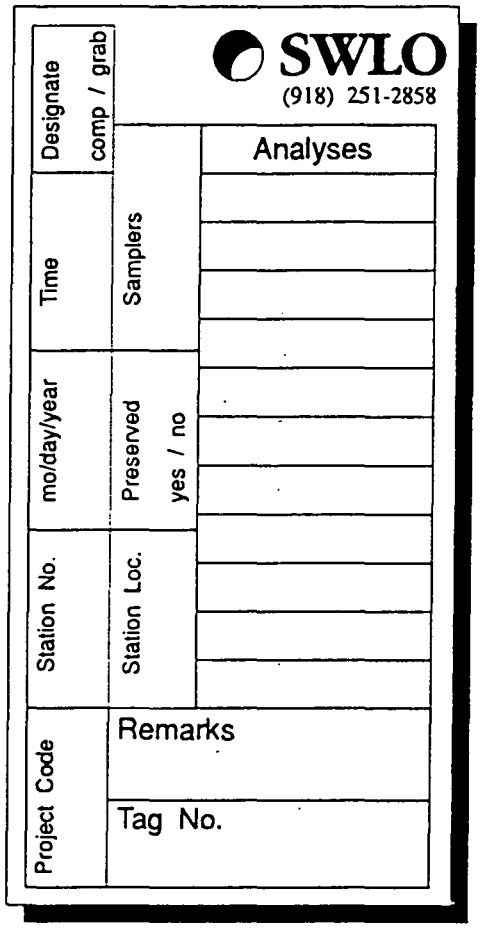


FIG. 3.1
Example of Sample Bottle Label (top) & Sample Tag (right).

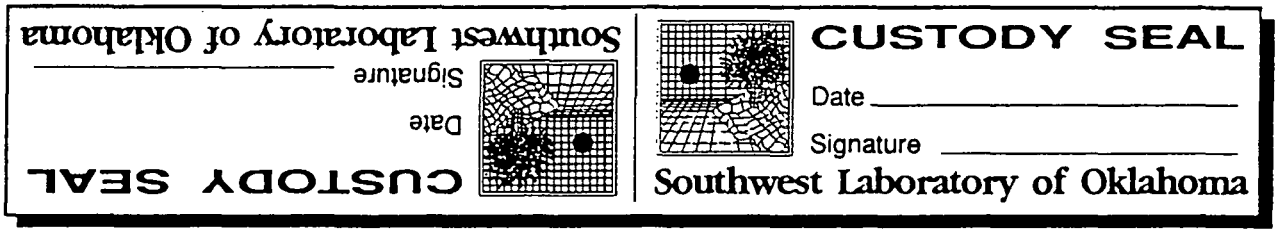


FIG. 3.10 Example Custody Seal for Sample Containers/Coolers

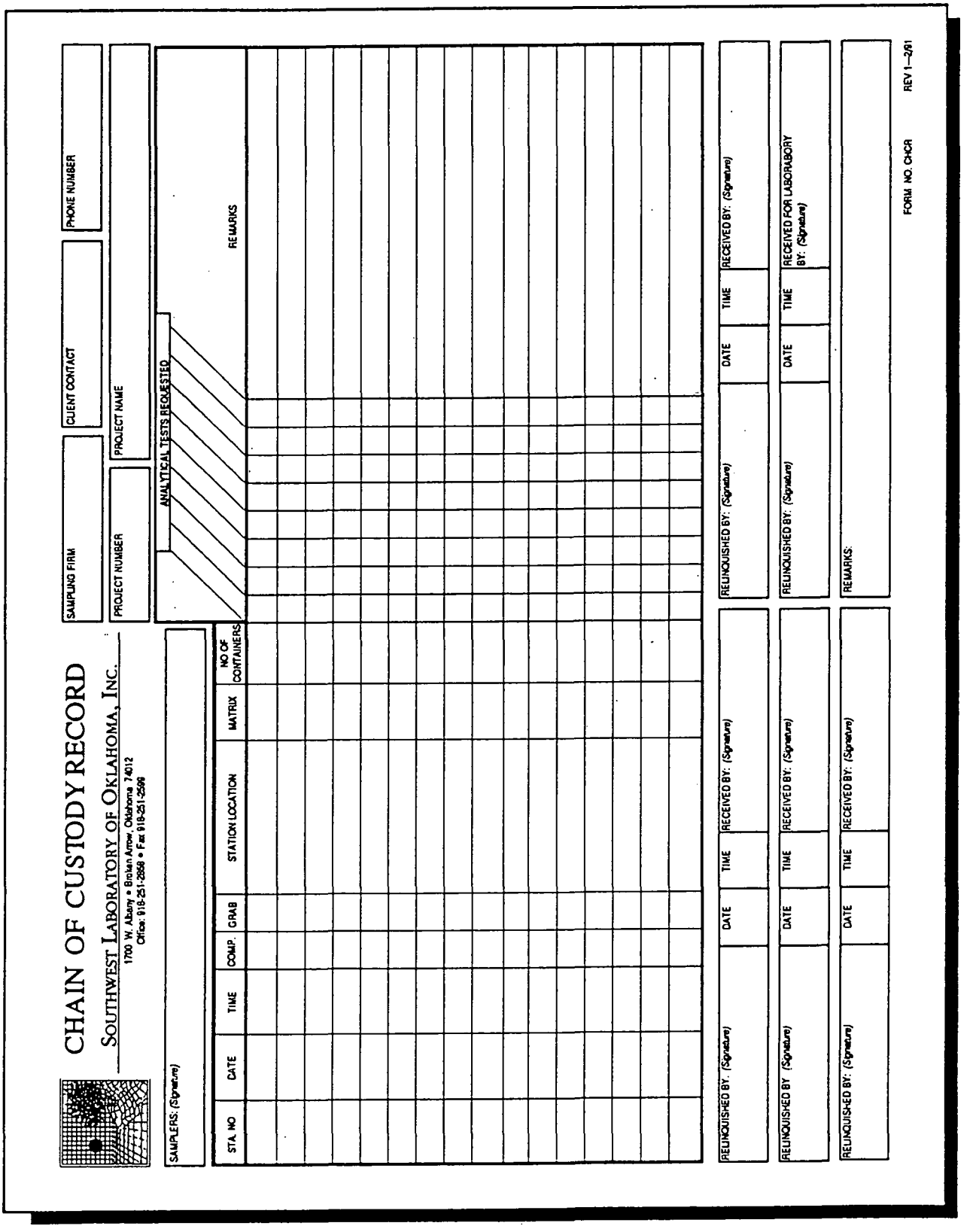
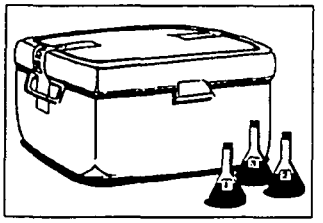
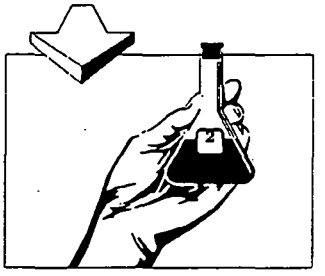


FIG. 3.2 Example of Chain of Custody Record

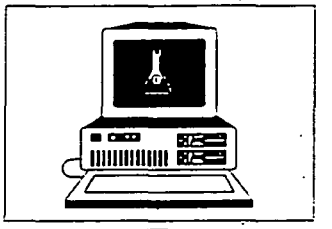
FIG. 3.3 Chain of Custody Sample Tracking Flow Diagram



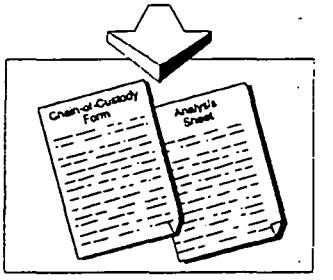
◀ Sample Receipt



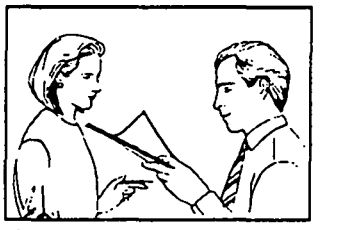
▲ Sample Inspection *(Primary & Secondary Containers)*



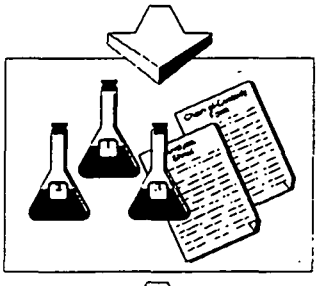
◀ Sample Log-In *(Assigned Unique ID Number)*



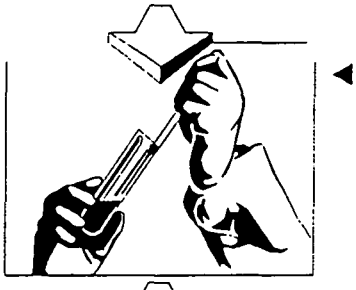
Initiate Internal Chain-of Custody Documentation ▶



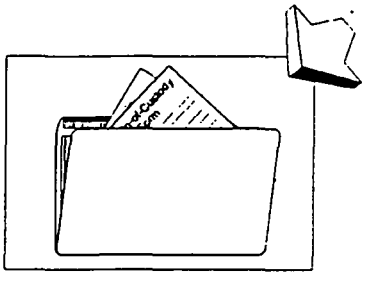
▲ Copy of Document Returned to Appropriate Official(s)



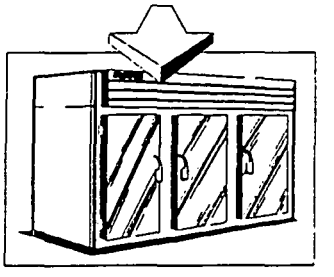
Sample Relinquished to Appropriate Lab Manager *(Sample maintained in locked storage)* ▶



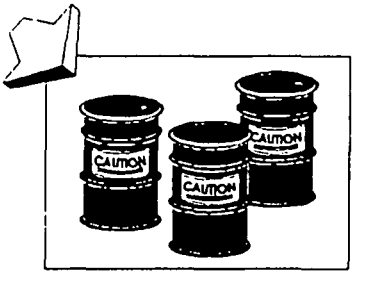
◀ Sample Preparation and Analysis *(Sample maintained in locked storage)*



▲ Chain of Custody Document Completed and Filed with Appropriate Data in Contract File



▲ Archive Sample Extract and Document Location in Locked Freezer



▲ Non-essential Sample Remains Disposed of *(Hazardous sample remains incinerated in controlled circumstances)*

PROJECT OFFICER: _____

COMMERCIAL
SAMPLE BOOKING
INFORMATION

DISTRIB.
SMPL REC _____
INORG. _____
EXTRACT _____
MS _____
GC _____
AATS _____

DATE OF CALL: _____ CLIENT: _____

CLIENT CONTACT: _____ PROJECT: _____

SHIP DATES: _____ REQ'D TAT: _____

DELVERABLES:
CLP / TAB-QC / SPECIAL

MS DEPT.

VOA			BNA			DIOX.			OTHER		
W	S	O	W	S	O	W	S	O	W	S	O

GC DEPT.

PEST/PCB			HERB			PAH			EXPLOS.			OTHER		
W	S	O	W	S	O	W	S	O	W	S	O	W	S	O

INORG. DEPT.

ICP			FURN.			Hg-CV			CN			WET CHEM.		
W	S	O	W	S	O	W	S	O	W	S	O	W	S	O

AATS

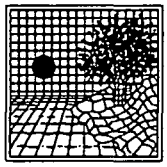
BTEX			TPH MOD-8015			TPH 418.1			O&G			OTHER		
W	S	O	W	S	O	W	S	O	W	S	O	W	S	O

COMMENTS: _____

_____

_____

FIG. 3.5 Commercial Sample Booking Information



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CLIENT/LABORATORY COMMUNICATION SYSTEM

TELEPHONE RECORD LOG

➤ In Reference to Case Contract/Proposal:

➤ Date of Call:

➤ Client Name:

➤ Client Contact:

➤ Call Initiated By: ☐ Client ☐ Laboratory

➤ In reference to data for the following sample number(s):

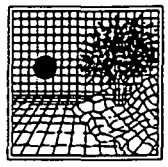
➤ Sumary of Questions/Issues Discussed:

➤ Summary of Resolution:

Signature: *Date:*

➤ Distribution: ☐ Lab Copy ☐ Client Copy ☐ Project Officer Copy

FIG. 3.5 Client/Laboratory Communication System



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ANALYTICAL REQUEST FORMS

➤ Client:	➤ Code:
➤ Client Contact:	➤ Phone No.:
➤ Project Name:	➤ P.O. #:
➤ Shipping Info.	➤ Projected Receipt Date:
➤ Date of Contact:	

ANALYTICAL REQUESTS

Quantity.	Matrix.	Code	Code	Code	Code	Code	TAT	Format

➤ Special Provisions

➤ Reporting Address:

➤ Billing Address:

➤ SWLO Contact:

