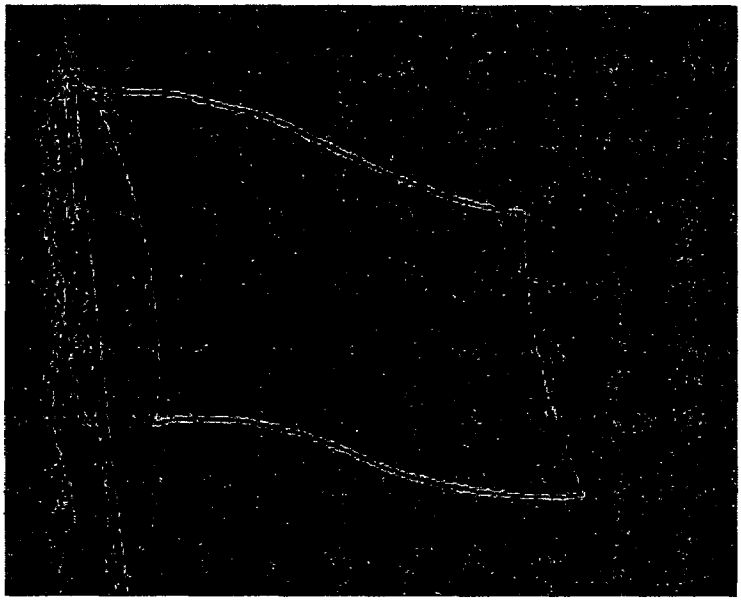
QUALITY ASSURANCE PROJECT PLAN

PROJECT MANAGEMENT, MEASUREMENT, ASSESSMENT AND DATA VALIDATION



State of New Mexico
Oil Conservation Division

2040 South Pacheco
Santa Fe, New Mexico 87505
505-827-7131

ORIGINAL

QUALITY ASSURANCE PROJECT PLAN

New Mexico Energy, Minerals and Natural Resources Department
Oil Conservation Division
2040 South Pacheco
Santa Fe, New Mexico 87505
(505)-827-7131

Pursuant to :
Amendments to the Environmental Protection Agency
General Grants Regulations (40 CFR Part 31)

Submitted by:

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Oil Conservation Division

Lester W Price Date 10-11-2000

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ORIGINAL

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Effective: 12-11-00 thru 12-11-01 **QTRAK #** 01-053

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A3. DISTRIBUTION LIST

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A4. PROJECT/TASK ORGANIZATION

PURPOSE: The NMOCD QAPP shall provide a clear understanding of intra and interorganization participation in project management, objective planning, sampling, analyses and data quality management.

It will also provide documentary evidence of the roles and responsibilities of key individuals within the NMOCD that are in charge of major data gathering activities related to UIC sampling projects. This QAPP shall ensure that contractors incorporate EPA QA/R-5 as well. The NMOCD is presently using Trace Analysis, Inc. of Lubbock, Texas for its contract laboratory services. (See Appendix E Trace Analysis, Inc. Quality Management Plan)

The Quality Assurance Officer (QAO) for the NMOCD is an Environomental Bureau Staff member who reports to the Environmental Bureau Chief. (appendix B See figure 1-1) The QA/QC officer works with the UIC director and UIC Administrator as well as the Environmental Bureau staff (appendix B See figure 1-2) to ensure that all samples are collected and data measurements incorporate the appropriate EPA approved QA/QC procedures and methods.

Environmental data generated from various sampling events will be collected, and reviewed by the NMOCD Environmental Bureau staff and NMOCD District Environmental representatives.

The data that is collected will be utilized by the following:

1. NMOCD Environmental Bureau staff.

2. NMOCD UIC Director.

3. NMOCD QAO.

Analytical data will be collected by experienced NMOCD personnel on the following types of UIC wells and regulated facilities with the following estimated frequency.

1. Class I non-hazardous Industrial wells at NMOCD permitted discharge plan facilities - (on approval and renewal).

2. Class II Salt Water disposal and secondary recovery injection wells - (on random type basis).

3. Class III brine wells -(on approval and renewal of WQCC discharge plans).

4. Class V non-hazardous industrial waste wells at oil and gas facilities regulated by the OCD. -(on random type basis upon discovery, and if permitted at least annually).

Note: OCD may require a greater frequency of sampling be conducted on regulated UIC well sites and discharge plan permit sites if the vadose zone and/or groundwater has been impacted.

A5. PROBLEM DEFINITION/BACKGROUND

This QAPP shall provide the needed measure of reliability for the NMOCD UIC program.

The plan shall specifically address methods which shall be utilized in the field while collecting samples for chemical analysis. These steps and procedures will ensure that data collected as a result of a field sampling events will be both reliable and non-contaminated as well as legally defendable in court.

This QAPP is a requirement for the EPA UIC program and is needed in order to ensure that the (UIC) programs provide quality data for the protection of surface, groundwater, human health and the environment.

The data when collected will be sent/reviewed through the NMOCD Environmental Bureau and the NMOCD QAO in order to make a decision/conclusion on the data in terms of its validity.

The QAO along with the Environmental Bureau Chief will then coordinate an appropriate corrective action with the NMOCD UIC Director. If Discharge plan facilities are involved then the appropriate member of the Environmental Bureau Staff will also be involved in the corrective action measures.

A6. PROJECT/TASK DESCRIPTION

The NMOCD Quality Assurance Project Plan will provide the framework in which the agency can evaluate chemical sample data. This data collected within the UIC program will ensure that conclusions drawn from the sample collection data are accurate and precise. Data that is collected may then be utilized by agency personnel so that sources of groundwater are protected as intended in the UIC program.

Samples to be collected will depend upon the type of facility and the possible contaminants that could exist. EPA approved sample methods will be utilized on samples to be analyzed.

The frequency of sampling will depend upon the permit conditions or the need for spot type sampling to ensure facility/operator compliance with State and Federal regulations.

Personnel from the Environmental Bureau as well as the District Environmental representatives will collect samples as part of the process described above.

Reports will be submitted to the QAO and when corrective action is needed will be sent to the Environmental Bureau Chief and UIC Director along with QAO and Environmental Bureau staff recommendations.

A7. DQO FOR MEASUREMENT DATA

The NMOCD QAPP must ensure that data quality objectives are maintained through the planning, sample collection and data generation process. In other words the data must be able to support conclusions that are drawn from it and be of such quality that the data can be defended.

Quantitative goals must therefore be established in order that the sample/data collection method is of sufficient quality and sensitivity. The Data must also be precise in the sense that a sufficient number of samples are obtained in order to produce the required degree of certainty.

The scope of this QAPP covers a wide range of Exploration and Production provinces within the state of New Mexico. Generally

the geographic areas can be divided into two areas, NorthWest New Mexico or the San Juan Basin, and SouthEast New Mexico or the Permian Basin. The Class II UIC wells receive exempt RCRA Exempt E&P wastes that can be different in chemical nature.
The San Juan Basin is mostly a Natural Gas production area producing from Cretaceous age sands, coals, and shales. The Permian Basin is mostly a crude oil production area that produces from carbonates of Permian age. The difference in the geology of the two basins leads to the produced and injected waters being chemically different in nature. The major differences would be in salinity, dissolved gases, and dissolved hydrocarbons.

The NMOCD also permits Class I Non-Hazardous and Class III brine extraction wells. The Class III Brine Extraction wells are located in southeast New Mexico. These wells are permitted with the NMOCD as discharge plans through the Water Quality Control Commission (WQCC) and Water Quality Act (WQA) of the state of New Mexico. The effluent generated at these sites would consist of very high salinity brines, which are used as drilling and completion fluids in Exploration and Production operations. The Class I Non-Hazardous wells receive non-hazardous type oil field wastes. These facilities are permitted by the NMOCD through the WQCC and WQA of the state of New Mexico. The operators of these sites are required to sample the injected effluent stream quarterly to ensure that the wastewater is non-hazardous.

The data that NMOCD obtains and reviews will essentially be generated from sampling of a wide range of media such as soils, surface and groundwater, including waste streams generated by Exploration and Production operations. The data would primarily be utilized by the Environmental Bureau Staff but could also be utilized by district environmental representatives, the UIC Director, and the general public, as well as the oil and gas industry. In the case of a compliance issue it could be used by all of the above and the Federal EPA along with other concerned regulatory agencies.

The data needed will be from specific UIC facilities. In other words the sampling requirements in terms of types and frequency will depend on the type of UIC facility. However, the QA/QC for the collection and analysis for the data would generally be the same. These procedures are listed below:

1. In Appendix C - Are sample holding times, sampling methods, and quantitative acceptance criteria.

2. In appendix D under OCD sampling procedures all sample types and collection methods are listed as a document.

3. In Appendix E under Trace Analysis, Inc. Quality Manual with Quality Management Plan lists all the quality control steps for the laboratory.

By integrating 1, 2, and 3 listed above the QAO for the NMOCD can maintain the needed sensitivity, precision, accuracy, and completeness of each sampling event for each major parameter. Thus allowing the goal of attaining data that will be representative, accurate, precise and comparable can then be met. The following process may then be integrated in a synergistic manner to obtain these goals:

- Develop and utilize statistical and/or random sampling methods where appropriate.
- Collect appropriate type and amount of samples.
- Ensure that all samples collected will be representative of the media by sampling at different locations within the project area.
- Include verification and validation of sampling and analytical techniques in the process.

Consistency will form the basis for obtaining sample data that is comparable. Selection of sampling methods, procedures, and preservation methods throughout a sampling project will result in results that are comparable.

A8. PROJECT NARRATIVE

The success of a project shall be determined by the accuracy and precision of the sample in relation to both the sampling event and the sample analysis. Sample design requirements will be surveyed in such a manner as to reduce or eliminate any possibly of the samples being rendered unacceptable in terms of accuracy and precision. Sample types and their collection location will also be of prime consideration and should be done in such a manner as to ensure that sample repeatability will not be compromised due to collection methods. Samples will be handled in such a manner as to ensure that custody transfer and sample handling is done in such a way as to ensure sample validity.

The personnel involved in collecting and using the data will be mostly NMOCD Environmental Bureau staff and would sometimes include district environmental staff representatives. The staff members have training and they have technical degrees in engineering and geology as well as on the job training.

Only EPA approved analytical methods will be selected based on the nature of the specimen i.e. solid or liquid and possible

constituents i.e. organic/inorganic. The analytical methods are outlined and discussed in OCD sampling procedures listed in appendix (C). The QAO and other environmental staff members will evaluate jointly the validity of ongoing sampling procedures in order to ensure that sample and analytical methods are delivering the desired results. The QAO and the lab will also work together in order to optimize sampling events in terms of methods that are selected are acceptable EPA standard methods for the sample of interest. Sampling events will be done in such a manner as to ensure that site problems and logistics issues are handled in such a manner as to assure sample validity i.e. items which can be controlled such as sample dates and sample equipment will be addressed so they do not have an adverse impact on the QA/QC of the samples being taken at a particular facility or project site.

A9. SPECIAL TRAINING/CERTIFICATION

All Environmental Bureau Staff (including the QAO) and District Environmental Representatives will receive the OSHA 1910.120 40 Hour HAZWOPER training required and maintain the refresher training annually. This training will ensure that NMOCD staff is collecting samples in such a manner that they should not pose a threat to themselves or others while in the act of collecting samples.

Any UIC training regarding UIC and sampling will be attended by the QAO with regards to QAPPs and QMPs. This will have to be done over time as the QAO has many other job responsibilities other than UIC Quality Assurance. The present NMOCD QAO has attended the EPA required seminars on the following:

- Orientation to Quality Assurance Management.
- Introduction to Data Quality Objectives.
- Quality Management Plans (QMPs) and Quality Assurance Project Plans (QAPPs).

All Environmental Bureau staff, including the QAO and Bureau Chief has technical degrees in either engineering, geology, or hydrology. Many of the staff members have worked in the oil and gas industry and therefore have a good understanding of what potential problems may arise at a particular project location.

All training and job qualifications are maintained at the OCD personnel office.

A10. DOCUMENTATION AND RECORDS

The importance of documentation and record keeping is of paramount importance towards the success of the UIC chemical sampling program and must therefore be considered an integral part of the NMOCD QAPP.

1. All records must be itemized with all information included.

2. The reporting format must be such that the results of the sampling event can be found with ease.

3. The report must also include the raw data, instrument printouts, QA/QC checks, and calibration where needed.

4. The Standard turnaround time will be 30 days with other options such as 24 and 72 hour emergency turnaround available through our contract lab.

5. The NMOCD staff member who collects the sample will note any difficulties in his/her field book. The field books are kept on file with the Environmental Bureau Chief.

6. All original documents are kept on file with the NMOCD Environmental Bureau located at 2040 South Pacheco street, in Santa Fe, New Mexico. Phone: (505-827-7131.)

Measurement/Data Acquisition:

B1. SAMPLING PROCESS DESIGN

A sampling process by design must be representative, complete and documented to provide scientific, legally defendable, usable environmental data.

The sample design process shall incorporate the following:

1. A general experimental design for the project.

2. The types of samples that are required.

3. Sample network design, frequency, matrices, measurement parameters, and rationale for the design.

4. Guidelines to be followed - including locations and accuracy of samples.

5. Classification of measurements.

6. Measurement validation procedures.

7. Measurement of process conditions.

In Appendix C and D are the NMOCD guidelines to be used in sample collection to ensure that all the points 1 - 7 above are covered.

B2. SAMPLING METHODS REQUIREMENTS

All sample methods will be EPA approved methods and are outlined in Appendix(S) - C, D, and E. These appendices address the entire range of sample collection through sample analysis at the lab. The NMOCD shall use the information in these appendices to ensure that all sample projects are complete, representative, and documented to provide scientific, legally defendable, and usable environmental data.

B3. SAMPLE HANDLING/CUSTODY REQUIREMENTS

The Handling and Custody transfer for samples is outlined in the appendices - C, D, and E. The use of the information in the appendices will allow the NMOCD to take into account maximum allowable holding times before extraction or analysis, and will provide the needed procedure to ensure that the appropriate provisions are maintained in sample custody.

B4. ANALYTICAL METHODS REQUIREMENTS

The required analytical methods will be EPA approved methods and are outlined in the QA/QC information submitted by the lab, this information may be found in Appendix E. The lab and NMOCD will work together in order to determine corrective steps to ensure method failure does not occur.

B5. QUALITY CONTROL REQUIREMENTS

All chemical method Quality control requirements are addressed in the Appendices - C, D, and E.

B6. INSTRUMENT/EQUIPMENT TESTING, INSPECTION, MAINTENANCE REQUIREMENTS

All Instrument/Equipment Testing, Inspection and Maintenance are drawn out in the Appendices - C, D, and E.

B7. INSTRUMENT CALIBRATION AND FREQUENCY

All instrument calibration and frequency of calibration are drawn out in the Appendices - C, D, and E.

B8. INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

All supplies and consumables shall be inspected and accepted for project use by the QAO and Environmental Bureau staff. Supplies will include all sample containers, custody tapes/labels and sampling gear such as bailers, Conductivity, and Ph. meters. Consumables shall consist of items such as indelible writing ink pens, gloves, hoses, distilled water, isopropyl alcohol, and soap.

All of the above items will be maintained and stored in such a manner as to ensure proper sample gathering procedures are carried out in order to reduce the chance of contamination of the sample being collected.

B9. DATA ACQUISITION REQUIREMENTS(NON-DIRECT MEASUREMENTS)

Data such as specific conductivity and groundwater depths will be obtained from the New Mexico State Engineer as well as Federal sources such as the USGS (United States Geological Survey). Information regarding site specific information where available will be obtained from existing NMOCD and NMED records on file in the Santa Fe offices.

Such data will be used in only establishing general trends-and not for detailed project specific analysis.

B10. DATA MANAGEMENT

All data that is collected in the field and obtained through laboratory analysis will be checked throughout the data report generation process. All data is kept on record at the NMOCD Santa Fe office as a paper hard copy and/or stored on computer floppy disk in the Environmental Bureau files. As of this moment

chemical data is not stored in any computer data base.

All Data will be checked by Environmental Bureau Staff members for completeness and precision/accuracy.

Assessment/Oversight:

C1. ASSESSMENTS AND RESPONSE ACTIONS

The purpose of data assessments and response actions is to ensure that the data collected will meet the criteria and goals of the projects intended purpose. The Environmental Bureau along with the QAO will implement assessments and response actions to ensure project compliance with QA/QC goals and project specific objectives. The QAO will report any problems and recommend project specific assessments on the particular sampling project in question. In the event that response actions are needed for non-conforming situations the QAO and the UIC Director will obtain advice for the Environmental Bureau staff before declaring a determination. All Environmental Bureau staff with the approval of the Environmental Bureau Chief, QAO, and UIC Director will implement response actions and project data assessments.

C2. REPORTS TO MANAGEMENT

Reports to management (UIC Director, OCD Director, UIC Administrator, Environmental Bureau Chief, and QAO) will occur when problems have been found, corrective action is needed, or upon special request. Each manager who is effected would be copied with the QAO as the designated recipient of the report.

Each report would incorporate the following:

1. Project Status.
2. Results of performance and system audits.
3. Results of periodic data quality assessments.
4. Significant quality assurance problems and recommended solutions.

Data Validation and Usability:

D1. DATA REVIEW, VALIDATION, VERIFICATION

Data will be reviewed by the Environmental Bureau Staff, QAO, and Environmental Bureau Chief in order to ensure data verification

and validation. Data will be accepted or rejected based on the policies/procedures outlined in Appendix - C, D, and E. Project objectives will be approved/disapproved based upon data collection procedures and analytic techniques utilized as well as lab QA/QC.

D2. VALIDATION AND VERIFICATION METHODS

The methods of validation and verification are described in Appendix C, D, and E from the time a sample is collected to point at which it is analyzed by the lab.

D3. RECONCILIATION WITH DQO(DATA QUALITY OBJECTIVES)

Upon evaluation of project data it must be reconciled in order to establish compatibility or consistency with data quality objectives. Issues will be resolved with the QAO if a discrepancy occurs with sample/project results.

The procedures outlined in Appendix C, D, and E will serve as the basis for the QAO to assess project precision, accuracy, and completeness. Issues that cannot be resolved by the QAO will be resolved by a group made up of the Environmental Bureau Staff, the UIC Director, QAO, and Environmental Bureau Chief.

APPENDIX A

TERMS AND DEFINITION

Activity - an all-inclusive term describing a specific set of operations or related tasks to be performed, either serially or in parallel (e.g., research and development, field sampling, analytical operations, equipment fabrication), that in total result in a product or service.

Assessment - the evaluation process used to measure the performance or effectiveness of a system and its elements. In this Standard, assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation, management systems review, peer review, inspection or surveillance.

Audit - a planned and documented investigative evaluation of an item or process to determine the adequacy and effectiveness as well as compliance with established procedures, instructions, drawings, QAPPs, and other applicable documents.

Characteristic - any property or attribute of a datum, item, process, or service that is distinct, describable, and measurable.

Contractor - any organization or individual that contracts to furnish services or items or perform work.

Computer Program - a sequence of instructions suitable for processing by a computer. Processing may include the use of an assembler, a compiler, an interpreter, or a translator to prepare the program for execution. A computer program may be stored on magnetic media, and be referred to as "software", or may be stored permanently on computer chips, and be referred to as "firmware". Computer programs covered by this Standard are those used for design analysis, data acquisition, data reduction, data storage (data bases), operation or control, and data base or document control registers when used as the controlled source of quality information.

Corrective Action - measures taken to rectify conditions adverse to quality and, where necessary, to preclude their recurrence.

Customer - any individual or organization for whom items or services are furnished or work performed in response to defined requirements and expectations.

Data Quality Assessment (DQA) - is a process for performing statistical analysis to determine whether the quality of a data set is adequate for its intended use.

Data Quality Objectives (DQOs) - a statement of the precise data, the manner in which such data may be combined, and the acceptable uncertainty in those data in order to resolve an environmental problem or condition. This may also include the criteria or specifications needed to design a study that resolves the question or decision addressed by the DQO process.

Data Quality Objectives Process - a Total Quality Management (TQM) tool developed by the U.S. Environmental Protection Agency to facilitate the planning of environmental data collection activities. The DQO process asks planners to focus their planning efforts by specifying the use of the data (the decision), the decision criteria, and their tolerance to accept an incorrect decision based on the data. The products of the DQO process are the DQOs.

Data Usability - the process of ensuring or determining whether the quality of the data produced meets the intended use of the data.

Design Review - a documented evaluation by a team, including personnel other than the original designers, the responsible designers, the customer for the work or product being designed, and a QA representative to determine if a proposed design will meet the established design criteria and perform as expected when implemented.

Engineered Environmental Systems - an all-inclusive term used to describe pollution control devices and systems, waste treatment processes and storage facilities, and site remediation technologies and their components that may be utilized to remove pollutants or contaminants from the environment. Examples include wet scrubbers (air), soil washing (soil), granulated activated carbon unit (water), and filtration (air, water). Usually, this term will apply to hardware-based systems; however, it will also apply to methods or techniques used for pollutant reduction of the contaminants, such as capping, solidification or vitrification, and biological treatment.

Environmental Conditions - the description of a physical medium (e.g., air, water, soil, sediment) or biological system expressed in terms of its physical, chemical, radiological, or biological characteristics.

Environmental Data - any measurements or information that describe environmental processes or conditions, or the performance of engineered environmental systems.

Environmental Data Operations - work performed to obtain, use, or report information pertaining to environmental processes and conditions.

Environmental Monitoring - the process of measuring or collecting environmental data.

Environmental Processes - manufactured or natural processes that produce discharges to or impact the ambient environment.

Environmental Programs - an all-inclusive term pertaining to any work or activities involving the environment, including but not limited to: characterization of environmental processes and conditions; environmental monitoring; environmental research and development; the design, construction and operation of engineered environmental systems; and laboratory operations on environmental samples.

Environmentally Related Measurements - the data collection activity or investigation involving the assessment of chemical, physical or biological factors in the environment which affect human health or the quality of life.

Environmental Technology - an all-inclusive term used to describe pollution control devices and systems, waste treatment processes and storage facilities, and site remediation technologies and their components that may be utilized to remove pollutants or contaminants from or prevent them from entering the environment. Examples include wet scrubbers (air), soil washing (soil), granulated activated carbon unit (water), and filtration (air, water). Usually, this term will apply to hardware-based systems; however, it will also apply to methods or techniques used for pollution prevention, pollutant reduction, or containment of contamination to prevent further movement of the contaminants, such as capping, solidification or vitrification, and biological treatment.

Extramural - relating to activities performed for NMOCD but not by NMOCD employees, usually by contracts, grants or cooperative agreements. Used in reference to QAPPs and QMPs.

Financial Assistance - the process by which funds are provided by one organization (usually government) to another organization for the purpose of performing work or furnishing services or items. Financial assistance mechanisms include grants, cooperative agreements, and government interagency agreements.

Graded Approach - the process of basing the level of application of managerial controls applied to an item or work according to the intended use of results and the degree of confidence needed in the quality of the results. (See Data Quality Objectives Process).

Hazardous Waste - any waste materials that satisfies the definition of "hazardous waste" as given in 40 CFR Part 261, "Identification and Listing of Hazardous Waste".

Independent Assessment - an assessment performed by a qualified individual, group, or organization that is not part of the organization directly performing and accountable for the work being assessed.

Inspection - examination or measurement of an item or activity to verify conformance to specific requirements.

Intramural - term used to describe activities performed by NMOCD employees, usually used in relationship to QAPPs, OMPs, contracts or grants.

Item - an all-inclusive term used in place of the following: appurtenance, facility, sample assembly, component, equipment, material, module, part, product, structure, subassembly, subsystem, system, unit, documented concepts, or data.

Management - those individuals directly responsible and accountable for planning, implementing, and assessing work.

Management System - a structured non-technical system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for conducting work and producing items and services.

Management System Review (MSR) - the qualitative assessment of a data collection operation and/or organization(s) to establish whether the prevailing quality management structure, policies, practices and procedures are adequate for ensuring that the type and quality of data needed are obtained.

May - denotes permission but not a requirement.

Method - a body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification) systematically presented in the order in which they are to be executed.

Mixed Waste - hazardous waste material, as defined by 40 CFR part 261 (RCRA), mixed with radioactive constituents.

Must - denotes a requirement that has to be met.

Objective Evidence - any documented statement of fact, other information or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measurements, or tests which can be verified.

Organization - a company, corporation, firm, enterprise, or institution, or part thereof, whether incorporated or not, public or private, that has its own functions and administration.

Peer Review - a documented critical review of work generally beyond the state of art or characterized by the existence of potential uncertainty. The peer review is conducted by qualified individuals (or organization) who are independent of those who performed the work, but are collectively equivalent in technical expertise (i.e., peers) to those who performed the original work. The peer review is conducted to ensure that activities are technically adequate, competently performed, properly documented, and satisfy established technical an quality requirements. The peer review is an in-depth assessment of the assumptions, calculations, extrapolations, alternate interpretations, methodology, acceptance criteria, and conclusions pertaining to specific work and of the documentation that supports them. Peer reviews provide an evaluation of a subject where quantitative methods of analysis or measures of success are unavailable or undefined, such as in research and development.

Performance Evaluation (PE) - a type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory.

Procedure - a documented set of steps or actions that systematically specifies or describes how an activity is to be performed.

Process - an orderly system of actions that are intended to achieve a desired end or result. Examples of processes include analysis, design, data collection, operation, fabrication, and calculation.

QTRAK - is a Computer Program that contains database information on Quality Management Plans and Quality Assurance Project Plans to the Program Managers, Project Officers, and the OQA for planning and assessment of the status of regional Quality Management Plans and the associated Project Plans.

Qualified Data - any data that have been modified or adjusted as part of statistical or mathematical evaluation, data validation, or data verification operations.

Quality - the sum of features and properties/characteristics or a process, item, or service that bears on its ability to meet the stated needs and expectations of the user.

Quality Assurance (QA) - an integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the customer.

Quality Assurance Forum - the interdivisional organization, with an advisory function for Quality Assurance activities of NMOCD in general and the Quality Assurance Office specifically. Provides regular feedback to the ESD Director and the customers of the QA Office.

Quality Assurance Management Staff (QAMS) - the U.S. EPA's headquarters staff element that establishes and promulgates Quality Assurance Policy.

Quality Assurance Officer (QAO) - the designated NMOCD staff member that has the delegated authority for approval of all Quality Management Plans in NMOCD, Chief of the Office of Quality Assurance.

Quality Assurance Program Description/Plan -see Quality Management Plan.

Quality Assurance Project Plan (QAPP) - a formal document describing in comprehensive detail the necessary QA, QC, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria.

Quality Control (QC) - the overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer.

Quality Improvement - a management program for improving the quality of operations. Such management programs generally entail a formal mechanism for encouraging worker recommendations with timely management evaluation and feedback or implementation.

Quality Indicators - measurable attributes of the attainment of the necessary quality for a particular environmental decision. Indicators of quality include precision, bias, completeness, representativeness, reproducibility, comparability, and statistical confidence.