FIG. 3.6 Sample Request Form/Analysis Request Form

INTERNAL CHAIN OF CUSTODY
SAMPLE TRACKING SHEET
SDG NUMBER : 401
FRACTION : ICP
MATRIX : Water

SWOK/AATS

WALK-IN DATE LOGGED-IN/ ANALYST	SAMPLE #	CASE/SAMPLE ID	NC	DATE LOGGED-OUT FOR PREP/ ANALYST	DATE RETURNED TO WALK-IN/ ANALYST	DATE DISCARDED/ ANALYST
01/24/91	4876.01	MFN444 (CASE815714)	2			
01/24/91	4876.02	MFN448 FIELD BLANK	2			
01/24/91	4876.05	MFN458 (CASE815714)	2			
01/24/91	4876.06	MFN459 (CASE815714)	2			
01/24/91	4876.07	MFN460 (CASE815714)	2			
01/24/91	4876.08	MFN461 (CASE815714)	2			
01/24/91	4876.13	MFN466 (CASE815714)	2			
01/24/91	4876.14	MFN467 (CASE815714)	2			
01/24/91	4876.15	MFN468 (CASE815714)	2			
01/24/91	4876.16	MFN469 (CASE815714)	2			

FIG. 3.7 Internal Tracking Sheet (example)

SWOK/AATS

1700 [illegible] ALBANY SUITE C
BROKEN ARROW, OK 74012

Date: 04/10/91

Clients: EPA

SID #	DATE	DESCRIPTION	MA	NC	TEST	PRI	DUE	DESCRIPTION	RESULTS	ANALYSTS	DATE/TIME
5590.01	04/05/91	CEB-51 (CASE#16181	W	3	MS310	3	05/04/91	VOA - CLP		DLC	04/08/91
5590.02	04/05/91	CEB-52 (CASE#16191	S	3	MS310	3	05/04/91	VOA - CLP	_____	_____	_____
					MS510	3	05/04/91	SEMIVOL CLP	_____	_____	_____
								EXTRACTION	_____	_____	_____
5580.03	04/05/91	CEB-53 (CASE#16191	S	3	MS310	3	05/04/91	VOA - CLP	_____	_____	_____
					MS510	3	05/04/91	SEMIVOL CLP	_____	_____	_____
								EXTRACTION	_____	_____	_____
5580.04	04/05/91	CEB-55 (CASE#16181	W	4	GC810	3	05/04/91	PEST/PCB CLP	_____	_____	_____
								EXTRACTION		TR	05-APR-91
					MS310	3	05/04/91	VOA - CLP		DLC	04/08/91
					MS510	3	05/04/91	SEMIVOL CLP	_____	_____	_____
								EXTRACTION		TR	05-APR-91
5580.05	04/05/91	CEB-56&MS/MSD	S	6	GC810	3	05/04/91	PEST/PCB CLP	_____	_____	_____
								EXTRACTION	_____	_____	_____
					MS310	3	05/04/91	VOA - CLP	_____	_____	_____
					MS510	3	05/04/91	SEMIVOL CLP	_____	_____	_____
								EXTRACTION	_____	_____	_____
5580.06	04/05/91	CEB-57 (CASE#16181	S	3	GC810	3	05/04/91	PEST/PCB CLP	_____	_____	_____
								EXTRACTION	_____	_____	_____
					MS310	3	05/04/91	VOA - CLP	_____	_____	_____
					MS510	3	05/04/91	SEMIVOL CLP	_____	_____	_____
								EXTRACTION	_____	_____	_____
5580.07	04/05/91	CEB-58 (CASE#16181	S	3	GC810	3	05/04/91	PEST/PCB CLP	_____	_____	_____
								EXTRACTION	_____	_____	_____
					MS310	3	05/04/91	VOA - CLP	_____	_____	_____
					MS510	3	05/04/91	SEMIVOL CLP	_____	_____	_____
								EXTRACTION	_____	_____	_____

FIG. 3.9 LIMS Generated Sample Worksheet

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SAMPLE LOG-IN SHEET

Date:	
Custodian: *(Signature)*	
Document Control #:	
Case Number:	
Airbill Number:	

CIRCLE THE APPROPRIATE RESPONSE

CUSTODY SEAL:	Present Absent	Intact Not Intact
CHAIN OF CUSTODY:	Present Absent	
SAMPLE TAGS:	Present Absent	
SAMPLE TAG NUMBERS:	Listed Not Listed	*(On Chain-of-Custody)*
SMO FORMS:	Present Absent	

Date Received	Time Received	Chain-of-Custody Record Number	SMO Sample Numbers	Corresponding Sample Tag Nos.	Corresponding Assigned Lab Nos	Does Info. on Custody Rec, Traffic Rept. and Sample Tags Agree?	REMARKS (Condition of Sample Shipment, etc.)

FIG. 3.10-A Sample Log-In Sheet

SAMPLE LOG-IN SHEET

Lab Name: ____________________ Page ____ of ____

Received By (Print Name): ____________________ Log-in Date: ____________

Received By: (Signature): ____________________

Case Number: ____________

Sample Delivery Group No: ____________

SAS Number: ____________

REMARKS:

1. Custody Seal(s) Present/Absent* Intact/Broken
2. Custody Seal Nos.: ________ ________
3. Chain-of-Custody Records Present/Absent*
4. Traffic Reports or Packing List Present/Absent!
5. Airbill Airbill/Sticker Present/Absent*
5. Airbill No: ________ ________
7. Sample Tags Present/Absent
   Sample Tag Numbers Listed/Not Listed on Chain-of-Custody
8. Sample Condition: Intact/Broken*/ Leaking
9. Does information on custody records, traffic reports, and sample tags agree? Yes/No*
10. Date Received at Lab: ________
11. Time Received ________

Sample Transfer

Fraction: ________ ________

Area #: ________ ________

By: ________ ________

On: ________ ________

	CORRESPONDING		
EPA SAMPLE #	SAMPLE TAG #	ASSIGNED LAB #	REMARKS: CONDITION OF SAMPLE SHIPMENT, ETC.

* Contact SMO and attach record of resolution

Received By: ____________________

Date: ____________________

Logbook No: ____________________

Logbook Page No: ____________________

FORM DC-1

3/90

FIG. 3.10-B Sample Log-In Sheet

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

Page 1

SAMPLES READY TO BE ARCHIVED — PRODUCED ON 04/04/91

SAMPLE	CLIENT	DESCRIPTION	MATRIX	REPORTED
5447.08	RS&A	MW-2	W	04/03/91
5447.09	RS&A	MW-21A	W	04/03/91
5447.10	RS&A	MW-21D	W	04/03/91
5447.11	RS&A	MW 18/B	W	04/03/91
5447.12	RS&A	MW-3B	W	04/03/91
5447.13	RS&A	MW-5	W	04/03/91
5447.14	RS&A	MW-3	W	04/03/91
5447.15	RS&A	MW-4	W	04/03/91
5447.16	RS&A	MW-14	W	04/03/91
5447.17	RS&A	MW-26B	W	04/03/91
5447.18	RS&A	MW-15A	W	04/03/91
5447.19	RS&A	MW-25	W	04/03/91
5447.20	RS&A	MW-34	W	04/03/91
5447.21	RS&A	TRIP BLANK	W	04/03/91
5447.22	RS&A	MW-6	W	04/03/91
5447.23	RS&A	MW-24	W	04/03/91
5447.24	RS&A	MW-23	W	04/03/91
5447.25	RS&A	MW-22A	W	04/03/91
5447.26	RS&A	MW-18B	W	04/03/91
5447.27	RS&A	MW-11B	W	04/03/91
5447.28	RS&A	MW-29	W	04/03/91
5447.29	RS&A	MW-33	W	04/03/91
5447.30	RS&A	MW-32	W	04/03/91
5447.31	RS&A	MW-30	W	04/03/91
5447.32	RS&A	EQUIP BLANK	W	04/03/91
5447.33	RS&A	MW-11A	W	04/03/91
5447.34	RS&A	MW-18T	W	04/03/91
5447.35	RS&A	MW-19	W	04/03/91
5447.36	RS&A	MW-20	W	04/03/91
5447.37	RS&A	MW-27	W	04/03/91
5447.38	RS&A	MW-28	W	04/03/91
5447.39	RS&A	TRIP BLANK	W	04/03/91
5450.01	KIMCLARK	OUTFALL001	W	04/01/91
5452.01	FHC	5-1	S	04/03/91
5452.02	FHC	5-2	S	04/03/91
5452.03	FHC	5-3	S	04/03/91
5452.04	FHC	5-4	S	04/03/91
5452.05	FHC	5-5	S	04/03/91
5452.06	FHC	6-1	S	04/03/91
5452.07	FHC	6-2	S	04/03/91
5452.08	FHC	6-3	S	04/03/91
5452.09	FHC	6-4	S	04/03/91
5452.10	FHC	6-5	S	04/03/91
5461.01	RS&ASSOC	5211.01	W	04/01/91
5466.01	ATAS	1788.01	S	04/02/91
5466.02	ATAS	1788.02	S	04/02/91
5466.03	ATAS	1788.03	S	04/02/91
5466.04	ATAS	1788.04	S	04/02/91
5467.01	ATAS	1789.16	S	04/03/91

FIG. 3.11 Sample Archive Record Sheet

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

STANDARD OPERATING PROCEDURE FOR SAMPLE CUSTODIAN

REV 2.2 —11/24/92

Contents

TABLES

FIGURES

I. SAMPLE CUSTODIAN

Sample Custodian (SC) for the laboratory has duties and responsibilities that include but are not limited to:

- Receiving samples
- Inspecting sample shipping containers for presence, absence, and condition of:
  - ✓ Custody seals, locks, "evidence tapes", etc.
  - ✓ Container breakage and/or container integrity
- Recording the condition of both shipping containers and sample containers (bottles, jars, cans, etc.) on appropriate forms
- Signing appropriate documents shipped with samples (i.e., airbills, COC record(s), traffic reports, etc.)
- Verifying and recording agreement or nonagreement of information on sample documents (i.e., sample tags, COC records, traffic reports, airbills, etc.) on appropriate forms; if there is a variance, the Project Officer (PO) is notified immediately for resolution by the client.
- Initiating the paperwork for sample analyses on appropriate laboratory documents
- Labeling samples with laboratory sample numbers and cross-referencing laboratory numbers with client numbers and sample tags
- Placing samples, sample extracts, and spent samples into appropriate storage and/or secure areas
- Controlling access to samples in storage and assuring that laboratory standard operating procedures are followed during sample movement
- Monitoring sample COC in the laboratory
- Monitoring sample tags
- Monitoring storage conditions for proper sample preservation
- Returning shipping containers to sampling teams or clients.

SAMPLE RECEIPT

Upon arrival at the laboratory, all sample shipping containers are opened and inspected. Field sampling personnel are notified on the same day of any problems concerning the samples or documents associated with the shipment. If samples arrive on a Saturday and field sampling personnel are unavailable, notification is made on the next working day.

II. INITIAL RECEIPT

All samples will be received by one of the Sample Custodians (SC). For after hour sample receipt, a designated person shall receive the samples and store them properly for sample log-in processing the next business day.

All samples received shall be considered to be hazardous samples, and all shipping containers shall be opened under an exhaust hood or an approved, well-ventilated area. All personnel associated with sample receipt are required to become familiar with safety procedures for the handling of hazardous samples.

The objective of the sample receipt procedure is to ensure that all pertinent information about the condition of the sample is recorded.

III. EXAMINATION OF SHIPPING CONTAINER

The SC or will examine the shipping container and shall record the following information on the COC sample log-in sheet*. Only one project or sample batch may be recorded per sheet.

- Condition of container, noting any damage, etc.
- Presence/absence of COC seals and their condition
- Labeling on shipping container

IV. OPENING SHIPPING CONTAINER

Shipping containers should be opened under an approved hood or in an approved, well-ventilated area. Approved hood space and/or approved, well ventilated areas shall be determined by the Laboratory's Health and Safety Officer or the Corporate Health and Safety Officer. Prior to the removal of samples, plastic-backed absorbent paper should be laid out on bench surface to receive sample bottles. The SC shall check the paperwork and notify the PO if the project/case number has not been scheduled (see the Client booking Sheet, Fig. 3.4). The SC shall note on the sample log-in form the following:

* For CLP Contracts the DC-1 Form is used (see fig. 3.10B)

- Presence/absence of the COC record(s)
- Presence/absence of airbills and/or bills of lading documenting shipment of samples
- Necessary project and sample information enclosed with the shipment
- When samples arrive without ice or blue ice.
- Temperature of cooler upon opening (measured by a calibrated infrared thermometer).

V. SAMPLE REMOVAL

The SC shall note on the COC form the following:

- Condition of samples (intact, broken, leaking, cold or ambient, headspace in VOA vials, etc.)
- Presence/absence of sample tags

If the sample tags are present:

- Record sample tag document control numbers
- Compare sample tags with COC record(s)
- Document whether these numbers agree
- If the sample tags are not listed on the COC record, record this fact.

If an odor is noticed after opening the shipping container prior to sample removal, it must be noted on the COC.

VI. SAMPLE DOCUMENT VERIFICATION

The SC will compare the following documents to verify agreement among the information contained on them: (a) COC; (b) sample tags; (c) Analytical Request Form; and (d) contract requirements. The SC shall document agreement among the forms and shall note any discrepancies found on the sample log-in sheet.

- If all samples recorded on the COC record were received and no problems observed, the SC will sign the COC record in the "received for laboratory by" box.

- If problems are noted, the SC will sign the COC record and note problems in the "remarks" box or reference another form that details the problems.

- If discrepancies are found, they shall be reported to the PO for client clarification.