Quality Management - that aspect of the overall management system of the organization that determines and implements the quality policy. Quality management includes strategic planning, allocation of resources, and other systematic activities (e.g., planning, implementation, and assessment) pertaining to the quality system.

Quality Management Plan (QMP) - a formal document that describes the quality system in terms of the organizational structure, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, and assessing all activities conducted.

Quality System - a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC.

Readiness Review - a systematic, documented review of the readiness for the startup or continued use of a facility, process, or activity. Readiness reviews are typically conducted before proceeding beyond project milestones and prior to initiation of a major phase of work.

Record - a completed document that provides objective evidence of an item or process. Records may include photographs, drawings, magnetic tape, and other data recording media.

Remediation - the process of reducing the concentration of a contaminant (or contaminants) in air, water, or soil media to a level that poses an acceptable risk to human health.

Self-Assessment - Assessments of work conducting by individuals, groups, or organizations directly responsible for overseeing and/or performing the work.

Service - the category of economic activity that does not produce manufactured items. In environmental data operations or engineering projects, such activities include design, inspection, laboratory and/or field analysis, repair, and installation.

Significant Condition - any state, status, incident, or situation of an environmental process or condition of an engineered environmental system in which the work being performed will be adversely affected in a manner sufficiently serious to require corrective action to satisfy quality objectives or specifications and safety requirements.

Specification - a document stating requirements and which refers to or includes drawings or other relevant documents. Specifications should indicate the means and the criteria for determining conformance.

Standard Operating Procedure (SOP) - a written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps, and that is officially approved as the method for performing certain routine or repetitive tasks.

Supplier - any individual or organization furnishing items or services or performing work according to a procurement document or financial assistance agreement. This is an all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, or consultant.

Surveillance - the act of monitoring or observing a process or activity to verify conformance to specified requirements.

Technical Review - a documented critical review of work that has been performed within the state of the art. The review is accomplished by one or more qualified reviewers who are independent of those who performed the work, but are collectively equivalent in technical expertise to those who performed the original work. The reviews are an in-depth analysis and evaluation of documents, activities, material, data, or items that require technical verification or validation for applicability, correctness, adequacy, completeness, and assurance that established requirements are satisfied.

Technical Systems Audit (TSA) - a thorough, systematic, on-site qualitative audit of facilities, equipment, personnel, training procedures, record keeping, data validation, data management, and reporting aspects of a system.

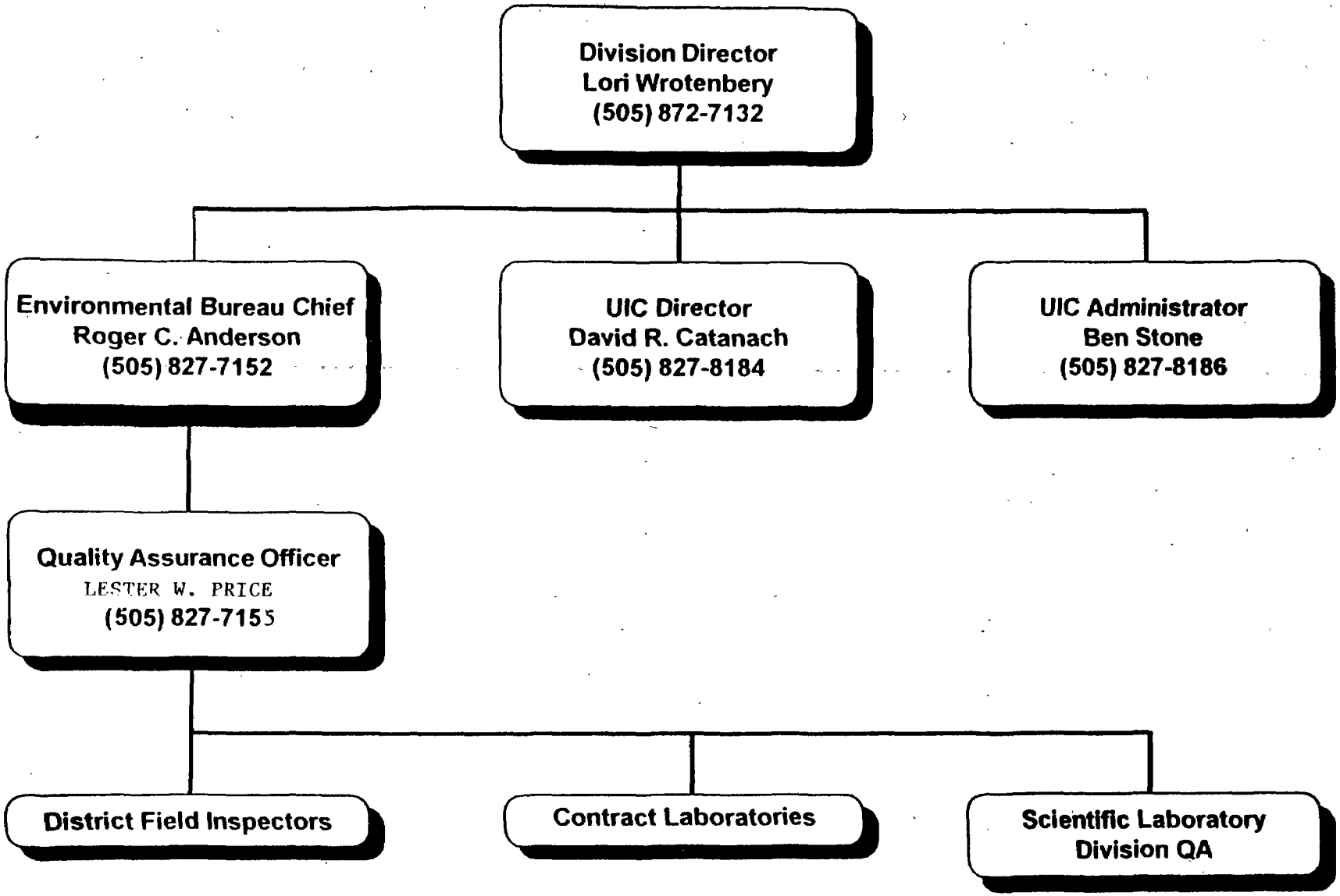
Total Quality Management (TQM) - the process of applying quality management to all activities of the organization, including technical and administrative operations. See Quality Management and Quality System.

Validation - an activity that demonstrates or confirms that a process, item, data set, or service satisfies the requirements defined by the user.

Verification - the act of authenticating or formally asserting the truth that a process, item, data set, or service is, in fact, that which is claimed.

Work - the process of performing a defined task or activity (e.g., research and development, field sampling, analytical operations, equipment fabrication).

APPENDIX B


Division Director
Lori Wrotenbery
(505) 872-7132
Environmental Bureau Chief
Roger C. Anderson
(505) 827-7152
UIC Director
David R. Catanach
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UIC Administrator
Ben Stone
(505) 827-8186
Quality Assurance Officer
LESTER W. PRICE
(505) 827-7155
District Field Inspectors
Contract Laboratories
Scientific Laboratory
Division QA

Figure 1-1

Oil Conservation Division

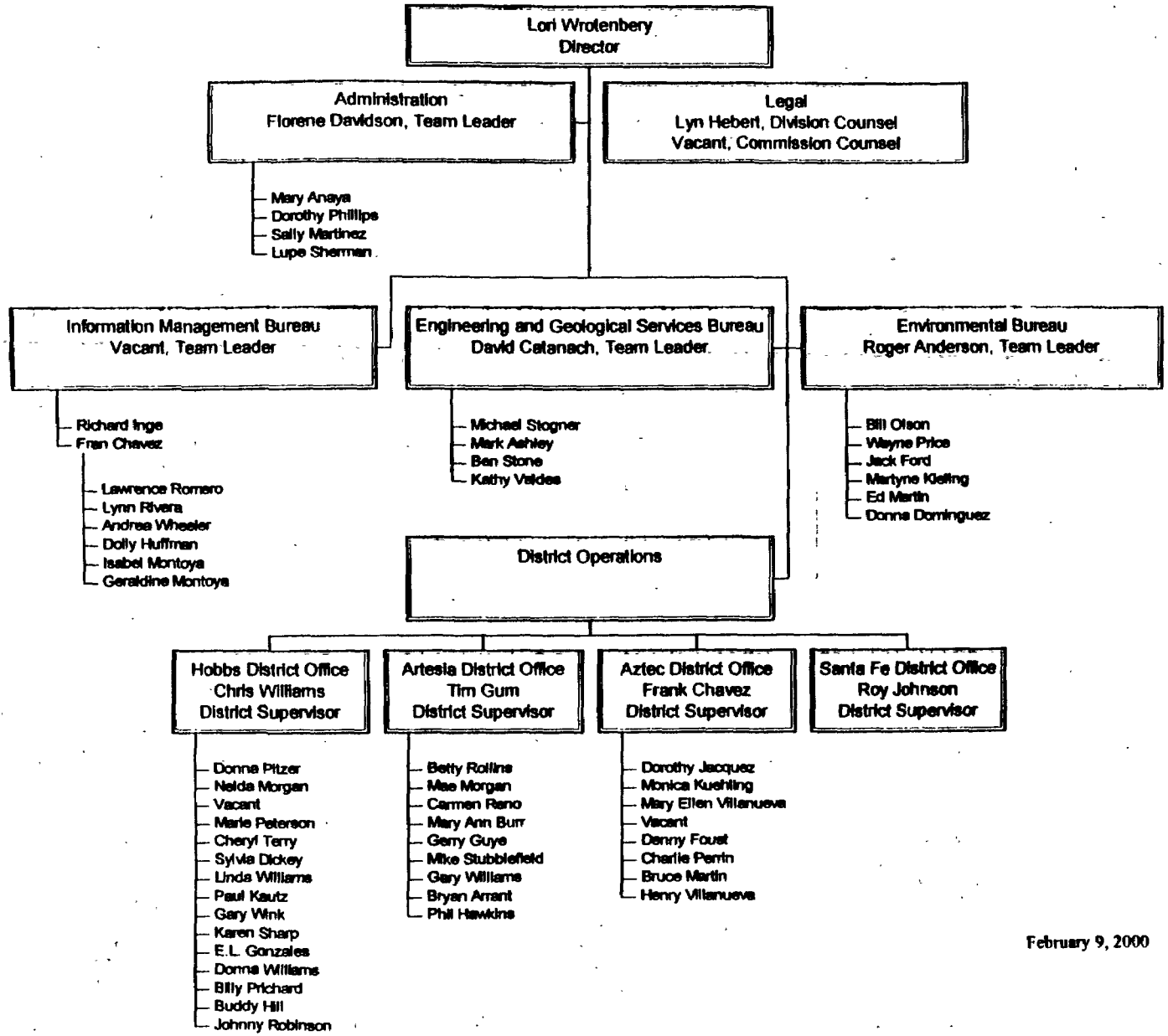


FIGURE 1-2

APPENDIX C

All water quality tests required in the UIC program must be done in accordance with one of the following methods:

1) Organic and inorganic compounds, water quality measurements: 40 CFR Part 136 "Guidelines Establishing Test Procedures for the Analysis of Pollutants," (as revised on October 26, 1984, and January 4, 1985), <136.3, Table I. This list references the accepted methods to analyze waters for organic and inorganic contaminants. It also includes some physical tests (temperature, specific gravity, etc.). This document is available from the SQAO.

2) Organic compounds, water quality measurements: "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", EPA-600/4-82-057, July 1982, available from the Center for Environmental Research Information (CERI) 26 West St. Clair Street, Cincinnati, Ohio 45268, Phone: (513) 684-7562 or FTS 684-7562.
Note: This technical report provides procedures that are as uniform and cost effective as possible (with some minor compromises) for the analysis of some organic pollutants. It also provides references that would be helpful to the analyst.

3) Methods for the analysis of inorganic compounds: "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, March 1979, available from Center for Environmental Research (CERI), 26 West St. Clair Street, Cincinnati, Ohio 45268. NOTE: This reference is included in 1. above and provides acceptable analytical methods.

4) Other analyses not covered above should be performed in accordance with the most recent edition of "Standard Methods for the Examination of Water and Wastewaters": American Public Health Association, American Water Works and the Water Pollution Control Federation. Other analyses not covered above should be performed by the best available methods.

5) For Class II programs, analyses which require a high degree of accuracy must be done as explained above or in accordance with "API Recommended Practice for Analysis of Oil-Field Waters" API RP 45.

6) US EPA Test Methods for Evaluating Solid Waste SW-846 Final Up-Dates.

Note: Techniques already approved and used for other programs (RCRA, CERCLA, NPDES, PWSS, etc.) should be deemed acceptable for the same type of analyses.