In addition, samples to be analyzed are checked for holding time requirements as listed in the Tables 2.1 and 2.2. Where sample preservation and/or sample holding time requirements are not in accordance with the table, the appropriate PO is notified. The PO then informs the client.

SAMPLE LOG-IN

Following inspection of shipping containers, records, and samples, the sample information will be added to the project information on the project sheet by the SC. Should any of the project information be incomplete or any other problems arise, the sample shall be placed on hold and the problems will be noted on the Client/Laboratory Communication System Sheet (Figure 3.5). This problem sheet shall be forwarded to the PO for client resolution. The samples shall remain on hold until all information necessary for log-in is received. Information concerning the sample will be entered into the laboratory data base to maintain an official record of receipt of the sample. Corrections will be made once the PO resolves all problems.

Any samples not properly preserved will be noted on the COC and the field sampling manager will be notified immediately of the problem. He will determine the necessary corrective action.

In the event holding times may be exceeded, the PO shall contact the field sampling manager or the client immediately to correct any log-in problems. In the event holding time for analysis is exceeded, the PO or SC shall notify the field sampling manager or the client and request either resampling or instruction for proceding with the analysis. If analysis is to be performed on the original samples, the PO shall note the fact that the holding time has been exceeded, and a comment to this effect shall be added to the final report.

SAMPLE SPLITTING

When clients supply their own containers or when bulk samples are received, the SC shall split the samples to provide sufficient aliquots for each analytical procedure that is to be performed. The following guidelines shall be used to determine the manner in which samples are split. Project Officer will notify the client of the necessity to split the sample and request instructions from the client.

SAMPLE SECURITY

Samples are in locked storage areas except during laboratory analysis. The work sheet informs the analyst of what samples are needed for sample preparation and/or analysis (Figure 3.8). An internal sample tracking sheet will be signed by the receiving analyst (Figure 3.7). The internal sample tracking sheet shall be secured in the project file. All laboratory personnel who receive samples are responsible for the care and custody of samples from the time each sample is received until samples (or appropriate documentation as to disposition of the empty containers) are returned to storage. All subsets (extraction, digestates, etc.) of the samples shall be kept in locked storage which is controlled by the appropriate laboratory manager.

SAMPLE STORAGE AND DISPOSAL

Once the samples have been logged into the computer system, the SC shall be responsible for the following:

VII. SAMPLE STORAGE

1. Samples shall be stored in a secure area.
   a. Inorganic samples shall be stored in refrigerators 8 & 9 (see facility layout).
   b. Volatile organics shall be stored in refrigerator 7.
   c. Volatile organics (CLP) shall be stored in refrigerator 3.
   d. Extractable organics shall be stored in refrigerators 8 & 9.
   e. High concentration organics shall be stored in refrigerator 4.
   f. All archived inorganic and extractable organics are stored in refrigerator 12.

2. Samples shall be removed from the shipping container and stored in their original containers unless damaged.

3. Damaged samples are to be documented and PO or the client is contacted immediately to notify him of the damaged samples.

4. Storage area is to be kept secured at all times. SC will control access to the storage area.

5. Samples removed from storage will be documented. All transfers of samples are documented in the internal COC.

6. VOA samples will be stored separately from other samples.

7. Standards and bulk chemicals are not stored with samples.

VIII. SAMPLE DISPOSAL

1. Upon completion of the analysis, an archive list is generated each month (Figure 3.11).
2. When sample analysis and all QC checks have been completed and a final report has been issued, the unused sample portion shall be archived for a period of not less than 60 days after the report has been issued.

3. The SC shall be responsible for returning all unused bottles, shipping containers, packing materials, blue ice packs, and if requested, the unused sample portions to the client.

4. Any sample remains shall be properly disposed of after a 120-day period, unless further instructions are received from the PO or client. Sample disposal shall be documented on the archive list (Figure 3.11).

FIELD DOCUMENTATION

IX. FIELD SAMPLE IDENTIFICATION

Sample tracking is accomplished in the field by assigning each sample a unique number as it is collected. This number is traceable back to the day, time, site, and depth (where appropriate) of collection. This is recorded on a sample label and the COC form as well as in the field logbook. All containers are labeled prior to actual sampling.

X. DAILY LOGS

Daily logs are kept during field activities by the Field Supervisor at each site. These daily logs are kept in a bound field notebook of water-resistant paper. All entries are made legibly in indelible ink, signed, and dated. Information that is to be recorded in the field notebook includes:

- Date, time, and place of sampling
- Field QC samples, as applicable
- Weather conditions at time of sampling, including ambient temperature and approximate wind direction and speed
- Data from field analyses (e.g., temperature, specific conductance, pH, and alkalinity of water samples)

- Turbidity of water samples
- Data from physical tests (sludge tests, etc.)
- Observations about site and samples (odors, appearance, etc.)
- Information about any activities, extraneous to sampling activities, that may affect the integrity of the samples (such as low-flying aircraft nearby, fossil-fueled motors being used nearby, painting operations being carried out upwind of sampling sites, etc.)
- Analyses and required preservation techniques
- Sample cooler temperature readings.

XI. CORRECTIONS TO DOCUMENTATION

When it becomes necessary to make corrections to any form of documentation (e.g., sample tags, COC forms, daily logbooks), the obsolete information is crossed out with a single line and the changes are made, initialed, and dated by the person making the change.

XII. DISPOSITION OF DOCUMENTATION

Upon conclusion of the field effort at a sampling site, all field documentation (i.e., maps, well logs, logbooks, photographs) is clearly labeled and placed in the project files.

LABORATORY DOCUMENTATION

XIII. SAMPLES LABELING/IDENTIFICATION

The SC shall assign laboratory sample numbers. These numbers will be listed on a document to cross-reference with the client number, sample tag number, and laboratory sample number.

Laboratory sample numbering is comprised of an "Episode" number (Episode meaning client batch) followed by .01 for the first sample, .02 designating second sample, etc. These numbers are sequentially generated by the SWLO "LIMS" system.

	SWLO ID	Client ID
Example:	3001.01	Sample A
	3001.02	Sample B
	3001.03	Sample C

This unique sample number shall be used for sample identification during storage, analysis and data reduction, data validation, and reporting.

Work sheets and internal chain-of-custody are sent to the various departments (i.e. inorganics, GC/MS, GC, etc.)

XIV. FILLING OF LOG-IN INFORMATION

The SC or a designee will log in samples. The date on the receipt form will be the date of sample receipt in the laboratory. All pertinent information (i.e., date of receipt, who received the shipment, airbill number, client sample number, tag numbers (if applicable), assigned laboratory numbers, presence or absence of seals/tags, etc.) will be documented on the sample log-in sheet (figure 3.10A)*. If the condition of the samples is good (without breakage or discrepancies) "intact" is recorded under the remarks column of the form.

XV. SAMPLE LOG-IN DOCUMENT STORAGE

There will be two repositories for documents associated with a project. The first repository is the project file. This file will contain the following documents:

- Contracts, purchase orders, task order, and/or other work authorization
- Original project sheet
- Computer-generated project sheet
- Project modification forms

The second repository for related documentation is the analytical data file, which will contain a copy of the final project report/QC report and any other documents related to the project analysis (i.e. 1) signed airbill; 2) signed chain-of-custodies; 3) work sheet; 4) sample tags; 5) traffic reports; 6) bench sheets; 7) raw data).

XVI. CORRECTIONS TO DOCUMENTATION

When it becomes necessary to make corrections to any form of documentation (e.g., sample tags, COC forms, daily logbooks), the obsolete information is crossed out in ink with a single line and the changes are made, initialed, and dated by the person making the change.

* For CLP Contracts the DC-1 Form is used (see fig. 3.10B)

SAMPLE PACKAGING AND SHIPPING

XVII. PREPARATION OF SAMPLES FOR SHIPMENT

The following is a description of the procedure followed when transporting environmental samples from the sampling site to the laboratory:

- The outer surface of all sample containers is cleaned with bottled water and paper towels.
- Sample collection points, depth increments, and sampling devices are identified and documented.
- Log book entries, sample tags, COC forms, and field record sheets with sample identification points, date, time and names or initials of all persons handling the sample in the field are completed.
- Custody tape is wrapped around the neck and cap of each container.
- Samples and trip blanks are placed into a sample cooler provided by the laboratory along with blue ice packs. After a cooler is filled, the appropriate COC form is placed inside the cooler and the outer surface of the cooler is cleaned.
- Glass sample containers are wrapped with plastic insulating material to prevent breakage.
- Once all packaging is completed, each cooler is sealed with identifying labels/ custody seals (see Figure 3.10) which are initialed by the field sampler for COC procedures. Custody seals are placed across the binding tape that secures the lid of the shipping container for both the front and back side of the container. For the back side, the custody seal is placed across the hinge, if possible.
- Samples are classified according to the Department of Transportation (DOT) regulations pursuant to Title 49 CFR.
- The laboratory is then notified prior to shipment that samples are being sent to the laboratory for analysis. This notice should be given at least 24 hours in advance of the expected sample arrival date. Notification includes shipping information (i.e., airbill number, courier company, number of shipment containers

to be sent).

XVIII. SHIPPING CONTAINERS

Samples are packaged in thermally insulated, rigid coolers, according to DOT specifications 173.510 and 172 Subparts B, C, and D, and Subparts A and B of Part 173. Sample containers are placed in a cooler that contains blue ice and absorbent packing for liquids or styrofoam packing for solids. The completed COC form is placed inside the shipping container, unless otherwise noted. Any drain plugs must be taped shut.

XIX. MARKING AND LABELING

The cooler is marked as follows:

- Proper shipping name: Hazardous substance, liquid, or solid
- Hazardous class: To be determined (label placed in upper left corner of outer container)
- Labels: "This Side Up" or arrows placed on the opposite side of the outer container if a liquid is to be shipped
- Custody tape is wrapped twice, in a single strip, around the outside of each cooler and initialed.

A hazardous material shippers certification is filled out and will accompany the shipment. The container is secured with strapping tape to prevent leakage.

XX. SHIPPING TRANSPORTATION/COURIER

It is recommended that an overnight express service (i.e., Federal Express) be used for sample transport. If an air freight service is used, samples can be picked up at the airport (located 20 minutes from the laboratory). When samples are scheduled to arrive at the laboratory on a Saturday, the laboratory must receive notice of this shipment at least 24 hours in advance.

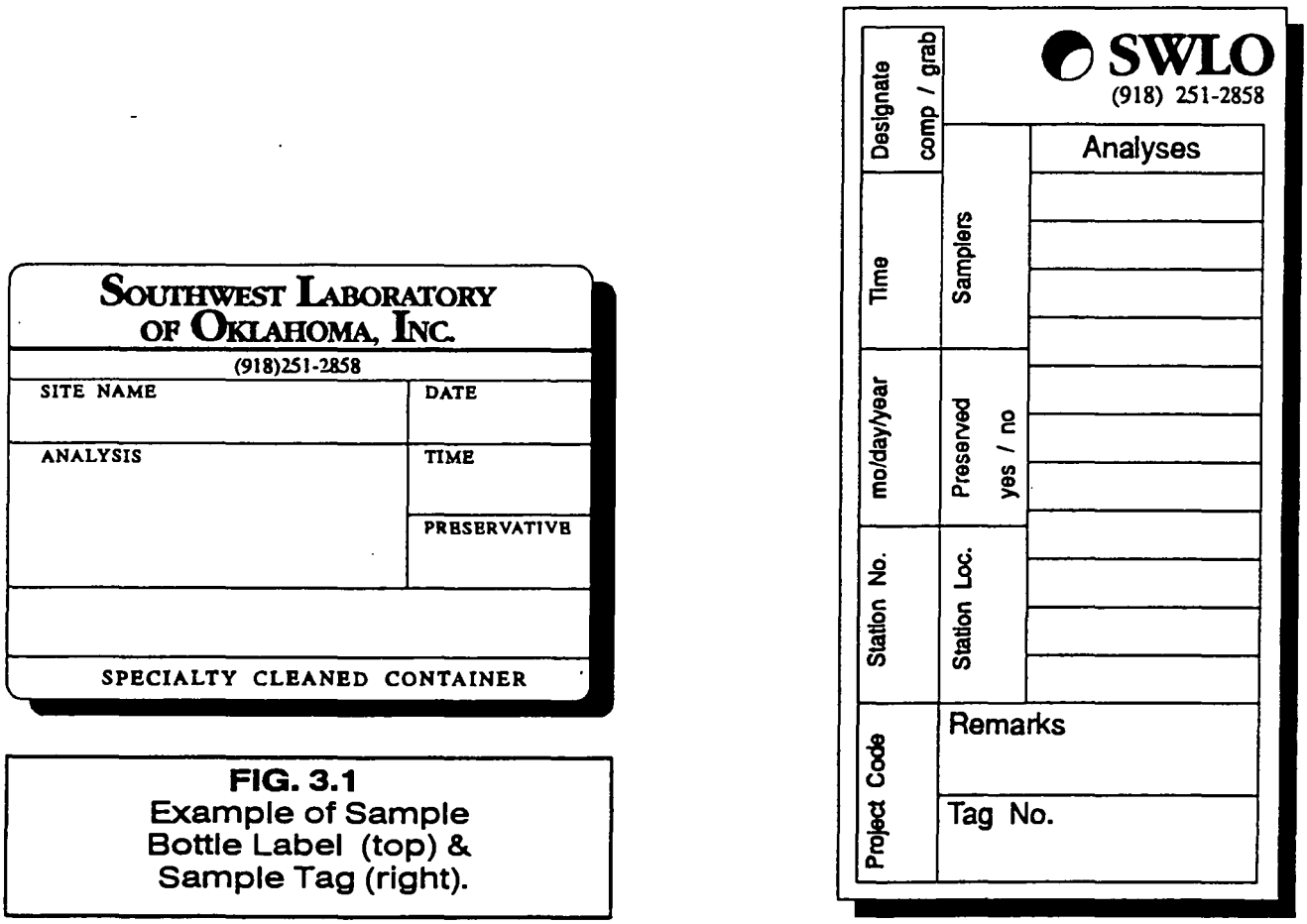


FIG. 3.1
Example of Sample Bottle Label (top) & Sample Tag (right).