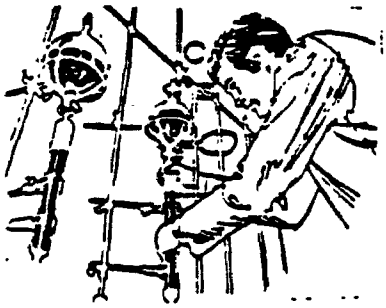
Parameter	Preservation Technique	Holding Time
Major Cations (Na^+, K^+, Ca^{+2}, Mg^{+2})	HNO_3 to pH<2.0	6 months
Major Anions (Cl^-, $SO_4^=$, F^-, Br^-)	Chill to 4°C	1 month
Trace Metals (Fe, Mn, Zn, Pb, Hg)	HNO_3 to pH < 2.0	6 months
Alkalinity	Chill to 4°C	14 days
Sulfide	Chill to 4°C 2nd Zn Acetate Reagent per liter, NaOH to pH>9.0	7 days
pH	None	1 hour maximum
Dissolved Oxygen	Meter method - none Winkler method - add $MnSO_4$ and Azide - NaOH reagents	determine on-site 8 hours
Specific Conductance	Chill to 4°C	28 days
Total Dissolved Solids	Chill to 4°C	7 days
Compatability	Chill to 4°C	48 hours

ANALYTICAL QUALITY ASSURANCE

ACCEPTAI CRITERIA FOR MEASUREMENT PARAMETERS IN A UEOUS MATRIX

PARAMETER	DETECTION LIMIT (NORMAL)	ACCEPTANCE CRITERIA PRECISION	ACCURACY	COMPLETENESS
BOD	2 mg/l	± 8%	Glucose-Glutamic Acid Solution Analyzed Weekly. Acceptable Value 200 ± 37 mg/l.	90%
COD	4 mg/l	± 10%	± 10%	90%
TOC	1 mg/l	± 4%	± 12%	95%
Non-Filterable Residue (TSS)	2 mg/l	<50 mg/l ± 15% >50 mg/l ± 10%	Periodically analyze reference sample ± 10 %	95%
Filterable Residue (TDS)	10 mg/l	± 10%	Periodically analyze reference sample, ± 10%	90%
Sulfate	5 mg/l	± 11%	± 15%	95%
Ammonia as N	0.01 mg/l	± 5%	± 10%	90%
Nitrate as N	0.01 mg/l	± 5%	± 5%	95%
Ortho-Phosphate and Total Phosphate as P	0.003 mg/l	<1 mg/l ± 15% >1 mg/l ± 8%	± 10%	90%
Oil and Grease	1 mg/l	>5 mg/l ± 25%	± 20%	90%
Hardness as $CaCO_3$	5 mg/l	± 11%	± 8%	95%
Fluoride	0.1 mg/l	± 8%	± 8%	95%
Chloride	5 mg/l	± 5%	± 10%	95%

PARAMETER	DETECTION LIMIT	ACCEPTANCE CRITERIA PRECISION	ACCURACY	COMPLETENESS
Total Phenols		±20.0%	±20.0%	90%
Total Cyanide		±20.0%	±15%	90%
Metals		±15.0%	±20%	90%
THM		±10.0%	±20%	90%
Pesticides		Not Determined		
Volatiles (GC/MS)		Not Determined		
Acids (GC/MS)		Not Determined		



REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter	Container[1]	Preservation[2,3]	Maximum holding time[4]
Bacterial Tests:			
Coliform, fecal and total	P,G	Cool 4°C, 0.008% $Na_2S_2O_3$[5]	6 hours.
Fecal streptococci	P,G	Cool 4°C, 0.008% $Na_2S_2O_3$[5]	6 hours.
Inorganic Tests:			
Acidity	P,G	Cool, 4°C	14 days.
Alkalinity	P,G	Cool, 4°C	14 days.
Ammonia	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days.
Biochemical oxygen demand	P,G	Cool, 4°C	48 hours.
Bromide	P,G	None required	28 days.
Biochemical oxygen demand, carbonaceous	P,G	Cool, 4°C	48 hours.
Chemical oxygen demand	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days.
Chloride	P,G	None required	28 days.
Chlorine, total residual	P,G	None required	Analyze immediately.
Color	P,G	Cool, 4°C	48 hours.
Cyanide, total and amenable to chlorination	P,G	Cool, 4°C, NaOH to pH>12, 0.6g ascorbic acid[6]	14 days.[6]
Fluoride	P	None required	28 days.
Hardness	P,G	HNO_3, to pH<2 or H_2SO_4 to pH<2	6 months.
Hydrogen ion (pH)	P,G	None required	Analyze immediately.
Kjeldahl and organic nitrogen	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days.
Metals:[7]			
Chromium VI	P,G	Cool, 4°C	24 hours.
Mercury	P,G	HNO_3, to pH<2	28 days.
Metals, except chromium VI and mercury	P,G	HNO_3, to pH<2	6 months.
Nitrate	P,G	Cool, 4°C	48 hours.
Nitrate-nitrite	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days.
Nitrite	P,G	Cool, 4°C	48 hours.
Oil and grease	G	Cool, 4°C, H_2SO_4 to pH<2	28 days.
Organic carbon	P,G	Cool, 4°C, HCl or H_2SO_4 to pH<2	28 days.
Orthophosphate	P,G	Filter immediately, Cool, 4°C	48 hours.
Oxygen, Dissolved Probe	G Bottle and top	None required	Analyze immediately.
Winkler	G Bottle and top	Fix on site and store in dark	8 hours.
Phenols	G only	Cool, 4°C, H_2SO_4 to pH<2	28 days.
Phosphorus (elemental)	G	Cool, 4°C	48 hours.
Phosphorus, total	P,G	Cool, 4°C, H_2SO_4 to pH<2	28 days.
Residue, total	P,G	Cool, 4°C,	7 days.
Residue, Filterable	P,G	Cool, 4°C,	48 hours.
Residue, Nonfilterable (TSS)	P,G	Cool, 4°C,	7 days.
Residue, Settleable	P,G	Cool, 4°C,	48 days.
Residue, volatile	P,G	Cool, 4°C,	7 days.
Silica	P	Cool, 4°C,	28 days.
Specific conductance	P,G	Cool, 4°C,	28 days.
Sulfate	P,G	Cool, 4°C,	28 days.
Sulfide	P,G	Cool, 4°C add zinc acetate plus sodium hydroxide to pH>9.	7 days.
Sulfite	P,G	None required	Analyze immediately.
Surfactants	P,G	Cool, 4°C	48 hours.
Temperature	P,G	None required	Analyze immediately.
Turbidity	P,G	Cool, 4°C	48 hours.
Organic Tests:[8]			
Volatile Organics (EPA) method 624-See Table A	G, Teflon lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$,[5] HCl to pH2[9,10]	14 days.
Semi-Volatile Organics plus PCB/Pesticides (EPA) method 625-See Table B	G Teflon-lined cap	Cool, 4°C, $Na_2S_2O_3$,[5] Store in dark	7 days until extracion. 40 days after extracion.
Pesticides Tests:			
Pesticides[11]	G, Teflon-lined cap	Cool, 4°C, pH 5-9[15]	7 days until extraction. 40 days after extraction.
Radiological Tests:			
Alpha, beta and radium	P,G	HNO_3 to pH<2	6 months.

[1] Polyethylene (P) or Glass (G)

[2] Sample preservation should be performed immediately upon sample collection. For composite chemical 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 chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

[3] When any sample is to be shipped by common carrier or 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 II, 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); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080%, by weight or less (pH about 12.30 or less).

[4] 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 be 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 samples under study are stable for the longer time, and has received a variance from the Regional Administrator under § 136.3(e). 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 that this is necessary to maintain sample stability. See § 136.3(e) for details.

[5] Should only be used in the presence of residual chlorine.

[6] Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustments 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.

Samples should be filtered immediately on-site before adding preservative for dissolved metals.

[7] Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

[8] Sample receiving no pH adjustment must be analyzed within seven days of sampling.

[9] The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

[10] 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 forty days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re the requirement for thiosulfate reduction of residual chlorine) and footnotes 12, 13 (re the analysis of benzidine).

[11] 1,2 diphenylhydrazine is likely to be present unless the pH of the sample is 4.0 ± 0.2 to prevent rearrangement to benzidine.

[12] Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.

[13] For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.

[14] The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

[15] The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.

[16] 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 forty days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re the requirement for thiosulfate reduction of residual chlorine) and footnotes 12, 13 (re the analysis of benzidine).

[17] 1,2 diphenylhydrazine is likely to be present unless the pH of the sample is 4.0 ± 0.2 to prevent rearrangement to benzidine.

[18] Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.

[19] For the analysis of diphenylnitrosamine, add 0.008% $Na_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.

[20] The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $Na_2S_2O_3$.

APPENDIX D

OCD SAMPLING PROCEDURES

INTRODUCTION

In order to standardize sampling procedures in the field, this summary of methods for investigation sampling of possible water contaminants has been obtained from the "National Handbook of Recommended Methods for Water-Data Acquisition", a publication of the United States Geological Survey, and from "Sample Collection Procedures", the New Mexico Scientific Laboratory Division.

Sampling is the process of collecting a representative portion of the fluids and or soils in question; thus a representative sample must typify the rest of the fluid and or soils. Collecting a representative sample and maintaining its integrity is important because the validity of each measurement begins with the sampling procedure.

To get the best analytical results the field and laboratory personnel should work together to plan what to look for and how to look for it. Laboratory analyses can be expensive, and, not closely following proper procedures can cause a sample to misrepresent the conditions it exhibited at the time it was collected.

Field examination of key properties should be performed to provide additional data to supplement the laboratory analyses. Properties such as specific conductance, pH, and temperature are closely related to the environment of the water (produced, ground, and effluent) and are likely to be altered by sampling and storage, therefore a value should be obtained in the field.

ONSITE MEASUREMENT

Specific Conductivity

The specific conductivity of a water sample is a measure of the waters ability to conduct an electrical current under specific conditions and gives an indication of the concentration of dissolved solids in the sample.

Specific conductivity meters should be equipped with an integral temperature probe, and read directly in micromhos/cm at a specific temperature. The meter should be "red line" calibrated before submerging the probe in the water sample.

Once the sample is in a container its specific conductivity should be measured as soon as possible because the specific conductivity will change with time as solids begin to precipitate out of the sample. The cell should be gently moved in the sample until a steady reading can be obtained. A second reading is recommended to ensure accuracy.

To avoid cross contamination, do not use a sample to be chemically analyzed for metering the

specific conductivity. Keep the sample to be sent to the lab for analyses separate.

Temperature

The temperature of the sample should be obtained by using the specific conductivity meter. The temperature will be used in determining the specific conductivity by adjusting the meter to the appropriate temperature. The temperature should be recorded to provide additional information to the analytical laboratory.

Solution pH

The pH of a solution is a measure of the effective hydrogen ion concentration and is controlled primarily by the carbonate system of gases and dissolved carbon dioxide, bicarbonates and carbonates. Other dissolved gases, such as hydrogen sulfide and ammonia, can also affect the pH of the system.

The pH of a solution can be measured in the field in one of two ways; by using pH indicator strips or a pH meter. The method of using pH strip paper is faster than the meter method, however the accuracy is reduced. A pH determination by meter is done with a glass hydrogen ion electrode compared against a reference electrode of known potential by means of a pH meter.

The pH meter must be calibrated prior to use. First wash the probe in a pH 7.00 buffer solution or deionized water. Immerse the electrode probe in a pH 7.00 buffer and adjust the temperature control to the temperature of the buffer solution. When the reading stabilizes, adjust the calibration control to set the display to the pH value of the buffer solution. Calibration can be assured by performing the calibration procedure on another buffer solution of a different pH value.

To obtain a pH value for the unknown solution, rinse the electrode probe with the unknown solution to decontaminate the probe from the buffer solution used to perform calibration. Immerse the probe in the sample solution and adjust the temperature of the meter to the temperature of the sample solution. Keep the probe submerged long enough for the pH reading to stabilize. Repeat the procedure to assure accuracy and recalibrate if necessary.

Headspace Analyses

The use of a photo ionization detector (PID) is used to determine the concentration of organic vapors in a given matrix. This field examination procedure is beneficial in the contaminant investigation of impoundments that have received exploration and production wastes containing volatile organic constituents.

Accepted OCD procedures are as follows:

1. Fill a 0.5 liter or larger jar half full of a sample and seal the top tightly with aluminum foil, or fill a one quart zip-lock bag half full of a sample and seal the top of the bag leaving the remainder of the bag full of air.

2. Ensure that the sample temperature is between 15 and 25 degrees Celsius (59-77 degrees Fahrenheit).

3. Allow aromatic hydrocarbon vapors to develop within the headspace of the sample jar or bag for 5 to 10 minutes. Sometime during this period, the sample container should be shaken vigorously for 1 minute or the contents of the bag massaged to break up soil clods.

4. If using a jar, pierce the aluminum seal with the probe of the PID and record the highest (peak) measurement. If using a bag, carefully open one end of the bag and insert the probe of the OVM into the bag and seal the bag around the probe as much as possible to prevent the vapors from escaping. Record the peak measurement. The OVM should be calibrated to ensure a benzene response factor.

SAMPLE COLLECTION

Sample Plans

Sampling of solid and liquid wastes for analytical properties requires that representative samples collected exhibit the average properties of the entire waste body. An appropriate sampling plan must be responsive both to regulatory and scientific objectives. Field and laboratory personnel must work together to plan what to look for and how best to obtain it. Because the burden of responsibility rests with the waste generator, it is advisable that he or she seek competent advise before designing a sampling plan if unsure of the proper procedures for collecting representative samples.

Refer to the EPA SW-846 Volume II: Field Manual (Ch. 9) for an in-depth description of accepted procedures for sampling plan design.

Recommended sample containers are plastic cubitainers and glass vials or jars, or other containers as recommended by the laboratory. If the sample container cannot be directly filled, a thoroughly cleansed glass canning jar, or other appropriate decontaminated sampling device may be used for collecting samples from well sites.

Pit Sampling

A location on the opposite side of the pit from the inflow should be chosen and the surface of

the pit fluid agitated to break up any deposits on the surface. Care should be taken not to allow surface oil or paraffins to get in the sample. The glass jar is used to dip fluid from the pit and to transfer the fluids to the specified sample container(s).

Separator, Dehydrator Sampling

When sampling effluent directly from separators or dehydrators, care should be taken to be prepared for a high pressure discharge and or higher temperature discharge. Be cautious and use common sense when opening valves.