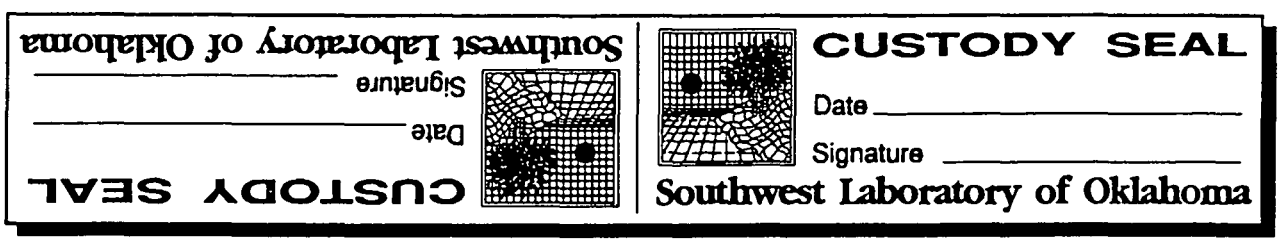


FIG. 3.10 Example Custody Seal for Sample Containers/Coolers

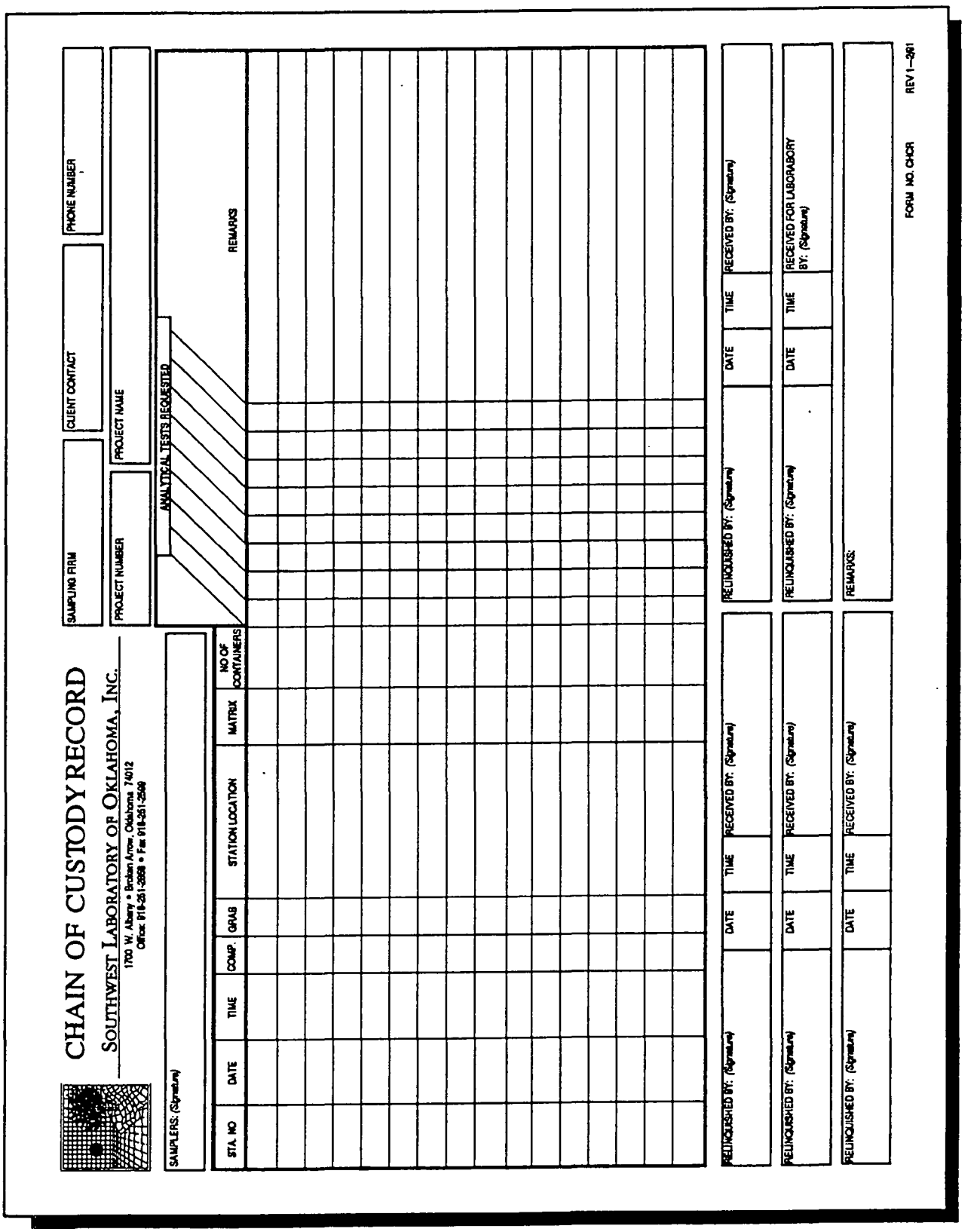
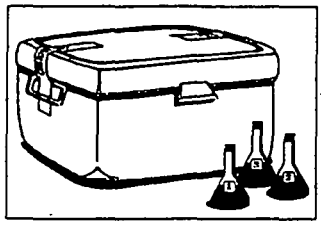
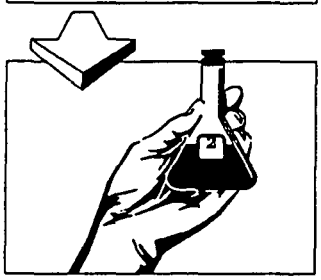


FIG. 3.2 Example of Chain of Custody Record

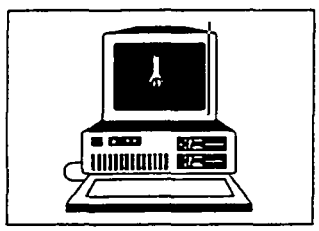
FIG. 3.3 Chain of Custody Sample Tracking Flow Diagram



◀ Sample Receipt



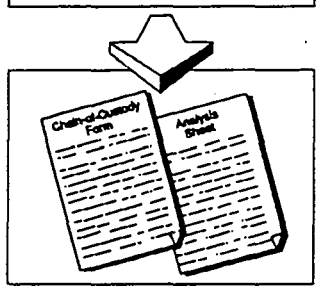
▲
Sample Inspection
(Primary & Secondary Containers)

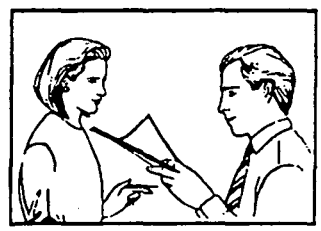


◀ Sample Log-In
(Assigned Unique ID Number)

FOR CLP

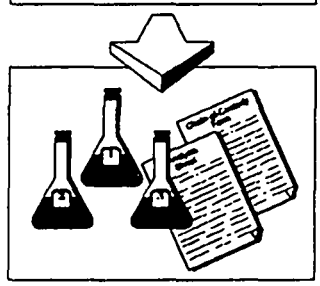
Initiate Internal Chain-of Custody Documentation ▶

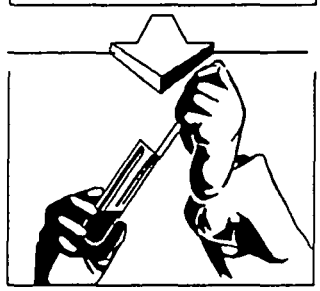




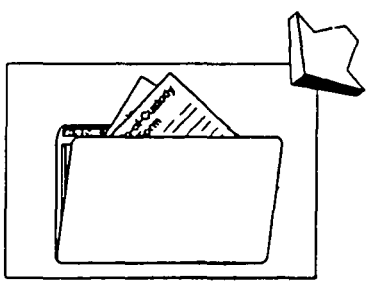
▲
Copy of Document Returned to Appropriate Official(s)

Sample Relinquished to Appropriate Lab Manager ▶
(Sample maintained in locked storage)

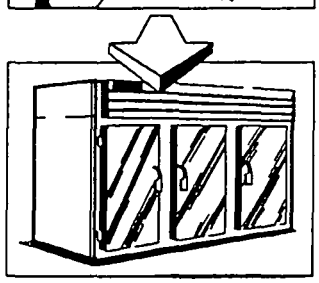




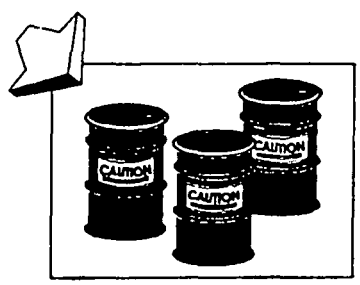
◀ Sample Preparation and Analysis
(Sample maintained in locked storage)



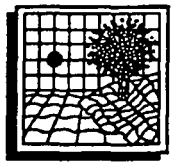
▲
Chain of Custody Document Completed and Filed with Appropriate Data in Contract File



▲
Archive Sample Extract and Document Location in Locked Freezer



▲
Non-essential Sample Remains Disposed of *(Hazardous sample remains incinerated in controlled circumstances)*



CLIENT BOOKING SHEET

QA/QC DEPARTMENT

DATE OF CALL:_____ CLIENT:_____

CLIENT CONTACT:_____ PROJECT:_____

SHIP DATES:_____ REQUIRED TAT:_____

DELIVERABLES: CLP ☐ TAB—QC ☐ SPECIAL ☐ CONTRACT:_____

MS DEPARTMENT

VOA	BNA	DIOXIN	OTHER
W ☐ S ☐ O ☐	W ☐ S ☐ O ☐	W ☐ S ☐ O ☐	W ☐ S ☐ O ☐

GC DEPARTMENT

PEST/PCB	HERB	PAH	EXPLOS.	OTHER
W ☐ S ☐ O ☐	W ☐ S ☐ O ☐	W ☐ S ☐ O ☐	W ☐ S ☐ O ☐	W ☐ S ☐ O ☐

INORGANIC DEPARTMENT

ICP	FURNACE	Hg-CV	CN	WET CHEM.
W ☐ S ☐ O ☐	W ☐ S ☐ O ☐	W ☐ S ☐ O ☐	W ☐ S ☐ O ☐	W ☐ S ☐ O ☐

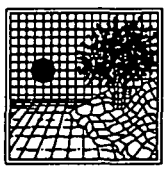
AATS

BTEX	TPH MOD-8015	TPH 418.1	O & G	OTHER
W ☐ S ☐ O ☐	W ☐ S ☐ O ☐	W ☐ S ☐ O ☐	W ☐ S ☐ O ☐	W ☐ S ☐ O ☐

TEST CODES/COMMENTS:_____

SOUTHWEST LABORATORY OF OKLAHOMA, INC.
1700 W. ALBANY • BROKEN ARROW, OKLAHOMA 74012 • OFFICE (918) 251-2858 • FAX (918) 251-2599 [QA010-0492-01]

FIG. 3.4 Commercial Sample Booking Information



SOUTHWEST LABORATORY OF OKLAHOMA, INC.
1700 W. Albany, Suite C • Broken Arrow, Oklahoma, 74012 • Office: 918-251-2858 • Fax 918-251-2599

CLIENT/LABORATORY COMMUNICATION SYSTEM

TELEPHONE RECORD LOG

➤ In Reference to Case Contract/Proposal:

➤ Date of Call:

➤ Client Name:

➤ Client Contact:

➤ Call Initiated By: ☐ Client ☐ Laboratory

➤ In reference to data for the following sample number(s):

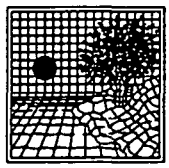
➤ Summary of Questions/Issues Discussed:

➤ Summary of Resolution:

Signature: *Date:*

➤ Distribution: ☐ Lab Copy ☐ Client Copy ☐ Project Officer Copy

FIG. 3.5 Client/Laboratory Communication System



SOUTHWEST LABORATORY OF OKLAHOMA

1700 W. Albany, Suite C • Broken Arrow, Oklahoma, 74012 • Office: 918-251-2858 • Fax 918-251-2599

ANALYTICAL REQUEST FORMS

➤ Client:	➤ Code:
➤ Client Contact:	➤ Phone No.:
➤ Project Name:	➤ P.O. #:
➤ Shipping Info.	➤ Projected Receipt Date:
➤ Date of Contact:	

ANALYTICAL REQUESTS

Quantity.	Matrix.	Code	Code	Code	Code	Code	TAT	Format

➤ Special Provisions

➤ Reporting Address:

➤ Billing Address:

➤ SWLO Contact:

FIG. 3.6 Sample Request Form/Analysis Request Form

INTERNAL CHAIN OF CUSTODY
SAMPLE TRACKING SHEET
SDG NUMBER :
FRACTION : VOA
MATRIX : Soil

SWOK/AATS

DATE LOGGED-IN/ ANALYST	SAMPLE #	CASE/SAMPLE ID	NC	DATE LOGGED-OUT FOR ANALYSIS/ ANALYST	ARCHIVE DATE/ ANALYST	DATE DISCARDED/ ANALYST
04/05/91	5580.02	CEB-52 (CASE#16181)	3			
04/05/91	5580.03	CEB-53 (CASE#16181)	3			
04/05/91	5580.05	CEB-56MS/MSD	6			
04/05/91	5580.06	CEB-57 (CASE#16181)	3			
04/05/91	5580.07	CEB-58 (CASE#16181)	3			
04/05/91	5580.08	CEB-59 (CASE#16181)	3			
04/05/91	5580.09	CEB-60 (CASE#16181)	3			

FIG. 3.7 Internal Tracking Sheet

INTERNAL CHAIN OF CUSTODY
SAMPLE TRACKING SHEET
SDG NUMBER :
FRACTION : BNA
MATRIX : Soil

SWOK/AATS

WALK-IN DATE LOGGED-IN/ ANALYST	SAMPLE #	CASE/SAMPLE ID	NC	DATE LOGGED-OUT FOR EXTRACTION/ ANALYST	DATE RETURNED TO WALK-IN/ ANALYST	DATE DISCARDED/ ANALYST
04/05/91	5580.02	CEB-52 (CASE#16181)	3			
04/05/91	5580.03	CEB-53 (CASE#16181)	3			
04/05/91	5580.05	CEB-56MS/MSD	6			
04/05/91	5580.06	CEB-57 (CASE#16181)	3			
04/05/91	5580.07	CEB-58 (CASE#16181)	3			
04/05/91	5580.08	CEB-59 (CASE#16181)	3			
04/05/91	5580.09	CEB-60 (CASE#16181)	3			

FIG. 3.7(cont.) Internal Tracking Sheet

INTERNAL CHAIN OF CUSTODY
SAMPLE TRACKING SHEET
SDG NUMBER :
FRACTION : PEST
MATRIX : Soil

SWOK/AATS

WALK-IN DATE LOGGED-IN/ ANALYST	SAMPLE #	CASE/SAMPLE ID	NC	DATE LOGGED-OUT FOR EXTRACTION/ ANALYST	DATE RETURNED TO WALK-IN/ ANALYST	DATE DISCARDED/ ANALYST
04/05/91	5580.05	CEB-56MS/MSD	6			
04/05/91	5580.06	CEB-57 (CASE#16181)	3			
04/05/91	5580.07	CEB-58 (CASE#16181)	3			
04/05/91	5580.08	CEB-59 (CASE#16181)	3			

FIG. 3.7(cont.) Internal Tracking Sheet

INTERNAL CHAIN OF CUSTODY
EXTRACT TRACKING SHEET
SDG NUMBER :
FRACTION : BNA
MATRIX : Soil

SWOK/AATS

REFRIG. #2 DATE LOGGED-IN/ ANALYST	SAMPLE #	CASE/SAMPLE ID	EXT. VOL.	DATE TO ANALYSIS/ ANALYST	ARCHIVE DATE/ ANALYST	DATE DISCARDED/ ANALYST
	5580.02	CEB-52 (CASE#16181)				
	5580.03	CEB-53 (CASE#16181)				
	5580.05	CEB-56MS/MSD				
	5580.06	CEB-57 (CASE#16181)				
	5580.07	CEB-58 (CASE#16181)				
	5580.08	CEB-59 (CASE#16181)				
	5580.09	CEB-60 (CASE#16181)				

FIG. 3.7(cont.) Internal Tracking Sheet

SWOK/AATS

INTERNAL CHAIN OF CUSTODY
EXTRACT TRACKING SHEET
SDG NUMBER :
FRACTION : PEST
MATRIX : Soil

REFRIG. #2 DATE LOGGED-IN/ ANALYST	SAMPLE #	CASE/SAMPLE ID	EXT. VOL.	DATE TO ANALYSIS/ ANALYST	ARCHIVE DATE/ ANALYST	DATE DISCARDED/ ANALYST
	5580.05	CEB-56MS/MSD				
	5580.06	CEB-57 (CASE#16181)				
	5580.07	CEB-58 (CASE#16181)				
	5580.08	CEB-59 (CASE#16181)				

FIG. 3.7(cont.) Internal Tracking Sheet

INTERNAL CHAIN OF CUSTODY
SAMPLE TRACKING SHEET
SDG NUMBER : 401
FRACTION : ICP
MATRIX : Water

SWOK/AATS

WALK-IN DATE LOGGED-IN/ ANALYST	SAMPLE #	CASE/SAMPLE ID	NC	DATE LOGGED-OUT FOR PREP/ ANALYST	DATE RETURNED TO WALK-IN/ ANALYST	DATE DISCARDED/ ANALYST
01/24/91	4876.01	MFW444 (CASE015714)	2			
01/24/91	4876.02	MFW448 FIELD BLANK	2			
01/24/91	4876.05	MFW458 (CASE015714)	2			
01/24/91	4876.06	MFW459 (CASE015714)	2			
01/24/91	4876.07	MFW460 (CASE015714)	2			
01/24/91	4876.08	MFW461 (CASE015714)	2			
01/24/91	4876.13	MFW466 (CASE015714)	2			
01/24/91	4876.14	MFW467 (CASE015714)	2			
01/24/91	4876.15	MFW468 (CASE015714)	2			
01/24/91	4876.16	MFW469 (CASE015714)	2			

FIG. 3.7(cont.) Internal Tracking Sheet

INTERNAL CHAIN OF CUSTODY
SAMPLE TRACKING SHEET
SDG NUMBER : 401
FRACTION : FURN
MATRIX : Soil

SWOKAATS

WALK-IN DATE LOGGED-IN/ ANALYST	SAMPLE #	CASE/SAMPLE ID	NC	DATE LOGGED-OUT FOR PREP/ ANALYST	DATE RETURNED TO WALK-IN/ ANALYST	DATE DISCARDED/ ANALYST
01/24/91	4876.03	MFW456 (CASE015714)	1			
01/24/91	4876.04	MFW457 (CASE015714)	1			
01/24/91	4876.09	MFW462 (CASE015714)	1			
01/24/91	4876.10	MFW463 (CASE015714)	1			
01/24/91	4876.11	MFW464 (CASE015714)	1			
01/24/91	4876.12	MFW465 (CASE015714)	1			
01/24/91	4876.17	MFW470 (CASE015714)	1			
01/24/91	4876.18	MFW471 (CASE015714)	1			
01/24/91	4876.19	MFW472 (CASE015714)	1			
01/24/91	4876.20	MFW473 (CASE015714)	1			

FIG. 3.7(cont.) Internal Tracking Sheet

INTERNAL CHAIN OF CUSTODY
SAMPLE TRACKING SHEET
SDG NUMBER : 401
FRACTION : CV
MATRIX : Water

SWOK/AATS

WALK-IN DATE LOGGED-IN/ ANALYST	SAMPLE #	CASE/SAMPLE ID	NC	DATE LOGGED-OUT FOR PREP/ ANALYST	DATE RETURNED TO WALK-IN/ ANALYST	DATE DISCARDED/ ANALYST
01/24/91	4876.01	MFW444 (CASE015714)	2			
01/24/91	4876.02	MFW448 FIELD BLANK	2			
01/24/91	4876.05	MFW458 (CASE015714)	2			
01/24/91	4876.06	MFW459 (CASE015714)	2			
01/24/91	4876.07	MFW460 (CASE015714)	2			
01/24/91	4876.08	MFW461 (CASE015714)	2			
01/24/91	4876.13	MFW466 (CASE015714)	2			
01/24/91	4876.14	MFW467 (CASE015714)	2			
01/24/91	4876.15	MFW468 (CASE015714)	2			
01/24/91	4876.16	MFW469 (CASE015714)	2			

FIG. 3.7(cont.) Internal Tracking Sheet

INTERNAL CHAIN OF CUSTODY
SAMPLE TRACKING SHEET
SDG NUMBER : 401
FRACTION : CN
MATRIX : Water

SWOK AATS

WALK-IN DATE LOGGED-IN/ ANALYST	SAMPLE #	CASE/SAMPLE ID	NC	DATE LOGGED-OUT FOR PREP/ ANALYST	DATE RETURNED TO WALK-IN/ ANALYST	DATE DISCARDED/ ANALYST
01/24/91	4876.01	MFW444 (CASE#13714)	2			
01/24/91	4876.02	MFW448 FIELD BLANK	2			
01/24/91	4876.03	MFW458 (CASE#13714)	2			
01/24/91	4876.04	MFW459 (CASE#13714)	2			
01/24/91	4876.07	MFW460 (CASE#13714)	2			
01/24/91	4876.08	MFW461 (CASE#13714)	2			
01/24/91	4876.13	MFW466 (CASE#13714)	2			
01/24/91	4876.14	MFW467 (CASE#13714)	2			
01/24/91	4876.15	MFW468 (CASE#13714)	2			
01/24/91	4876.16	MFW469 (CASE#13714)	2			

FIG. 3.7(cont.) Internal Tracking Sheet

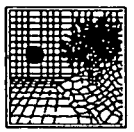
SWOKAATS

1700 · ALBANY SUITE C
BROKE · ARROW, OK 74012

Date: 04/10/91
Client: EPA

SID #	DATE	DESCRIPTION	MA	NC	TEST	PRI	DUE	DESCRIPTION	RESULTS	ANALYSTS	DATE/TIME
5580.01	04/05/91	CEB-51 (CASE#16181)	W	3	MS310	3	05/04/91	VOA - CLP		DLC	04/08/91
5580.02	04/05/91	CEB-52 (CASE#16181)	S	3	MS310	3	05/04/91	VOA - CLP			
					MS510	3	05/04/91	SEMIVOL CLP			
								EXTRACTION			
5580.03	04/05/91	CEB-53 (CASE#16181)	S	3	MS310	3	05/04/91	VOA - CLP			
					MS510	3	05/04/91	SEMIVOL CLP			
								EXTRACTION			
5580.04	04/05/91	CEB-55 (CASE#16181)	W	4	GC810	3	05/04/91	PEST/PCB CLP			
								EXTRACTION		TR	05-APR-91
					MS310	3	05/04/91	VOA - CLP		DLC	04/08/91
					MS510	3	05/04/91	SEMIVOL CLP			
								EXTRACTION		TR	05-APR-91
5580.05	04/05/91	CEB-56&MS/MSD	S	6	GC810	3	05/04/91	PEST/PCB CLP			
								EXTRACTION			
					MS310	3	05/04/91	VOA - CLP			
					MS510	3	05/04/91	SEMIVOL CLP			
								EXTRACTION			
5580.06	04/05/91	CEB-57 (CASE#16181)	S	3	GC810	3	05/04/91	PEST/PCB CLP			
								EXTRACTION			
					MS310	3	05/04/91	VOA - CLP			
					MS510	3	05/04/91	SEMIVOL CLP			
								EXTRACTION			
5580.07	04/05/91	CEB-58 (CASE#16181)	S	3	GC810	3	05/04/91	PEST/PCB CLP			
								EXTRACTION			
					MS310	3	05/04/91	VOA - CLP			
					MS510	3	05/04/91	SEMIVOL CLP			
								EXTRACTION			

FIG. 3.8 LIMS Generated Sample Worksheet



SOUTHWEST LABORATORY
OF OKLAHOMA, INC.
1700 W. Albany, Suite C • Broken Arrow, Oklahoma, 74012
Office: 918-251-2858 • Fax 918-251-2599

SAMPLE LOG-IN SHEET

Date:	
Custodian: *(Signature)*	
Document Control #:	
Case Number:	
Airbill Number:	

CIRCLE THE APPROPRIATE RESPONSE

CUSTODY SEAL:	Present Absent	Intact Not Intact
CHAIN OF CUSTODY:	Present Absent	
SAMPLE TAGS:	Present Absent	
SAMPLE TAG NUMBERS:	Listed Not Listed	*(On Chain-of-Custody)*
SMO FORMS:	Present Absent	

Date Received	Time Received	Chain-of-Custody Record Number	SMO Sample Numbers	Corresponding Sample Tag Nos.	Corresponding Assigned Lab Nos.	Does Info. on Custody Rec, Traffic Rept. and Sample Tags Agree?	REMARKS (Condition of Sample Shipment, etc.)

FIG. 3.10-A Sample Log-In Sheet

SAMPLE LOG-IN SHEET

Lab Name: _____ Page ____ of ____

Received By (Print Name): _____ Log-in Date: _____

Received By: (Signature): _____

Case Number: _____

Sample Delivery Group No: _____

SAS Number: _____

REMARKS:

1. Custody Seal(s) — Present/Absent* Intact/Broken
2. Custody Seal Nos.: _____ _____
3. Chain-of-Custody Records — Present/Absent*
4. Traffic Reports or Packing List — Present/Absent
5. Airbill — Airbill/Sticker Present/Absent*
5. Airbill No: _____ _____
7. Sample Tags — Present/Absent
   Sample Tag Numbers — Listed/Not Listed on Chain-of-Custody
8. Sample Condition: Intact/Broken*/ Leaking
9. Does information on custody records, traffic reports, and sample tags agree? Yes/No*
10. Date Received at Lab: _____
11. Time Received _____

Sample Transfer

Fraction: _____ _____

Area #: _____ _____

By: _____ _____

On: _____ _____

	CORRESPONDING		
EPA SAMPLE #	SAMPLE TAG #	ASSIGNED LAB #	REMARKS: CONDITION OF SAMPLE SHIPMENT, ETC.