Water Well Sampling

Groundwater samples should be collected in clean containers supplied by the analytical lab that will conduct the analyses or from a reliable laboratory supply company. Samples for different analyses require specific types of containers. The OCD or the laboratory can provide information on the types of containers required for sample collection.

The recommended information to accompany all well samples includes: point and method of collection, exact location of well, rate of discharge, duration of pumping prior to sampling, field measurements that apply, date and time of collection, appearance, presence of gas, associated odors, and any other relevant observation, such as the use of the well being sampled. Include the depth of the well, depth to the top of the fluid, diameter of the casing, and the location of effluent disposal areas and the proximity in relation to the well.

Domestic wells should be sampled at the closest point to the wellhead, such as the well faucet or the pressure tank. The water should be allowed to run until three casing volumes of water has been discharged before catching the sample, if possible.

Monitor wells must be sampled with clean bailers in order to avoid cross contamination. Bailors should be cleaned prior to each sample point using the following procedure: 1) wash bailor inside and out using a laboratory cleaning soap; 2) rinse with deionized water; 3) rinse with laboratory reagent alcohol containing only ethanol and methanol; 4) rinse with deionized water. The OCD believes that PVC bailers will provide accurate results for samples containing dissolved hydrocarbons. The use of a clear polycarbonate plastic bailer is preferred where floating product is present in the well. If possible, three casing volumes of water should be bailed or pumped before the sample is captured.

SAMPLE FILTRATION

When concentrations of dissolved inorganic constituents in water is needed, a one gallon sample

must be filtered through a 0.45 mm average pore diameter membrane filter. If the sample has many solids, it may be necessary to use a pre-filter in addition to the 0.45 mm filter.

It is advisable to discard the first 150 to 200 ml of filtration in order to rinse the filter and filtration apparatus of any contaminating substance.

The filtrate, collected in 2 labelled one-liter containers, is divided so that one container is filtered but not acidified; the second container is filtered and immediately acidified with 2 ml concentrated nitric acid. If nitrates or phosphates are to be tested for, a third container should be collected, filtered and preserved by adding 2 ml of H_2SO_4.

PRESERVATION

Deteriorated samples negate the efforts and costs in obtaining good samples. In general, the shorter the time that elapses between the collection of a sample and its analysis, the more reliable the analytical results. Samples can be preserved by chilling and/or by adding the appropriate acid. Samples may then be allowed to stand for a longer period of time before the analysis. Select the method of analysis and determine what preservative is recommended for the particular analysis before adding a preservative to any sample.

Samples for metal analysis can be preserved by the addition of nitric acid; samples for organic constituent determinations by chilling; and samples for the determination of Total Organic Carbon (TOC), biodegradable substances such as nitrogen and phosphorous species, nitrates, phosphates, and surfactants by filtering, adding H_2SO_4, and chilling the sample immediately in an ice bath. Organic samples for hydrocarbon determination are then stored in the dark at a temperature just above freezing until the analyses are made. Samples for analysis of certain dissolved inorganic species must not be frozen because it is not always possible to reconstitute the original sample exactly as it was before freezing.

Samples for metals analysis that are preserved with nitric acid may be stored for several months. Chilled or refrigerated samples are also stable if no sediment is present. However, most samples should be analyzed as soon as possible within the time limitations specified in each analytical method.

Under normal conditions the following sample containers would be appropriate:

Heavy Metal Analysis - 1 one-liter plastic container, filtered, preserved with HNO_3.

Major Cations and Anions - 1 one-liter container, filtered, not preserved.

Purgeable Organics - 2 40-ml glass vials with teflon-lined discs, samples not filtered, not acidified

Nitrogen Species and Phosphorous Species - 1 one-liter cubitainer, filtered, preserved with H_2SO_4

Phenols Analysis - 1 one-liter glass jar, unfiltered, preserved with HNO_3 plus $CUSO_4$.

Polynuclear Aromatic Hydrocarbons - 2 one liter brown glass containers, unfiltered, not acidified.

SAMPLE IDENTIFICATION

Sampling points should be identified by a detailed and accurate description of their location. a field book record should be made of every sample collected, and every bottle and container should be identified, preferably by attaching an appropriately inscribed label or tag, or writing with waterproof felt pen directly on the container if it is plastic.

The recommended minimum information recorded in a field book should include: geographic location of the site, well name and all pertinent information posted on the company sign at the well site, exact location of the sampling site and point of collection (blowdown pit, separator, etc), date and time of collection, rate of discharge (if possible), and size and collection of pit sampled. Sample from domestic wells should include the name, address, and phone number of the user.

Each sample should be numbered in the following manner:

Sample: # 93 08 06 1325
year month date time (i.e. sample #9308061325)

Each container should be labeled before collection including the well name, sample location, date, and time of collection as recorded in the field book. Glass containers will contain non-filtered samples, plastic containers will be labeled "F" (filtered) or "NF" (non-filtered), and "NA" (non-acidified) or "A" (acidified) together with the acid name (HNO_3 or H_2SO_4). Further discussion of this can be found in the "Preservation" and "Filtration" section of these guidelines.

The name of the person(s) collecting the sample should be recorded in the field books and on the sample containers in case of questions concerning the collection and identity of the sample. Chain-of-custody procedures should be followed if containers tracking of the possession is needed (see chain-of-command section) of sampling guidelines.

CHAIN OF CUSTODY

Procedures have been developed to track samples from the moment of their collection through laboratory testing, data processing, and reporting of the results. The major concerns noted in the procedures include sample possession, the need to preserve the identity and integrity of the sample and documentation. Each link in the chain of custody must strengthen the potential evidentiary nature of the resulting data for litigation.

In order to form an exception to the hearsay rule, chain of custody procedures must be in written form and implemented as the normal operating procedure in cases where litigation can be expected. Routine monitoring and sampling do not require strict compliance with chain of custody procedures, but reasonable care should be maintained to insure sample validity.

Evidence tape for chain of custody samples will be placed over the caps and shoulders of vials and cubitainers before shipment to the lab. The type cannot be removed without providing evidence that sample tampering has not occurred.

SHIPMENT OF SAMPLES

Shipping containers should be sturdy and well packed to prevent breakage and excessive temperature changes. All samples should be individually wrapped and boxes filled with insulating material such as styrofoam, popcorn, etc. Boxes should be labeled with the laboratory address and a return address. Organic samples should be chilled. Cubitainers filled with water and frozen make for a good way of chilling the samples during shipment, however, care should be taken to prevent these containers from leaking.

Note: The shipping of all samples will conform to US Department of Transportation (DOT) and/or U.S. Postal Service (USPS) regulations.

OIL CONSERVATION DIVISION FIELD SAMPLING PROCEDURES

Illustrations

OCD FIELD SAMPLING PROCEDURES

I. Introduction

In order to standardize sampling procedures in the field, this summary of methods for investigation of possible water contaminants has been obtained from the National Handbook of Recommended Methods for Water-Data Acquisition, a publication of the United States Geological Survey, and from "Sample Collection Procedures", the Scientific Laboratory Division of the New Mexico Health & Environment Division.

Field examination of produced water, fresh ground water and effluents is a key point in Oil Conservation Division (OCD) environmental studies. Certain properties of produced water and ground water, especially the pH, are so closely related to the environment of the water that they are likely to be altered by sampling and storage, and a meaningful value can be obtained only in the field. Other properties such as specific conductance are easily determined in the field with sample equipment. The results are useful in supplementing information obtained from analyses of samples and as a guide as to which sources should be sampled for more intensive study. The principal constituents of water which are of interest to the OCD are those listed under the Ground Water Standards in Part 3 of the New Mexico Water Quality Control Commission Regulations (Table 1). Other constituents commonly analyzed include sodium, calcium, potassium, magnesium, and carbonates. Analyses for oil and grease, total organic carbon and chemical oxygen demand give an indication of hydrocarbons or other pollutants present in waste waters or contaminated ground waters.

TABLE 1. NEW MEXICO WATER QUALITY CONTROL COMMISSION GROUND WATER STANDARDS

A. Human Health Standards

Arsenic (As)	0.1 mg/l
Barium (Ba)	1.0 mg/l
Cadmium (Cd)	0.01 mg/l
Chromium (Cr)	0.05 mg/l
Cyanide (CN)	0.2 mg/l
Fluoride (F)	1.6 mg/l
Lead (Pb)	0.05 mg/l
Total Mercury (Hg)	0.002 mg/l
Nitrate (NO_3 as N)	10.0 mg/l
Selenium (Se)	0.05 mg/l
Silver (Ag)	0.05 mg/l
Uranium (U)	5.0 mg/l
Radioactivity: Combined	

Radium-226 and Radium-228	30.0 pCi/l
Benzene	0.01 mg/l
Polychlorinated biphenyls (PCB's)	0.001 mg/l
Toluene	0.75 mg/l
Carbon Tetrachloride	0.01 mg/l
1, 2-dichloroethane (EDC)	0.01 mg/l
1, 1-dichloroethylene (1, 1-DCE)	0.005 mg/l
1, 1,2, 2-tetrachloroethylene (PCE)	0.02 mg/l
1, 1, 2-trichloroethylene (TCE)	0.1 mg/l
ethylbenzene	0.75 mg/l
total xylenes	0.62 mg/l
methylene chloride	0.1 mg/l
chloroform	0.1 mg/l
1, 1-dichloroethane	0.025 mg/l
ethylene dibromide (EDB)	0.0001 mg/l
1, 1,1-trichloroethane	0.06 mg/l
1, 1,2-trichloroethane	0.01 mg/l
1, 1,2, 2-tetrachloroethane	0.01 mg/l
vinyl chloride	0.001 mg/l
PAHs: total naphthalene plus monomethylnaphthalenes	0.03 mg/l
benzo-a-pyrene	0.0007 mg/l

B. Other Standards for Domestic Water Supply

Chloride (Cl)	250. mg/l
Copper (Cu)	1.0 mg/l
Iron (Fe)	1.0 mg/l
Manganese (Mn)	0.2 mg/l
Phenols	0.005 mg/l
Sulfate (SO_4)	600. mg/l
Total Dissolved Solids (TDS)	1000. mg/l
Zinc (Zn)	10.0 mg/l
pH	between 6 and 9

C. Standards for Irrigation Use

Aluminum (Al)	5.0 mg/l
Boron (B)	0.75 mg/l
Cobalt (Co)	0.05 mg/l
Molybdenum (Mo)	1.0 mg/l
Nickel (Ni)	0.2 mg/l

II. Sampling Procedures

Sampling is the process of collecting a representative portion of the fluids in question; thus, a representative sample must typify the rest of the fluid. Collecting a representative sample and maintaining its integrity until it is analyzed is important because the validity of each

measurement begins with the sampling procedure. Sampling procedures and preservation of the samples are specific for analyses of different constituents. Not all constituents need to be sampled all the time.

Recommended sample containers are plastic Cubitainers* and glass vials or jars. If the sample container cannot be directly filled, thoroughly cleansed glass Mason canning jars may be used for collecting samples from well sites. These jars can be connected to PVC plastic pipe with screw clamps to aid in the collection of samples from pits.

Pit Sampling

A location on the opposite side of the pit from the inflow should be chosen, and the surface of the pit fluid agitated to break up any deposits on the surface. The bottom of the dipping jar clamped to the plastic pipe handle may be used to stir the surface deposits, but for ease of filtration, care should be taken to allow no surface oil or paraffin to enter the jar. The Mason jar is used to dip fluid from the pit; if the sample is to be filtered a labeled one-gallon plastic Cubitainer should be filled with fluid, as well as two 40-ml glass vials with teflon-lined discs. The white teflon-coated side of the disc should always face the fluid. No bubbles or air space should be included in the capped vials. The Mason jar should be refilled in order to run pH, specific conductance, and temperature field tests. If equipment is not available for field filtration and if analyses are to be made for major ions, heavy metals and nitrogen determination, three separate one liter (quart) plastic Cubitainers must be filled and labeled "NF" (non-filtered). Samples for organic analysis are not filtered.

Separator, Dehydrator Sampling

When sampling effluent directly from separators or dehydrators, the same procedures should be followed except that care should be taken because of high discharge pressures and temperatures sometimes present.

Water Well Sampling

Samples of ground water may be collected from domestic or monitor wells to determine chemical and physical values. The recommended information to accompany all samples includes: point and method of collection, exact location of well, rate of discharge, duration of pumping prior to sampling, water temperature and other field measurements, date and time of collection, appearance, presence of gas, odor, and any other

*Registered trademark

relevant observation, such as use of the water. If available, depth and diameter of well, water level, and location of nearby septic tanks or other effluent disposal areas should be noted.

Domestic wells should be sampled at the closest point to the wellhead, such as at the well faucet or the pressure tank. The water should be allowed to run until a fresh sample from the well can be obtained; this is especially important in the presence of metal pipes.

Monitor wells should be sampled with clean bailers in order to avoid cross contamination. Bailers, especially ones used in monitor wells containing product, should be cleaned using the following procedure: 1) wash bailer inside and out with a laboratory cleaning soap; 2) rinse with deionized water; 3) rinse with laboratory reagent alcohol containing only ethanol and methanol and 4) rinse with deionized water. The OCD believes that PVC bailers will provide accurate results for samples containing dissolved hydrocarbons. The use of a clear plastic polycarbonate bailer (eg. Lexan Tm.) is preferred where floating product is present in the well. If possible, three casing volumes of water should be bailed or pumped before a sample is taken.

III. Sample Identification

Sampling points should be identified by a detailed and accurate description of their location. A field book record should be made of every sample collected, and every bottle and Cubitainer should be identified, preferably by attaching an appropriately inscribed tag or label, or writing with waterproof felt pen directly on the plastic Cubitainers.