* Contact SMO and attach record of resolution

Received By: _____

Date: _____

Logbook No: _____

Logbook Page No: _____

FORM DC-1

3/90

FIG. 3.10-B Sample Log-In Sheet

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

Page 1

SAMPLES READY TO BE ARCHIVED — PRODUCED ON 04/04/91

SAMPLE	CLIENT	DESCRIPTION	MATRIX	REPORTED
5447.08	RS&A	MW-2	W	04/03/91
5447.09	RS&A	MW-21A	W	04/03/91
5447.10	RS&A	MW-21B	W	04/03/91
5447.11	RS&A	MW 1B/B	W	04/03/91
5447.12	RS&A	MW-3B	W	04/03/91
5447.13	RS&A	MW-5	W	04/03/91
5447.14	RS&A	MW-3	W	04/03/91
5447.15	RS&A	MW-4	W	04/03/91
5447.16	RS&A	MW-14	W	04/03/91
5447.17	RS&A	MW-26B	W	04/03/91
5447.18	RS&A	MW-15A	W	04/03/91
5447.19	RS&A	MW-25	W	04/03/91
5447.20	RS&A	MW-34	W	04/03/91
5447.21	RS&A	TRIP BLANK	W	04/03/91
5447.22	RS&A	MW-6	W	04/03/91
5447.23	RS&A	MW-24	W	04/03/91
5447.24	RS&A	MW-23	W	04/03/91
5447.25	RS&A	MW-22A	W	04/03/91
5447.26	RS&A	MW-18B	W	04/03/91
5447.27	RS&A	MW-11B	W	04/03/91
5447.28	RS&A	MW-29	W	04/03/91
5447.29	RS&A	MW-33	W	04/03/91
5447.30	RS&A	MW-32	W	04/03/91
5447.31	RS&A	MW-30	W	04/03/91
5447.32	RS&A	EQUIP BLANK	W	04/03/91
5447.33	RS&A	MW-11A	W	04/03/91
5447.34	RS&A	MW-18T	W	04/03/91
5447.35	RS&A	MW-19	W	04/03/91
5447.36	RS&A	MW-20	W	04/03/91
5447.37	RS&A	MW-27	W	04/03/91
5447.38	RS&A	MW-28	W	04/03/91
5447.39	RS&A	TRIP BLANK	W	04/03/91
5450.01	KIMCLARK	OUTFALL001	W	04/01/91
5452.01	FHC	5-1	S	04/03/91
5452.02	FHC	5-2	S	04/03/91
5452.03	FHC	5-3	S	04/03/91
5452.04	FHC	5-4	S	04/03/91
5452.05	FHC	5-5	S	04/03/91
5452.06	FHC	6-1	S	04/03/91
5452.07	FHC	6-2	S	04/03/91
5452.08	FHC	6-3	S	04/03/91
5452.09	FHC	6-4	S	04/03/91
5452.10	FHC	6-5	S	04/03/91
5461.01	RS&ASSOC	5211.01	W	04/01/91
5466.01	ATAS	1788.01	S	04/02/91
5466.02	ATAS	1788.02	S	04/02/91
5466.03	ATAS	1788.03	S	04/02/91
5466.04	ATAS	1788.04	S	04/02/91
5467.01	ATAS	1789.16	S	04/03/91

FIG. 3.11 Sample Archive Record Sheet

TABLE 2.1
RECOMMENDATION FOR SAMPLING AND PRESERVATION OF SAMPLES ACCORDING TO MEASUREMENT[1]

Measurement	SWL/AATS Test Codes	Vol. Req. (mL)	Container[2]	Preservative[3,4]	Holding Time[5]
Physical Properties					
Color	IN100	50	P,G	Cool, 4°C	48 Hrs.
Conductance	IN080	100	P,G	Cool, 4°C	28 days
Hardness	IN140	100	P	HNO_3 to pH <2	6 mos.
pH	IN220	2	P,G	None Req. Immediately	Analyze
Residue					
Filterable	IN270	100	P,G	Cool, 4°C	7 days
Non-Filterable	IN275	100	P,G	Cool, 4°C	7 days
Total	IN280	100	P,G	Cool, 4°C	7 days
Volatile	IN285	100	P,G	Cool, 4°C	7 days
Settleable Matter	IN287	1,000	P,G	Cool, 4°C	48 Hrs.
Turbidity	IN310	100	P,G	Cool, 4°C	48 Hrs.
Metals					
Dissolved		200	P	Filter on site HNO_3 to pH <2	6 Mos.
Suspended		200		Filter on site	6 Mos.[8]
Total		100	P	HNO_3 to pH <2	6 Mos.
Chromium*[6]	MT169	200	P	Cool, 4°C	24 Hrs.
Mercury (Dissolved)	MT310	100	P	Filter HNO_3 to pH <2	28 Days
Mercury (Total)	MT310	100	P	HNO_3 to pH <2	28 Days
Inorganics, Non-Metallics					
Acidity	IN005	100	P,G	Cool, 4°C	14 Days
Alkalinity	IN010	100	P,G	Cool, 4°C	14 Day
Bromide	IN030	100	P,G	None Req.	28 Days
Chloride	IN060	50	P,G	None Req.	28 Days
Chlorine	IN070	200	P,G	None Req.	Analyze Immediately
Cyanides	IN120	500	P,G	Cool, 4°C NaOH to pH >12 0.6g ascorbic acid[6]	14 Days[7]
Fluoride	IN130/IN135 /IN137	300	P,G	None Req.	28 Days
Iodide	IN150	100	P,G	Cool, 4°C	24 Hrs.

TABLE 2.1 (CONTINUED)

Measurement	SWL/AATS Test Codes	Vol. Req. (mL)	Container[2]	Preservative[3,4]	Holding Time[5]
Nitrogen					
Ammonia	IN015/IN020	400	P,G	Cool, 4°C H_2SO_4 to pH <2	28 Days
Kjeldahl, Total	IN170	500	P,G	Cool, 4°C H_2SO_4 to pH <2	28 Days
Nitrate plus Nitrite	IN108/IN185 /IN187/IN190/IN195	100	P,G	Cool, 4°C H_2SO_4 to pH <2	28 Days
Nitrate[9]	IN180/IN185/IN87	100	P,G	Cool, 4°C	48 Hrs.
Nitrite	IN190/IN195	50	P,G	Cool, 4°C	48 Hrs.
Dissolved Oxygen					
Probe	IN235	300	G bottle and top	None Req.	Analyze Immediately
Phosphorus					
Ortho-phosphate	IN250.UB255	50	P,G	Filter on site Cool, 4°C	48 Hrs.
Silica	IN260	50	P only	Cool, 4°C	28 Days
Sulfate	IN290/IN295	50	P,G	Cool, 4°C	28 Days
Sulfide	IN300	500	P,G	Cool, 4°C add 2 mL zinc acetate plus NaOH to pH >9	7 Days
Sulfite	IN307	50	P,G	None Req.	Analyze Immediately
Organics					
BOD	IN025	1,000	P,G	Cool, 4°C	48 Hrs.
COD	IN090	50	P,G	Cool, 4°C H_2SO_4 to pH <2	28 Days
Oil & Grease	IN200/IN205	1,000	G only	Cool, 4°C H_2SO_4 or HCl to pH <2	28 Days
Organic Carbon	IN045	25	P,G	Cool, 4°C H_2SO_4 or HCl to pH <2	28 Days
Phenolics	IN230	500	G only	Cool, 4°C H_2SO_4 or HCl to pH <2	28 Days

TABLE 2.1 (CONTINUED)

Measurement	SWL/AATS Test Codes	Vol. Req. (mL)	Container[2]	Preservative[3,4]	Holding Time[5]
Organics (Cont.)					
MBAS	IN160	250	P,G	Cool, 4°C	48 Hrs.
Purgeable Halocarbons (601)	GC110	40	G, Teflon-lined Septum	Cool, 4°C 0.008% $Na_2S_2O_3$[6]	14 Days
Purgeable Aromatic Hydrocarbons (602)	GC120	40	G, Teflon-lined Septum	Cool, 4°C, 0.008% $Na_2S_2O_3$[6], HCl to Ph 2	14 Days
Phenols[12]	MS505	1,000	G, Teflon-lined	Cool, 4°C, 0.008%	7 days until extraction
EPA Method 604	GC700		Cap	$Na_2S_2O_3$	40 days after extraction
Organochlorine	GC800/GC810	1,000	G, Teflon-lined	Cool, 4°C, pH 5-9	7 days until extraction
Pesticides/PCBs[12]	GC800/GC810		Cap		40 days after extraction
EPA Method 608	GC800/GC810				
Polynuclear Aromatic Hydrocarbons[12]	GC420	1,000	G, Teflon-lined	Cool, 4°C, 0.008%	7 days until extraction
EPA Method 610	GC420		Cap	$Na_2S_2O_3$[6], store in dark	40 days after extraction
TCDD[12]	MS700	1,000	G, Teflon-lined	Cool, 4°C, 0.008%	7 days until extraction
EPA Method 613	MS700		Cap	$Na_2S_2O_3$[6]	40 days after extraction
Purgeables	MS300/MS310	2 x 40	G, Teflon-lined	Cool, 4°C, 0.008%	14 Days
EPA Method 624	MS300/MS310		Septum	$Na_2S_2O_3$[6]	
Base/Neutrals Acids	MS500/MS510	1,000	G, Teflon-lined	Cool, 4°C, 0.008%	7 days until extraction
EPA Method 625	MS500/MS510		Cap	$Na_2S_2O_3$[6]	40 days after extraction

1. More specific instructions for preservation and sampling are found with procedures as detailed in EPA-600/4-79-020, revised March 1983, and in the Federal Register, Vol. 49, No. 209, Oct. 26, 1984, EPA 40 CFR part 136.

2. Plastic (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.

3. Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

4. When any sample is to be shipped by common carrier of sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table 1, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at

concentrations of 0.35% by weight or less (pH about 1.15 or greater); Sodium hydroxide (NaOH) in water solutions at concentrations of 0.08% by weight or less (pH about 12.30 or less).

5. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of sample under study are stable for the longer time, and has received a variance from the Regional Administrator. Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.

6. Should only be used in the presence of residual chlorine.

7. Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before the pH adjustment in order to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.

8. Samples should be filtered immediately on-site before adding preservatives for dissolved metals.

9. For samples from non-chlorinated drinking water supplies concentrated H_2SO_4 should be added to lower sample pH to less than 2. The sample should be analyzed before 14 days.

10. Sample receiving no pH adjustment must be analyzed within seven days of sampling.

11. The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within three days of sampling.
12.When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for seven days before extraction and for 40 days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 6 (requirement for thiosulfate reduction of residual chlorine), and footnotes 13 and 14 (analysis of benzidine).

13. If 1,2-diphenylhydrazine is likely to be present, adjust the sample pH to 4.0 + 0.2 to prevent rearrangement to benzidine.

TABLE 2.2

RECOMMENDATION FOR SAMPLING AND PRESERVATION OF SOIL SAMPLES ACCORDING TO MEASUREMENT[A]

Measurement	Vol. Req. (oz)	Container[b]	Preservative[c,d]	Holding Time[e]
Inorganics, Non-Metallics				
Petroleum Hydrocarbons	32	G	Cool, 4°C	28 days
Metals				
Total Recoverable	8	G	Cool, 4°C	6 months
Extraction Procedure Toxicity	32	G	Cool, 4°C	6 months
Organics				
VOCs and Xylenes, EPA Method 8240	2 x 4	G	Cool, 4°C	14 days
Extractable Priority Pollutants EPA Method 8270	32	G	Cool, 4°C	14 days - extraction 40 days - analysis

a. More specific instructions for preservation and sampling are found with procedures as detailed in EPA-600/4-79-020, revised March 1983, and in the Federal Register, Vol. 49, No. 209, Oct. 26, 1984, EPA 40 CFR Part 136, Table II.

b. Plastic (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.

c. Sample preservation should be performed immediately upon sample collection. for composite samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

d. When any sample is to be shipped by common carrier of sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table 1, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); Sodium hydroxide (NaOH) in water solutions at concentrations of 0.08% by weight or less (pH about 12.30 or less).

e. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of sample under study are stable for the longer time, and has received a variance from the Regional Administrator. Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.

f. Should only be used in the presence of residual chlorine.