The recommended minimum information recorded in a field book should include: geographic location of the site, well name and all information posted on company well site sign, exact location of the sampling site and point of collection (blowdown pit, separator pit, etc.), date and time of collection, rate of discharge (if possible), and size and condition of pit sampled. Samples from domestic wells should include the name, address and phone number of the user.

Each sample should be numbered in the following manner:

Sample:	#	85	05	06	1325
		year	month	date	time

Each Cubitainer or glass vial should be labeled before collection with the well name, sampling location, date, and time of collection as recorded in the field book. Glass vials

will contain non-filtered samples, but Cubitainers will be labeled F (filtered) or NF (non-filtered), and NA (non-acidified) or A (acidified) together with acid name (HNO_3 or H_2SO_4). Further discussion of this is found in the filtration and preservation chapters. Sample containers and collection bottles should be rinsed with sample fluids if enough is available.

The name of the person(s) collecting the sample should be recorded in the field book and on the sample containers in case of questions concerning the collection or identity of the sample. Chain-of-custody procedures (Section VIII) will need to be followed if continuous tracking of sample possession is needed.

IV. On-Site Measurement of Unstable Constituents

Samples used for determining specific conductance, temperature, and pH should not be filtered.

A. Specific Conductance

The specific conductance of a water sample is a measure of its ability to carry an electrical current under specific conditions. Specific conductance, which is a measurement of the ionized salts, gives an indication of the concentration of dissolved solids in the water.

Once the sample is in the container, its specific conductance may change with time as a result of precipitation of minerals from the water. A sample that has been acidified or otherwise treated will not yield an accurate representation of the specific conductance of the water; therefore, it is essential to obtain an accurate field determination.

Specific Conductance Method Summary

Specific conductance meters used in the field should be battery operated, equipped with an integral temperature probe, and read directly in micromhos/cm at a specific Centigrade temperature.

The meter should be red-line calibrated before suspension of the conductance cell in the sample in the Mason jar. The conductance cell should have one inch of fluid on all sides to give an accurate measurement.

The cell should be gently moved in the sample until a steady reading of specific conductance can be obtained. A second reading of specific conductance is recommended to ensure accuracy.

Probe Care

To avoid sample cross contamination, do not use a sample to be chemically analyzed for SC measurement. The probe should be rinsed with deionized water and denatured alcohol between samples, and with sample fluid before reading a measurement. Consult the meter operating manual for additional cleaning instructions.

B. Solution pH

The pH of a solution is a measure of effective hydrogen-ion concentration (degree of acidity), and it is controlled primarily by the carbonate system of gaseous and dissolved carbon dioxide, bicarbonate and carbonate ions. Other dissolved gases, such as hydrogen sulfide and ammonia, can also affect the pH of the solution. Measurement of pH is temperature sensitive, so the standard buffers should be within ± 1°C of the sample solution for precise determinations.

A high sodium concentration will give an anomalous pH reading, which must be corrected according to the recommendation of the manufacturer of the pH electrode. This correction is usually necessary only if pH is greater than 11, and sodium concentration is more than 230,000 mg. per liter.

A colorimetric procedure using pH paper or strips is available that is quicker than the solution method, but accuracy is somewhat reduced.

pH Method Summary

The pH is determined with a glass hydrogen ion electrode compared against a reference electrode of known potential by means of a pH meter. Because pH is exponentially related to concentration, great care must be exercised in making a measurement. However, pH measurements are usually reported only to the nearest tenth of a pH unit (e.g. 7.5).

Instructions for the use of the Corning 103 hand held pH meter are included in the Appendix.

V. Filtration

When the determination of concentrations of dissolved inorganic constituents in a water sample is needed, the one gallon sample collected must be filtered through a 0.45 mm. average pore diameter membrane filter. If the sample has many solids, it may be necessary to use a pre-filter in addition to the 0.45 mm. filter. It is advisable to discard the first 150 to 200 ml of filtrate in order to rinse the filter and

filtration apparatus of any contaminating substance. The filtrate, collected in 2 labeled one-liter Cubitainers, is divided so that one Cubitainer is filtered but not acidified; the second Cubitainer is filtered and immediately acidified with 5 ml of concentrated nitric acid. If nitrates or phosphates are to be tested, a third Cubitainer will contain filtered sample acidified with 2 ml concentrated H_2SO_4. Because membrane filters may contribute significant amounts of phosphorous to samples containing low concentrations of phosphates, when analyzing for phosphorous the membrane filter must be washed by running several hundred milliliters of distilled water through it.

Acidifying the filtrate (sample) minimizes the risk of precipitation of dissolved constituents and also inhibits adsorption of constituents by the walls of the container. Acidized samples are used for the determination of dissolved metallic constituents, nitrogen species, and phosphorous species. Non-acidified samples are used for the analyses of major cations and anions. In the event of extremely turbid samples, limited sample volume, or absence of equipment, filtering of the non-acidified sample may be eliminated.

VI. Preservation

Deteriorated samples negate all the efforts and cost expended in obtaining good samples. In general, the shorter the time that elapses between the collection of a sample and its analysis, the more reliable will be the analytical results. Samples can be preserved by chilling and/or by adding the appropriate acid. They may then be allowed to stand for a longer period of time before analysis. It is necessary, however, to select the method of analysis and determine what preservative is recommended for the particular analysis before adding a preservative to any sample.

Samples for metal analysis can be preserved by the addition of nitric acid; samples for organic constituent determinations by chilling; and samples for the determination of Total Organic Carbon (TOC), biodegradable substances such as nitrogen and phosphorous species, nitrates, phosphates, and surfactants by filtering, adding H_2SO_4, and chilling the sample immediately in an ice bath. Organic samples for hydrocarbon determination are then stored in the dark at a temperature just above freezing until the analyses are made. Samples for analysis of certain dissolved inorganic and organic species must not be frozen because it is not always possible to reconstitute the original sample exactly as it was before freezing.

Generally, samples for metal analysis that are preserved with nitric acid may be stored for several months. Chilled or refrigerated samples are also stable if no sediment is present. However, most samples should be analyzed as soon as possible within the time limitations specified in each analytical method.

To prevent any possible cross-contamination, known highly contaminated organic samples should be kept separate from each other, and "blue ice" should not be used for keeping samples chilled.

Each sample site should normally result in the following labeled sample containers:

(a) 1-one liter plastic Cubitainer, sample filtered and acidified with HNO_3 (heavy metal analysis).

(b) 1-one liter plastic Cubitainer, sample filtered but not acidified (major cations and anions).

(c) 2-40 ml glass vials with teflon-lined discs, samples not filtered, not acidified (purgeable organic). One vial is a duplicate in case of breakage. All samples should be kept cool, and the organic sample must be chilled but not frozen.

Additional samples may include:

(d) 1-one liter plastic Cubitainer, sample filtered and acidified with H_2SO_4 (nitrogen species and phosphorus species).

(e) 1-one gallon glass jar, sample unfiltered and acidified with HNO_3 plus $CuSO_4$ (phenols analysis).

VII. This section contains samples of the current chain-of-custody forms, sample labels and custody seals.

6701 Aberdeen Avenue, Ste. 9
Lubbock, Texas 79424
Tel (806) 794-1296
Fax (806) 794-1298
1 (800) 378-1296

TraceAnalysis, Inc.

4725 Ripley Dr., Ste A
El Paso, Texas 79922-1028
Tel (915) 585-3443
Fax (915) 585-4944
1 (888) 588-3443

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

LAB Order ID # _____

Company Name: _____ Phone #: _____

Address: (Street, City, Zip) _____ Fax #: _____

Contact Person: _____

Invoice to:
(If different from above) _____

Project #: _____ Project Name: _____

Project Location: _____ Sampler Signature: _____

ANALYSIS REQUEST
(Circle or Specify Method No.)

LAB # (LAB USE ONLY)	FIELD CODE	# CONTAINERS	Volume/Amount	MATRIX				PRESERVATIVE METHOD							SAMPLING	
				WATER	SOIL	AIR	SLUDGE	HCL	HNO_3	$NaHSO_4$	H_2SO_4	NaOH	ICE	NONE	DATE	TIME

MTBE 8021B/602	BTEX 8021B/602	TPH 418.1/TX1005	PAH 8270C	Total Metals Ag As Ba Cd Cr Pb Se Hg 6010B/200.7	TCLP Metals Ag As Ba Cd Cr Pb Se Hg	TCLP Volatiles	TCLP Semi Volatiles	TCLP Pesticides	RCI	GC-MS Vol. 8260B/624	GC/MS Semi. Vol. 8270C/625	PCB's 8082/608	Pesticides 8081A/608	BOD, TSS, pH					Turn Around Time if different from standard	Hold

Relinquished by: Date: Time: Received by: Date: Time:

Relinquished by: Date: Time: Received by: Date: Time:

Relinquished by: Date: Time: Received at Laboratory by: Date: Time:

LAB USE ONLY

Intact ___ Y / N

Headspace ___ Y / N

Temp ___ °

Log-in Review ___

REMARKS:

Carrier # _____

Submittal of samples constitutes agreement to Terms and Conditions listed on reverse side of C.O.C.

VII. SAMPLE LAB FORM

SAMPLE CUSTODY LABELS

TRACE ANALYSIS, INC.

6701 Aberdeen, Ste. 9 Lubbock, Texas 79424 806•794•1296 FAX 806•794•1298
4725 Riley Dr., Ste. A El Paso, Texas 79922 915•585•3443 FAX 915•585•4944

Company _____ COC# _____

Project _____ Preservative _____

Location _____ Sampler _____

Date _____ Time _____ Sample ID _____

Comments _____

TRACE ANALYSIS, INC.

CUSTODY SEAL

Date

Signature

TABLE 2. Summary of Water Sample Containers and Treatment for Laboratory Analysis

Analysis	Container	Treatment
Temperature, pH, specific conductance	One-quart glass Mason jar	Field treatment: Unfiltered, non-acidified
Major Cations and Anions	One-liter plastic Cubitainer	Filtered, non-acidified, and chilled
Trace elements and Heavy Metals	One-liter plastic Cubitainer	Filtered, 5 ml. conc. HNO_3 and chilled
Nitrogen species, Phosphorus species, & Total Organic Carbon (TOC)	One-liter plastic Cubitainer	Filtered, 2 ml. conc. H_2SO_4, and chilled
Purgeable Organics	40 ml. glass vial with teflon-lined disc	Unfiltered, non-acidified, 3 mg. Thiosulfate, (added if to be analyzed for Tri-halomethanes) and chilled
Extractable Organics	2000 ml. amber glass bottle with teflon-lined disc	Unfiltered, non-acidified, and chilled
Phenols	1 gallon amber glass jar	Unfiltered, 5 ml. H_3PO_4 plus 4 g $CuSO_4$, and chilled

TABLE 3. Field Sampling Equipment

Equipment	Use
Sample Containers and Labels	Appropriate to Analysis desired.
Sample Preservatives	Appropriate to Analysis desired.
Coolers with Ice	Used for preserving, shipping samples.
PVC Plastic Pipe Pole with Clamp and Mason jar(s)	Used to extend reach and depth so that water samples can be safely taken from shore of pit. Clean Mason jars thoroughly after use to avoid contamination of samples.
Field Log Book	Record field observations.
Specific Conductance Meter	Measure specific conductance and temperature of sample
pH Meter, strips or paper	Measure pH of sample.
Filtration Equipment, Prefilter, and 0.45 mm. Filters	Filter sample from 1 gallon Cubitainer into liter Cubitainers.

APPENDIX

The following pH measurement instructions are taken directly from the instruction manual for the Corning 103 Hand Held pH Meter.

Instrument Check Procedure

1. Select mV mode.
2. Disconnect the electrode and connect the shorting plug to the pH socket.
3. Check that the display reads between -002 and 002.
4. Select pH mode.
5. Set TEMPERATURE control to 25°C.
6. Check that the display can be set to 7.00 using the CALIBRATE control.
7. Check that the display can be set to 8.00 by clockwise rotation of the CALIBRATE control.
8. Check that the display can be set to 6.00 by counterclockwise rotation of the CALIBRATE control.

pH MEASUREMENTS

Calibration

1. Select pH mode.
2. Rinse electrode with pH 7.00 buffer or deionized water.
3. Immerse the electrode in pH 7.00 buffer and adjust TEMPERATURE control to the temperature of the buffer.
4. When the reading stabilizes adjust the CALIBRATE control to set the display to the value of the buffer.

NOTE: Variations in pH values for changes in buffer temperature are shown on Corning buffer solution bottles.

5. For a 2-point calibration continue with paragraph 6; if a 1-point calibration is being performed continue with paragraph 9.

2 - Point Calibration

6. Rinse electrode with the second buffer or deionized water.

7. Immerse electrode in the second buffer and adjust TEMPERATURE control to the temperature of the buffer.

8. When the reading stabilizes adjust the cal 2 % control, with the slope adjustment tool, to set the display to the value of the second buffer.

Measuring Samples

9. Rinse electrode with unknown solution or deionized water.

10. Immerse electrode in the unknown solution and adjust TEMPERATURE control to the temperature of the unknown solution.

11. Allow time for the display to stabilize, then note the reading.

12. Repeat paragraphs 9 to 11 for further samples.

13. Recalibrate periodically. The frequency will depend on the degree of accuracy required and the condition of the electrode.

APPENDIX E

QUALITY MANUAL
WITH
QUALITY MANAGEMENT
PLAN

RECEIVED

AUG 0 4 2000

Environmental Bureau
Oil Conservation Division

QUALITY MANUAL WITH QUALITY MANAGEMENT PLAN

REVISION 5

FOR

TRACEANALYSIS
4725 RIPLEY DRIVE, SUITE A
EL PASO, TX 79922
(915)583-3443

TRACEANALYSIS
6701 ABERDEEN AVE, SUITE 9
LUBBOCK, TX 79424
(806)794-1296
(CORPORATE OFFICE)

SUBMITTED ON: 11OCT99

PREPARED BY:
JAMES TAYLOR
(SAME AS LUBBOCK OFFICE)

EFFECTIVE DATE: 11OCT99

Blair Leftwich 8-3-00

BLAIR LEFTWICH (COORPORATE MANAGER, LUBBOCK LABORATORY DIRECTOR/ TECHNICAL DIRECTOR) — DATE

James Taylor 08/03/00

JAMES TAYLOR (COORPORATE QUALITY ASSURANCE OFFICER) — DATE

DOCUMENT CONTROL NUMBER 458

TABLE OF CONTENTS

APPENDICES

1.0 Introduction

1 1 Preface

TraceAnalysis, Inc , with laboratories located in El Paso and Lubbock, Texas, provides a wide variety of chemical services to a broad range of customers. The Quality Assurance Program is designed to assure the customer that a high standard of accuracy, reliability and impartiality are consistently applied to all services rendered by the laboratory

This Quality Assurance Plan is written in accordance with the elements required in *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations*, EPA QA/R-5, October 1997. This document contains the required elements of a Quality Assurance Plan.

The QA philosophy of the management at TraceAnalysis is one of total commitment to ensuring the technical and legal reliability and validity of all analytical laboratory data. This philosophy encompasses all phases of chemical and physical analyses and extends through the interpretation and final publication of results. The Quality Assurance Office, an independent operations group reporting directly to the company president, consistently monitors these functions. This separation allows the QA Office the flexibility and independence to shape the program in a manner that best fits the needs of the laboratory and clients.

The QA Plan defines the systems of quality control and quality assessment that make up the comprehensive Quality Assurance program at TraceAnalysis. Quality control consists of specific procedures applied to all phases of analysis from sample receipt through the final reporting of results. The purpose of quality control is to ensure that quality goals are met under routine operating procedures. Quality assurance involves the continuous evaluation of data and monitoring of analytical processes for the purpose of ensuring that the quality control systems are performing effectively.

The QA program objectives are:

1) To ensure the accuracy and precision of all analytical results;
2) To assess the capabilities of analytical methods for meeting users' needs regarding precision, accuracy, sensitivity and specificity;
3) To establish and monitor the routine operational performance of our laboratory through appropriate systems checks for ensuring that all aspects of the QA program are operative;
4) To run performance audits of blind samples for evaluation of our laboratory;
5) To perform corrective action as necessary;
6) To ensure that client's rights are protected, including the confidentiality of all information garnered, and the protection of any proprietary rights a client may have.

1.2 Quality Policy

TraceAnalysis is committed to quality and expects from its management and staff a high degree of commitment to providing legally defensible data of known and appropriate quality to its clients. The validity and reliability of the data generated is ensured by the adherence to documented standard operating procedures (SOPs). TraceAnalysis' SOPs are written to comply with the approved analytical methods.

TraceAnalysis emphasizes the application of sound quality assurance /quality control principles beginning with the initial planning of the project, throughout all analytical procedures, and ultimately with the preparation of the final report. The principles of the data quality objectives for representativeness, completeness, comparability, precision, and accuracy are applied to the analytical data generated.

To ensure client satisfaction, TraceAnalysis encourages strong interaction with the client at all phases of the project. Proactive interaction with the client helps TraceAnalysis to deliver a final product that meets the Quality Assurance Plan objectives as well as project-specific data quality objectives. TraceAnalysis is committed to providing the resources, facilities, equipment, and personnel, to ensure the timely completion of analysis and adherence to applicable QA/QC protocols.

1 3 Fields of Testing Covered

TraceAnalysis provides environmental testing for industry, municipalities, regulatory agencies, and consulting and engineering firms using approved analytical methods Analytical procedures fall into one of four categories of analysis: chemical analysis, physical analysis, traces metal analysis, and organic analysis

1.4 Management of Quality Assurance Project Plan

1.4.1 Responsibility

The management of TraceAnalysis' Quality Assurance Project Plan is the responsibility of the Quality Assurance Officer.

1.4.2 QA Project Plan Review Frequency

The manual is reviewed as appropriately by the Quality Assurance Officer. At any time during the year, lab personnel may request changes to the manual based on actual lab practice. Request for revision of the manual must come directly to the quality assurance department and are reviewed for admission into the next quality plan revision.

2 0 Organization and Responsibility

2 1 TraceAnalysis Inc. owns and operates two labs in Texas:

2 1.1 The El Paso Lab operates in inorganic, metals along with Environmental Lead Testing, and organic fields.

2 1.2 The Lubbock Lab operates in the inorganic, metal and organic fields including PCBs.

2.2 The organizational chart for the corporation is located in Appendix A and the laboratory organizational charts are located in Appendices B and C.

2.3 Key Personnel

2.3.1	Blair Leftwich	- Corporate President/Managing Director, Operations Manager of Lubbock Lab (Deputy: James Taylor)
2.3 2	James Taylor	- Corporate Quality Assurance Officer (Deputy: Blair Leftwich)
2.3.3	William Weigart	- Operations Manager of El Paso Lab (Deputy: Karen Costa)
2 3 4	Karen Costa	- Technical Director of El Paso Lab (Deputy: William Weigart)
2.3.5	Marc Stroope	- Production Manager of Lubbock Lab

2.4 Ultimate Responsibility

Ultimate responsibility for company policy and decision belongs to Blair Leftwich, President of TraceAnalysis, Inc.

3 0 Roles and Responsibilities

3 0.1 Quality Assurance Officer

The Quality Assurance Officer (QAO) has the responsibility for ensuring that all activities of the lab are in compliance with quality policies. The QAO leads the QA team and reports directly to the President. The QAO has the authority and the responsibility to implement and approve corrective actions as needed. The QAO is responsible for monitoring QC sample analysis results and the results obtained for analyses of external performance samples to identify potential problems. He is responsible for initiating both preventive and corrective action processes as needed to ensure proper operations within the laboratory The QAO is also responsible for maintaining certifications required for laboratory operations The QAO has the authority to stop work should there be serious problems with data quality

3.0 2 Laboratory Director

A Laboratory Director manages the laboratory with the responsibility for the technical and financial performance of the company. The Laboratory Director also has the ultimate responsibility for all aspects of the Quality Assurance Plan. Other duties include client consultation, final data review, and signature of lab reports.

3 0.3 Operations Manager

The Operations Manager manages the laboratory with the responsibility for daily operations and financial performance of the El Paso laboratory. Other duties include client services and project managing.

3.0.4 Technical Director

A Technical Director's responsibility is for the technical performance of the El Paso laboratory. The Technical Director also has the ultimate responsibility for all aspects of the Quality Assurance under the QAPP and reports directly to the QAO for all QA matters. Other duties include final data review and signature of lab reports.

3 0.5 Production Manager

The Production Manager assures that the sample input and data output of the lab runs smoothly in Lubbock. The Production Manager duties also include assuring sample hold-times and turn around times are met.

3.0.6 Supervisory Personnel

An organic, inorganic and metals section supervisor oversees technical operation in their respective areas. Responsibilities include scheduling of samples, chemist training, instrument preventive maintenance, and raw data review.

3.0.7 Client Services

Client services provide the client interface and the project management staff necessary to ensure a project is complete in a manner required by the client. Client services are under the direction of Nell Green in Lubbock and William Weigart in El Paso.

3.0 8 Analysts and Technical Staff

Laboratory analysts and technicians are responsible for performing analyses according to standard operating procedures and for evaluating the acceptability of their data based on established quality control criteria. Analysts are also responsible for initiating corrective action when QC criteria are not met.

3.0.9 Marketing

Marketing is responsible for advertising for the labs. Marketing is responsible for printed materials and trade shows representation. Business development is included under marketing The marketing director is Dan Lokey

3 0.10 LIMS Director

The LIMS Director is responsible for developing and maintaining the LIMS system including the networking of the laboratory. Computer training is also provided for the operation of the LIMS as well as other programs.

4.0 Specific Company Policies

4 0 All of TraceAnalysis' documents are controlled following the SOP for Document Control.

4 1 Before new work is accepted for TraceAnalysis the SOP for Capacity should be followed. This will help to assure quality work in a reasonable time by the laboratory.

4.2 In the case where erroneously results are reported to the client or if a report needs to be amended, then the corrected report is sent to the client labeled as a corrected certificate and the corrections are noted on the report. More information on proper policy for erroneous errors is found in the SOP on Erroneous Reporting.

4.3 Employees of TraceAnalysis perform their work so that they are free from any commercial or financial pressures by clients of TraceAnalysis or any other external sources.

4.4 TraceAnalysis' Contingency Plan is as follows: In the event of instrument failure, every effort will be made to analyze samples within holding times by approved alternate means. If duplication of instrumentation is insufficient to handle the samples of concern, efforts will be made to secure the equivalent or similar analyses from another approved laboratory. The client will be consulted immediately in this eventuality.

4.5 TraceAnalysis is responsible for seeing that confidentiality is maintained by its employees concerning all confidential information with which they become acquainted as a result of their contact with any given project. Trace agrees to hold all disclosed confidential or proprietary information or trade secrets in trust and confidence. The information shall be used only for the client's purposes. The information shall not be disclosed to any third party without written consent of the client.

4.6 Each employee and method of TraceAnalysis are subject to an internal audit at the determination of the Quality Assurance Office The results of the internal audits are filed in the Quality Assurance department and copied into the employee's training file It is the Quality Assurance Office's endeavor to cover a majority of the analytical methods annually Copies of the internal audits are given to the managing director for the annual manager's review.

4.7 Departures from TraceAnalysis procedures or policies are permitted if the client (if applicable) has been notified as to why a departure is needed for the project. Also, the lab manager and QA officer has to be notified before the departure from TraceAnalysis procedures or policies is take place. The SOP for Departure has to be followed

5.0 Laboratory Facilities

5 0 TraceAnalysis of El Paso operates in El Paso, Texas. The lab occupies a space, which encompasses approximately 6,000 square feet of combined analytical and administrative areas. The lab was designed and built from ground up to incorporate the latest technology in laboratory ventilation and ergonomics. Positive and negative pressure in the different laboratories helps assure that airborne contamination, a very common problem in volatile analyses, does not occur. TraceAnalysis of El Paso's floor plan is depicted in Appendix D

5 1 TraceAnalysis of Lubbock operates in Lubbock, Texas. The laboratory occupies approximately 11,000 square feet of which approximately 8,500 square feet are dedicated to laboratory space Extraction and instrumentation labs are kept separate with individual HVAC units to minimize cross-contamination Each area is provided with an emergency notification device. TraceAnalysis' of Lubbock floor plan is depicted in Appendix E.

5 2 Combination of the laboratories provides 17,000 square feet for laboratory functions. In each area of the lab is a fire extinguisher. Eye wash stations, safety shower and fire blanket are accessible to all areas where chemicals are used for sample extraction and preparation purposes. Safety storage cabinets are located in areas where flammable chemicals, acids, or corrosives are stored. The individual laboratories are large, clean, and well lighted, and promote a natural flow of sample analysis. The combination of these two laboratories provides full scale analytical support to various industries throughout the West.

6.0 Quality Assurance Objectives

6 0 Introduction

The purpose of this Quality Assurance Plan is to define procedures for the establishment of analytical systems and for the acquisition, documentation, evaluation, reporting, and archival of legally defensible data of known quality. The objective is to provide uniform systems for sample receipt, sample handling, instrument maintenance and calibration, methods control, performance evaluation, data acquisition, evaluation of quality, and reporting of the data. Specific procedures to be used for maintaining chain of custody, sample receipt, storage and disposal of samples, preventive maintenance, chemical analyses, internal quality control, data reporting, QA audits and corrective actions are described in specific sections of this plan or in standard operating procedures SOPs which are referenced when applicable. This section addresses the objectives of accuracy, precision, completeness, representativeness, and comparability.

6.1 Objectives

6.1.1 Precision and Accuracy

The QA objectives for precision and accuracy are to establish and maintain analytical systems that produce analysis results supported by QC data within acceptance criteria specified in the proposed analytical procedures. Precision and accuracy guidelines for the organic and inorganic procedures recommended by the USEPA are normally specified in the individual methods. These provide guidance as laboratory specific criteria are developed for each analytical method.

6.1.1.1 Accuracy

Accuracy is indicated by the measure of the difference between observed and true values. A minimum of one of every 20 environmental samples for organic analyses or one in 10 for inorganic analyses is spiked with a standard solution to assist in the evaluation of accuracy of the method for a given sample matrix through calculation of percent recovery of the matrix spike.

Each batch of up to 20 samples is prepared with a laboratory control sampled to ensure the analysis system is operating in control. The percent recovery for the LCS is calculated by comparison of the value obtained for the analysis with the true value for the LCS.

Surrogate compounds are spiked into samples analyzed by GC and GC/MS methods. The percent recoveries of the surrogates are used as an indicator of the accuracy and extraction efficiency of the analysis.

The calculation of percent recovery is performed in the following manner:

Matrix Spike Recovery

$$\% \text{ Recovery} = \frac{SSR - USR}{SA} \times 100\%$$

Where: SSR = Spiked sample result
USR = Unspiked sample result
SA = Spike added

Surrogate or Lab Control Sample Recovery

$$\% \text{ Recovery} = \frac{\text{Result obtained}}{\text{True Value}} \times 100\%$$

6 1 1 2 Precision

Precision refers to the reproducibility of results obtained for the analyses of duplicate samples or matrix spiked duplicate samples. One out of every 20 samples of similar matrix analyzed by each method for organic (1 in 10 for inorganic) is run in duplicate or as matrix spike duplicates for determining precision.