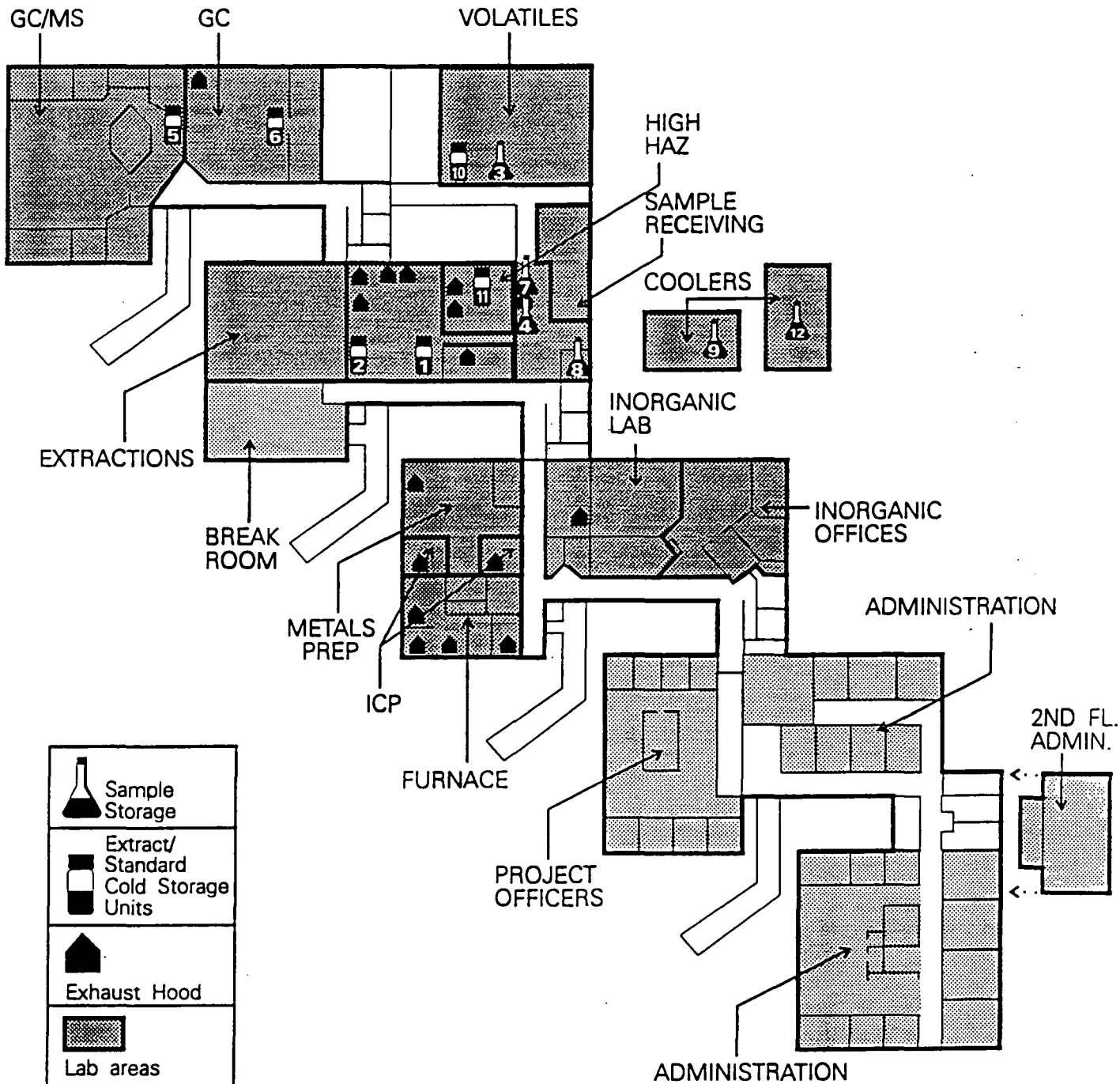
g. For samples from non-chlorinated drinking water supplies, concentrated H_2SO_4 should be added to lower sample pH to less than 2. The sample should be analyzed before 14 days.

h. Sample receiving no pH adjustment must be analyzed within 7 days of sampling.

i. If analysis is to include benzene, toluene, and/or ethyl benzene, sample must be analyzed within 7 days of sampling.

FACILITY LAYOUT

Southwest Laboratory of Oklahoma, Inc., Broken Arrow, OK



Layout of Southwest Laboratory of Oklahoma's 32,000 square foot facility located in Broken Arrow, Oklahoma.

AUTHORIZED LIST OF EMPLOYEE'S
FOR ACCESS TO
SECURED STORAGE AREAS

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

1700 West Albany • Broken Arrow, Oklahoma 74012 • Office (918) 251-2858 • Fax (918) 251-2599

AUTHORIZED PERSONNEL

SAMPLE CUSTODIANS

Briggs, Paul
Hamby, Missy

PROJECT OFFICERS/PROGRAM MANAGERS

Alstatt, Daryl
Borg, Harry
Daniello Paul
Harris, Robert
Hoover, Chuck
Markham, Steve
Mannan, Claude
Shringapure, Jayant
Smith, Mark
Staggs, Randy
Wright, Jack

ANALYSTS

Agimudie, Rickki
Alexander, Sam
Anderson, Doug
Beckett, Lois
Beebe, Paul
Beree, Deborah
Burns, David
Caldwell, Diana
Chase, Karen
Crandall, Debi
Dees, Brett
Fee, Rebecca
Flora, Diana
Fryer, Cindy
Foster, Desmond
Godbold, Linda
Hall, Vicki
Humphrise, Sonja
Jackson, Gina
Loper, David
Keeth, Bill
Kerkemeyer, Carl
Kidd, Gary
Moore, John
Morrison, Lisa
Newman, Julie
Pavey, Seretha
Perry, Mike
Peterson, Denise
Pettus, Debbie
Phuong, Vo
Rhodes, Sharon
Ruckman, Jason
Rutledge, Tim
Rymas, Maureen
Sappington, Susan
Shahreza, Ali
Sharpe, Matt
Simpson, Otto
Sims, Keith
Singleton, Mike
Smith, Bryce
Tiffany, Paul
Watson, Brent
Webb, Jim
Williamson, Janet
Wright, John
Zimmer, Angela

6/30/92

EMPLOYEE SIGNATURE AND INITIAL LISTING

EMPLOYEE SIGNATURE and INITIAL LISTING

EMPLOYMENT DATE	EMPLOYEE NAME	INITIALS	WRITTEN NAME	WRITTEN INITIALS	DATE OF TERMINATION
1-01-77	Jack Wright	JW	Jack Wright	JW	
8-24-81	Desmond Foster	DF	Desmond Foster	D.F.	
4-08-83	Robert Elkins	RE	Robert Elkins	R.E.	4/24/87
7-01-83	Robert W. Harris	RWH	Robert W. Harris	RWH	
4-30-84	Lois A. Beckett	LAB	Lois A. Beckett	LAB	
10-01-84	Patty Northam	PN	Patty Northam	PN	
6-10-85	John W. Keeth	JWK	John W. Keeth	JWK	
9-09-85	Claude A. Mannan	CAM	Claude A. Mannan	CAM	7-7-87
11-01-85	Jayant D. Shringarpure	JDS	J.D. Shringarpure	JDS	
3-10-86	Mark A. Smith	MAS	Mark A. Smith	MAS	9-1-89
5-08-86	Margie Frischkorn	MF	Margie Frischkorn	MF	
8-11-86	Paula Sieber	PS	Paula Sieber	ps	4-14-89
8-18-86	Mark L. Owen	MLO	Mark L. Owen	MLO	9-2-88
9-11-86	Rickki Agimudie	RA	R. L. Agimudie	RA.	
11-17-86	Susie Johnson	SJ	Susie Johnson	SJ	
11-24-86	Michael S. Perry	MSP	Michael S. Perry	MSP	
12-01-86	James David Hunter	JDH	James David Hunter	JDH	5-6-88
2-09-87	Carl Rapson	CR	Carl Rapson	CR	
2-16-87	David Morton	DM	David Morton	DM	11-22-88
4-27-87	Robert M. Prater	RMP	Robert M. Prater	RMP	8-12-88
4-29-87	Keith Sims	KS	Keith Sims	KS	
5-12-87	John Collins	JC	John Collins	JC	5-27-88
6-01-87	Charles F. Hoover	CFH	Charles F. Hoover	CFH	
7-13-87	Russell Carlson	RC	Russell Carlson	R.C.	8-14-87
8-3-87	Linda Godbold	LG	Linda Godbold	LG	
8-24-87	Judy A. Parli	JAP	Judy A. Parli	JAP	9-23-88
9-14-87	Russell E. Johnson	REJ	Russell E. Johnson	REJ	6-8-90
9-1-87	K.M.Bagawandoss	KMB	K. Bagawandoss	KB	4-12-91

EMPLOYEE SIGNATURE and INITIAL LISTING

EMPLOYMENT DATE	EMPLOYEE NAME	INITIALS	WRITTEN NAME	WRITTEN INITIALS	DATE OF TERMINATI
9-28-87	Terry Martindale	TM	Terry Martindale	TM	
9-28-87	Terry Bogey	TB	Terry Bogey	TB	9-8-89
11-30-87	Phyllis Cornelius	PC	Phyllis Cornelius	PC	
2-9-88	Sheron W. Williams	SW	Sheron Williams	SW	7-1-88
2-15-88	Cynthia Woodward	CW	Cynthia Woodward	CW	1-6-89
5-11-88	Gina B. ~~Brooks~~ Jackson	GBB	Gina B Jackson ~~Gina Brooks~~	GBB ~~GBB~~	
5-16-88	Marty R. Taber	MRT	Marty R. Taber	MRT	9-13-89
5-16-88	Vicki L. Hall	VLH	Vicki L. Hall	VLH	
6-27-88	Karen Walker	KLW	Karen Walker	KLW	
7-18-88	Kevin L. Miller	KM	Kevin Miller	KM	11-8-90
8-8-88	Steve L. Markham	SLM	Steve L Markham	SLM	
8-8-88	Alison M. Robinson	AR	Alison M. Robertson	AR	8-30-89
8-15-88	Valerie Markham	VM	Valerie Markham	VM	10-30-91
10-24-88	Philip Duncan	PD	Philip Duncan	PD	12-8-89
10-31-88	David LeMaster	DL	David LeMaster	DL	
11-25-87	Gary Kidd	GK	Gary Kidd	GK	
6-6-88	Howard Marquise	HM	Howard Marquise	HM	8-31-89
9-26-88	John Moore	JM	John F. Moore	JM	
10-3-88	Ellen Morelock	EM	Ellen Morelock	EM	11-27-89
1-9-89	Phyllis Stein	PS	Phyllis Stein	PS	5-19-89
1-16-89	Carl Kerkemeyer	CK	Carl Kerkemeyer	CK	
1-16-89	Claude A. Mannan	CAM	Claude A. Mannan	CAM	
1-24-89	Alan Swartz	AS	Alan Swartz	AS	
4-24-89	Vikki Hodo	VH	Vikki Hodo	VH	7-6-90
5-[illegible]-89	Missy Sherman	MS	Missy Sherman	MS	
5-5-89	Otto Simpson	OS	Otto E. Simpson	OES	
6-26-89	Jason Ruckman	JR	Jason Ruckman	JR	
7-5-89	Keith Cooper	KC	Keith Cooper	KEC	9-7-90

EMPLOYEE SIGNATURE and INITIAL LISTING

EMPLOYMENT DATE	EMPLOYEE NAME	INITIALS	WRITTEN NAME	WRITTEN INITIALS	DATE OF TERMINATI
7-10-89	Sonja ~~Scott~~ Humphrise	SS	Sonja M Humphrise	SMH	
7-10-89	Diana Baker	DB	Diana D. Baker	DB	
7-17-89	Daryl Alstatt	DA	Dsl Alstatt	DSA	
7-24-89	Julie Lee	JL	Julie A. Lee	JAL	
8-7-89	Gaye ~~Lewis~~ Henson	GL	Gaye Henson	GL	
8-16-89	Sherri Farley	SF	Sherri Farley	SF	
8-28-89	Paul Tiffany	PT	Paul Tiffany	PT	
9-5-89	Kellee Fisher	KF	Kellee Fisher	KF	8-13-90
9-5-89	Deborah Peters	DP	Deborah Peters	DP	10-3-9
9-5-89	Seretha Pavey	SP	Seretha Pavey	SP	
9-6-89	Lisa Morrison	LM	Lisa Morrison	LM	
9-11-89	Anne-Marie Martyn	AMM	Anne Marie Martyn	AMM	11-14-90
[redacted]-89	Maureen Rymas	MR	Maureen K Rymas	MR	
9-25-89	Pauline Lewis	PL	Pauline Lewis	PL	
9-26-89	Brian Florence	BF	Brian Florence	BLF	10-2-90
1-2-90	Randy Staggs	RS	Randy Staggs	RS	
1-10-90	Tim Rutledge	TR	Tim H Rutledge	TR	
1-15-90	Bonnie Benson	BB	Bonnie Ellen Benson	—	3-23-90
1-15-90	Michelle Mathis	MM	Michelle Mathis	MM	8-6-90
1-29-90	Sam Alexander	SA	Sam Alexander	SA	
2-5-90	Janet Williamson	JW	Janet Williamson	JW	
2-13-90	Gayle Williams	GW	Gayle Williams	GW	
3-29-90	David Loper	DL	David Loper	DL	
4-9-90	Brent Watson	BW	Brent Watson	BW	
5[redacted]0	Lisa Kirby	LK	Lisa G. Kirby	LK	
[redacted]1-90	Debbie Pettus	DP	Debbie Pettus	DP	
6-20-90	Carmen Brooks	CB	Carmen Brooks	CB	6-8-92
6-29-90	John Mason	JM	J Scott Mason	JSM	12-9-90

EMPLOYEE SIGNATURE and INITIAL LISTING

EMPLOYMENT DATE	EMPLOYEE NAME	INITIALS	WRITTEN NAME	WRITTEN INITIALS	DATE OF TERMINAT
7-12-90	Patrick Gaddis	PG			11-16-9
7-16-90	Ali Shahreza	AS			
7-23-90	Beth Wolters	BW			2-2-91
7-27-90	Julie Bailey	JB			
7-30-90	Cindy ~~Langley~~ Frye	CL			
7-30-90	Darla ~~Nelson~~ Blan	DN			
8-27-90	Sharon Davidson	SD			
9-4-90	Emiline Bauder	EB			
9-10-90	Kelly Charleville	KC			10-30-91
9-12-90	Marcel Schatzmann	MS			5-24-91
9-24-90	Matthew Persons	MP			10-30-91
9-24-90	David Wright	DW			3-6-92
[illegible]1-90	Brian Duzan	BD			7-26-91
10-4-90	Trip Ishmael	TI			7-26-91
10-29-90	Robert West	RW			
11-5-90	Marilou Kaupke	MK			
10-15-90	Jan Lookadoo	JL			
12-3-90	Brenda Carper	BC			
12-10-90	Sandra Collins	SC			8-29-91
1-2-91	Donnie Cox	DC			7-12-9
1-2-91	Michael Singleton	MS			
2-4-91	Jeff Cushing	JC			11-1-91
2-6-91	Angela Braly	AB			
3-18-91	Janice Travis	JV			
[illegible]-91	Matthew Sharpe	MS			
[illegible]-91	Diana Flora	DF			
4-15-91	Brawn Fahrny	BF			
5-1-91	Brett Dees	BD			

EMPLOYEE SIGNATURE and INITIAL LISTING

EMPLOYMENT DATE	EMPLOYEE NAME	INITIALS	WRITTEN NAME	WRITTEN INITIALS	DATE OF TERMINAT
5-20-91	David Burns	DB			
5-28-91	Paul Daniello	PD			
6-17-91	Rebecca Fee	RF			
7-8-91	Tiffany Benshoof	TB			
8-12-91	Deborah Beree	DB		DJB	
8-12-91	Bryce Smith	BS		BKS	
8-12-91	Paul Beebe	PB		PB	
9-4-91	Janet O'Shansky	JO			
9-5-91	Paul Briggs	PB			
9-9-91	Mark Smith	MS			
9-11-91	Keith Cooper	KC			
9-18-91	Cheryl Scoggin	CS			
9-23-91	Leslie Davis	LD			
10-14-91	James Webb	JW		JLW ~~JW~~ ~~JLW~~	
10-16-91	Deborah Crandall	DC			
11-4-91	Susan Pohl	SP		SP	
11-13-91	Diana Caldwell	DC			
11-25-91	Douglas Anderson	DA		DCA	
12-02-91	John Wright	JHW		JHW	
12-09-91	Wylie Brake	WB		WSB	3-21-92
12-09-91	Irma Fortey	IF		IF	2-28-92
12-09-91	Diane Snelson	DS		DNS	
12-19-91	Sharon Rhodes	SR		SR	
11-25-91	Susan Sappington	SS			
2/18/92	Harry Borg	HB		HB	
2/24/92	Scott Danks	SD			
12/16/92	Roxane Brantes	RB		RB	
3/30/92	Jayne Preaus	JP		JP	

EMPLOYEE SIGNATURE and INITIAL LISTING

EMPLOYMENT DATE	EMPLOYEE NAME	INITIALS	WRITTEN NAME	WRITTEN INITIALS	DATE OF TERMINA
5/1/92	Karen Chase	KC	Karen L. Chase	KC	
5/11/92	(Donita)Penny Thompson	PT	Penny Thompson	P. T.	
5/18/92	Sandra Tackett	ST	Sandra Tackett	St.	
5/26/92	Denise Peterson	DP	Denise Peterson	DP	
6/1/92	Karen Lollis	KL	Karen Lollis	KL	
6/8/92	Phuong Vo	PV	Phuong V.	PV	

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

STANDARD OPERATING PROCEDURE FOR LABORATORY INFORMATION MANAGEMENT SYSTEM (LIMS) FOR SAMPLE RECEIVING

REV 1.0 —8/22/91

LOG ON

To log onto the LIMS >SRLAB1 is typed, followed by the return key.

MAIN MENU

The main menu appears giving you options of *Sample Management, Worksheet Options, Maintenance*, etc.

Sample Management Option is chosen by hitting the return key.

SAMPLE MANAGEMENT KEY

The *Sample Management* menu gives you options to log-in samples, modify samples, or cancel samples. To log-in, choose option #1.

EPISODE LOG-IN

The episode information is entered including the following:

Episode Number:
Log-In Date:
Client:
Site:
Project:
P.O. Number:
Comments:
Case Number:
SDG No:

INDIVIDUAL SAMPLE LOG-IN

Once all the episode information is entered, F10 is typed and then the individual samples for the episode can be logged in. Each sample is assigned a sequential number preceeded by the four digit episode number.

3551.01 Sample #1
3551.02 Sample #2
3551.03 Sample #3

Beginning with sample number 1 (.01), the required test codes are entered, for example:

MS300	for volatile organics by Method 8240
MS500	for semivolatile organics by Method 8270
MT910	for CLP metal analysis

Once all the test codes are entered for each sample, F10 is typed.

WORKSHEET GENERATION

Leave the *Sample Management* menu by hitting ESC or F3 until the main menu returns. Choose the *Worksheet Options* and hit return. Several options are given. Use the "*Print Log-In Worksheet*" option and type in the assigned episode number. Hit the F10 key twice; the LIMS system will then generate the Worksheet.

INTERNAL CHAIN-OF-CUSTODY

From the *Worksheet Options*, the internal chain-of-custody can be generated by typing in teh episode number.

SOUTHWEST LABORATORY OF OKLAHOMA, INC.

STANDARD OPERATING PROCEDURE FOR PREVENTIVE MAINTENANCE (GENERAL)

REV 1.0 —7/10/92

Table of Contents

I. SUMMARY

Preventive maintenance is defined as an orderly program of positive actions for preventing failure of equipment and ensuring that the equipment is operating with the reliability required for quality results. The actions include specification checks, calibrating, cleaning, lubricating, reconditioning, adjusting and checking.

II. FIELD EQUIPMENT

A. Summary

Preventive maintenance is carried out on all field equipment prior to being shipped to the sampling site. This preventive maintenance includes regular battery checks and maintaining a sufficient stock of spare parts and supplies. Field personnel are strongly cautioned that these instructions are for general purpose only. Should equipment break down in the field and field crews are unable to repair the equipment within a reasonable amount of time, the operations manager in the laboratory is notified. A replacement is shipped immediately via overnight courier. Whenever possible, duplicates of all equipment are initially sent to the field. For specific preventive maintenance procedures, the appropriate instrument manual should be consulted.

B. pH Meter

The following is a description of the preventive maintenance procedures for the field pH meters:

- Charging Batteries

After the initial charge when first placing the instrument in operation, the batteries are recharged after each 30 hours of operation. Allow the batteries to charge 16 hours to restore them fully. Exceeding the 16-hour period will not damage the batteries. Overnight charging is recommended, and periods of operation between charges should not exceed 30 hours. With proper charging practices, a set of batteries should last for more than 300 charge cycles.

- Battery Replacement

When batteries no longer hold a charge for a reasonable length of time, they should be replaced. This unit requires six AA size nickel-cadmium batteries. Replace them as follows:

- Remove the accessories from the foam insert above the instrument panel

- Remove the four screws securing the panel in the case

- Lift the panel from the case and place it face down on a padded surface

- Pry the batteries from their clips with a screwdriver and replace all six batteries

- Replace the panel in the case, and replace the accessories in the foam insert

- Connect the charge unit to the instrument and allow the batteries to charge for 15 hours.

- pH Electrode Care Storage

When the electrode is not in use, the wetting cap with filling solution-soaked cotton should be reinstalled over the tip, and the fill hole cover should be placed over the hole. This will prevent loss of filling solution through evaporation. Always maintain the filling solution level just below the fill hole.

- pH Electrode Cleaning

Normal cleaning of the electrode can be performed in the following manner:

- Immerse the electrode tip in 0.1N HCl followed by immersion in 0.1N NaOH and again in 0.1N HCl, each for a 2 minute period. Rinse with ASTM Type II reagent water and soak in pH 7 buffer solution for 30 minutes.

- If the electrode is slow to respond or readings are unstable and the connection cannot be remedied with normal cleaning, the reference junction may be clogged. Clean the junction for 10 minutes in dilute potassium chloride solution. First dilute a saturated potassium chloride solution about 1:10 with water. Place the electrode tip in the boiling solution for about 10 minutes.

- Remove heat and allow the electrode to cool while immersed in the solution. Then rinse with ASTM Type II reagent water and soak in pH 7 solution before testing again.

If these steps fail to improve electrode response, replace the electrode. If the pH bulb becomes contaminated or left dry, it may be reconditioned by following the cleaning procedure above.

C. Specific Conductance Meter

The following is a description of the preventive maintenance procedures for the field specific conductivity meters:

- Battery Replacement

Low battery condition is indicated by an arrow on the display. When the arrow appears, the battery should be replaced.

D. Thermometer

After each use, the thermometer probe should be rinsed with ASTM Type II reagent water. Should the sample contain oils or other heavy hydrocarbon mixture, the probe should be washed with laboratory-grade detergent and rinsed with ASTM Type II reagent water.

III. LABORATORY INSTRUMENTATION

A. Summary

A preventive maintenance program for the instrumentation ensures fewer interruptions of analyses, personnel efficiency, and lower repair costs. It eliminates premature replacement of parts, and reduces discrepancy among test results. It increases reliability of results.

The laboratory has established the following preventive maintenance program:

1. Each type of equipment/instrument has a written Standard Operating Procedure (SOP) which describes the methods for routine inspection, cleaning, maintenance, testing, calibration, and/or standardization of the equipment. Instrument operating manuals are kept near the instrument or where analysts have easy access.

2. Analysts using the instruments are properly trained and develop trouble-shooting skills in equipment failure to reduce dependence upon outside servicing agencies. In complicated cases, the servicing agency or supplier is called to solve the problem.

3. Written equipment records are kept to document all inspection, maintenance, trouble-shooting, calibration, or modifications. Whenever maintenance is performed on an instrument, it is properly documented in a preventive maintenance logbook, which is kept near the equipment to monitor the adequacy of maintenance schedules. The records contain the date (month, day, year), description of the maintenance done, the actual findings, the name of the person doing the maintenance and a statement of whether the maintenance operations were routine, and if those operations followed the written SOP.

4. Performance criteria is established for judging when data from instrument performance checks indicate the need to make adjustments in the instrument operating conditions. (See Section 4.0, Calibration Procedures and Frequency for details)

B. Chromatographic Instruments

Preventive maintenance is done through a daily performance check and calibration of standards. Parameters such as retention time and response factors are observed and back-checked with prior operational performance.

In addition, the following are done:

- GC detectors are cleaned whenever performance degradation (i.e., calibration criteria are not met, retention time shifts, noisy baseline, etc.) is observed by the analyst.

- Septa are replaced as needed.

- Incoming gas drying cartridges are changed whenever the color of the adsorbent is noticed.

- Effluent adsorbent traps are changed every month.

- Columns (GC and HPLC) are checked by performance and operating conditions when in use or prior to use.

- Oven performance checked daily prior to use.

C. Gas Chromatography/Mass Spectroscopy (GC/MS)

The preventive maintenance includes:

Maintenance Requirements	Frequency
Clean filters on cooling fans	Monthly
Check cooling fan for proper operation	Monthly
Check line voltage	Monthly
Clean CDC disc drive pre-filter	Monthly
Check cool-flow level	Monthly
Change mechanical pump oil	Every 4 months
Clean source and rods	Every 4 months
Check power supplies in QEM Box	Every 4 months
Clean printer inside and outside	Every 4 months
General cleaning of instrument	Every 4 months
All items from monthly maintenance schedule	Every 4 months
Change primary filters on CDC disc drive	Every 6 months
Sensitivity analysis through BFB and DFTPP tune criteria	Every 12-hour clock

D. Atomic Absorption Spectrophotometers/ICP

Preventive maintenance is done for atomic absorption through the following checks:

- Minimum warm-up period of 30 minutes
- Alignment of hollow cathode tube to produce the maximum emitted light to the detector
- For flameless AA, the inert gas flow inside the furnace is optimized to ensure maximum sensitivity
- Digital readout values obtained for the standard curve of each element are checked to ensure linearity
- If readings are low, the operator checks the gas flows, burner or cell alignment, wavelength, slit width, photomultiplier voltage and lamp intensity prior to analysis

E. General Laboratory Equipment

Analytical balances of various capacities and operational modes are calibrated annually by a licensed specialist and officially recorded as verification of performance.

Balances are calibrated with standard Class S calibration weights before usage. The pH/specific-ion meters are calibrated before use with a minimum of two standard solutions. All combination pH electrodes will be stored in pH 4 buffer solutions. Appendix D shows SOPs used for some instrumentation and equipment.