The results of the duplicate analyses are computed and the absolute relative percent difference (RPD) is calculated as follows:

$$RPD = \frac{2\,(R1 - R2)}{(R1 + R2)} \times 100\%$$

where: R1 = First replicate result
R2 = Second replicate result

The RPD must fall within set acceptance limits for the results to be accepted and subsequent data validated.

6.1.2 Representativeness

Representativeness is a qualitative measure that is related to the ability to obtain a sample that best reflects the characteristics of the part of the environment that is to be assessed. The laboratory uses homogenization of the sample, if compatible with the tests to be performed, to ensure the results obtained are representative of the sample as received.

6.1.3 Completeness

Completeness is a measure of successfully obtaining all information necessary for a valid scientific study. The objective for completeness is: the methodology proposed for chemical characterization of the samples collected will provide data meeting QC acceptance criteria, following standard laboratory data review and validation, for at least 95% of all samples collected. Completeness may also be defined as a comparison of the number of tests successfully completed (with acceptable QC) to

the number of tests requested. Nonconformance/corrective action (NC/CA) reports are completed in accordance with standardized procedures in order to provide explanation when QC criteria are not met. The analyst describing the situation encountered completes the NC/CA report. The corrective action required is taken and documented in the appropriate section of the NC/CA report by the supervisor and analyst. See Corrective Action in Section 17.

6 1.4 Comparability

The objective of comparability is to produce results that do not differ significantly from those produced by other parties for the same purpose. TraceAnalysis participated in blind proficiency studies provided by USEPA WS/WP programs. Since the USEPA WS/WP programs discontinuation, TraceAnalysis has been analyzing single blind studies from privatized WP/WS and Solid waste programs. TraceAnalysis at El Paso also participates in the ELPAT programs. TraceAnalysis also participates in intra-laboratory comparison studies and double blind studies. Replicate testing using the same or different methods, re-testing of retained samples, and the correlation of results for different characteristics are also utilized as appropriate, and as specified in the standard operating procedures. The analyses of proficiency test items are to follow the same internal quality control schemes established for client samples.

7.0 Sample Custody and Handling Procedures

7.0 Sample containers TraceAnalysis provides its clients with pre-cleaned sample containers necessary to carry out any given project. Sample containers are constructed of polyethylene or glass, as listed on Tables 4-1A and 4-1B. TraceAnalysis routinely uses new sample containers obtained from a supplier that has been qualified, by the laboratory's analysis of DI water blanks to deliver containers free from contamination. Sample containers are used only once and disposed of according to federal, state, and local guidelines. In addition, TraceAnalysis can supply certified, pre-cleaned containers upon request.

7.1 Sample Container Orders

7.1.1 Bottle Order Form

Bottle orders are prepared by the Support Services Manager using a bottle order form or equivalent Appendix H. Bottle orders must be placed as far in advance as possible The bottle order form must contain the following information: analyses, matrices, number of samples, name and shipping address, and date required.

7 1 2 Trip Blanks

Trip blanks are prepared by completely filling a 40 mL VOA vial with organic-free reagent water. The last few drops are gently poured into the vial so that surface tension holds the water in a convex meniscus The vial is then capped If air space is present, the procedure is repeated The vial is labeled as a trip blank.

7.1.3 Filling Sample Container Orders

The sample container order is filled by a member of the support services group. Bottles, with proper preservatives added, are packed in shipping containers using bubble-wrap to minimize breakage. The containers are typically sent in the ice chest in which they will be returned to the lab. A chain-of-custody form is sealed in a plastic bag and sent with each bottle order. Labels and custody seals are also made available. The bottles may be picked up at the laboratory, delivered by TraceAnalysis personnel or a third party carrier.

7.2 Definition of Holding Times and Preservatives

Holding times are defined as the amount of time that elapses between the collection of the sample from the source in the field and the beginning of the analysis procedure. Preservatives are defined as techniques used to maintain the target analytes at concentration representative of those in the source sampled until the sample is analyzed in the laboratory. Published holding time is viewed as valid as long as the associated preservation and container requirements have been met. Appendix G lists appropriate sample containers, preservatives, and maximum holding times for each analysis.

7 3 Definition of Turn Around Time

Turn-around-times are defined as the amount of time that elapses between the receipt of the sample at the lab and the receipt of the data by the client, excluding weekends and holidays Reports are faxed upon completion with hard-copy final reports mailed thereafter.

7 4 Chain-Of-Custody

A chain-of-custody record Appendix H should be completed with each sampling event to document sample custody from the time of collection through transfer of custody to the laboratory. At a minimum, the chain-of-custody record must contain the following information:

7 4.1 analyses required

7.4 2 type of sample bottle

7.4 3 preservative

7.4.4 sample identification

7.4.5 signature of collector

7.4 6 date and time of collection

7 4.7 signature and inclusive date and times of possession for each person taking custody of the samples.

A chain of custody completed by the client and/or sampler accompanies all samples received by TraceAnalysis. TraceAnalysis provides chain-of-custody forms for all containers supplied to the client. Clients choosing to use chain-of-custody forms other than those provided by TraceAnalysis are responsible for ensuring all essential information is included on the form.

7.5 Sample Receiving

7.5.1 Sample Receipt and Verification of Documentation

Samples are received in accordance with the procedures set forth in TraceAnalysis sample receipt and log-in SOP. Shipping containers are inspected for custody seals and the condition is noted in the bottom right hand corner of the chain-of-custody. The shipping containers (usually ice chests) are then opened and inspected for enclosed documentation. The sample bottle labels are inspected and compared to the chain-of-custody. Any discrepancies are noted on a nonconformance/corrective action (NC/CA) report form and the client is notified by client services personnel to determine the corrective action required. Samples received with no paperwork are held in refrigerated storage until the proper instruction for analysis is received. The client is contacted immediately and the resolution of the problem is documented in the project file.

7.5.2 Verification of Sample Preservation

The temperature inside the shipping container is determined using a hand-held infrared thermometer and recorded on the chain-of-custody form. The pH of preserved aqueous samples is verified as soon as possible after sample receipt and recorded on the internal chain-of-custody form. The pH of preserved VOA vials is measured at the time of sample preparation and recorded in the instrument run log.

7.5.3 Notification of Clients

If samples are received improperly preserved, broken, or with head space in VOA vials, the client is notified to determine corrective action. This is recorded on a NC/CA report form.

7.6 Sample Log-In

Samples are logged into TraceAnalysis Laboratory Information Management System (LIMS) in accordance with the sample receipt and log-in SOP. Each project is assigned a unique batch code and each sample receives a unique sample number. Upon entry of all required sample identification and analysis information into the LIMS, the information is reviewed and approved by the laboratory director for accuracy and completeness. Any errors or omissions are corrected at this time.

7.7 Sample Storage

The samples are stored in designated refrigerators according to the type of analysis to be performed. Samples to be analyzed for volatile organic compounds are stored in separate refrigerators designated for volatile samples (VOA vials only). All refrigerators are monitored daily to ensure the temperature is maintained within a range of 2-5° C. Deviations from this temperature range are noted in the temperature logbook and corrective action is taken immediately to ensure the integrity of the samples.

7.8 Sample Access and Internal Chain-of-Custody

Operating the laboratory facilities under controlled access ensures integrity of samples. Only employees are allowed into the laboratory areas. Visitors must register upon arrival and allowed access to the facility only with an escort. An internal chain-of-custody for samples, is also maintained within the laboratory. Analysts must check the samples in and out of cold storage on the provided internal chain-of-custody form.

7.9 Sample Subcontracting Documentation

When samples are subcontracted to other laboratories due to TraceAnalysis' inability to perform the required analyses, a separate chain-of-custody record and analysis request is filled out and sent accompanying the samples. A copy is also put into the client file. Subcontracted work is reported on the letterhead of the laboratory which performed the analysis. The client will be notified in writing of the subcontracted work. TraceAnalysis will have on file the QAPP and any other QA records needed of the subcontracting laboratory.

7.10 Sample Disposal

Samples not totally consumed during analysis and any excess extracts or digests generated during analysis are disposed of in accordance with local, state, and federal regulations. Specific disposal requirements are arranged with the client before receipt of samples. Sample disposal is addressed in the sample disposal SOP

8.0 Analytical Procedures

8 0 Purpose and Applicability

This section specifies the sources of analytical methods used by TraceAnalysis and defines controls on standard operating procedures SOPs, their content, approval for use, distribution, and revision. A list of preparation and analytical methods performed at TraceAnalysis is included as Appendix I.

8 1 Laboratory Reference Documents

TraceAnalysis employs analytical methods from the following recognized sources:

8.1.1 40 CFR Part 136, Code of Federal Regulations,

8 1 2 EPA-600/4-79-20, Methods for Chemical Analysis of Water and Wastes, March 1983 Revision and updates

8.1.3 SW-846, Test Methods for Evaluating Solid Wastes, November 1986, Third Edition and updates

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

8.1.5 Methods of Soil Analysis, American Society of Agronomy, 2nd Edition, 1982

8.1.6 American Society for Testing of Materials

8.1.7 Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1987

8 2 Method Modifications

Method modifications are permissible to allow for advances in analytical techniques as long as the actual chemistry of the method is not changed. An example of this would be modifying a gas chromatographic method for the use of capillary columns. Other permissible modifications would include sample volume or weight changes as long as the ratios set forth in the methods are retained.

8.3 Standard Operating Procedures

All analytical procedures are performed according to a written standard operating procedure, incorporating specifics regarding TraceAnalysis' quality control procedures, set-up, and operation of current laboratory instrumentation. SOPs address the following:

8.3.1 Method Reference -Lists the reference document from which the SOP was derived;

8.3.2 Scope and Application -Lists the property, analyte(s), or class of compounds measured by the method and summarizes the procedure. Describes the sample matrices working ranges, and situations to which the procedure applies;

8.3.3 Definitions - acronyms, abbreviations, and specialized forms used in the SOP;

8.3.4 Health and Safety Warnings - indicating operations that could result in personal injury or loss of life and explaining what will happen if the procedure is not followed or is followed incorrectly, listed here and at the critical steps in the procedure;

8.3.5 Cautions - indicating activities that could result in equipment damage, degradation of sample or possible invalidation of results, listed here and at critical steps in the procedure;

8.3.6 Personnel Qualifications – explaining what the minimum qualifications the of the technician needs to be before running the test;

8.3.7 Equipment-Describes the instruments, glassware, and other equipment applicable to the procedure;

8.3.8 Reagents-Describes the reagent and standard concentration grade, preparation, and use,

8.3.9 Apparatus and Materials - list or specify; note also designated locations where found;

8.3.10 Handling and Preservation – Preservation, Holding times and special requirements needed for sample procurement;

8.3.11 Procedure-Describes the sequence of activities to be performed. This includes calibration or standardization, sample pretreatment, sample analysis, calculations, reporting limits, quality control checks, and special glassware cleaning procedures as appropriate to the method Interferences;

8.3.12 Data Acquisition, Calculation & Data Reduction – how data is received, calculated and reduced to the final form for management review,

8.3.13 Computer Hardware & Software - used to analyze analytical results and report data;

8.3.14 Data Management & Records Management – forms, logbooks, standard and reagent logs, and locations for data and data storage;

8.3.15 Corrective Action-Describes corrective actions taken when nonconformance or out-of-control situations occur during the procedure. This includes invalid calibrations, method blanks, quality control checks, and matrix interference;

8.3.16 Preventive Maintenance and Troubleshooting -Describes daily or routine maintenance procedures on instrumentation or equipment used in the analytical procedure and any common procedures to correct instrument breakdown.

Any additional information on Standard Operating Procedures can be found in "Writing the SOP" Standard Operating Procedure identified as "SOP-Writing".

All SOPs are approved by the appropriate Section Supervisor, the Quality Assurance Officer and Laboratory Director. The Quality Assurance Officer retains master copies of SOPs. Controlled copies are distributed to appropriate areas of the laboratory. SOP revisions must be approved and distributed in the same manner as the original method.

8.4 Method Start-Up QC

Before a method is approved to generate client data, method start-up quality control must be performed by each analyst and retained on file. Method start-up QC is method dependent and includes at a minimum Initial Demonstration of Capability and Method Detection Limit Studies. If a modification is made to a method, the method start-up QC must be repeated with the modification as an integral part of the method. Method detection limit studies must be conducted at a minimum of once a year.

8.4.1 Initial Demonstration of Capability

The laboratory must demonstrate that it can meet the specifications in the method for recovery of analytes spiked into a reference matrix (reagent water). The test consists of spiking the analytes of interest into a set of four portions of reagent water and processing these aliquots through the entire analytical procedure. The mean concentration and the standard deviation of the mean concentration are calculated for each analyte, and these values are compared to specifications in each method. If the mean and standard deviation are within limits, the analyst can use the method to analyze client samples.

8.4.2 Method Detection Limit Studies

The procedure for determining MDLs is published in 40 CFR part 136, Appendix B. All programs across the EPA cite this reference. The study is based on repetitive analysis of an interference-free sample spiked with a known amount of the target analyte. In general, seven aliquots of the spiked sample are taken through the entire sample preparation and instrument analysis protocol. The standard deviation of the results is determined, then multiplied by the one-tailed t-statistic at the 99% confidence level for the number of degrees of freedom in the study (one less than the number of repetitions used to calculate the standard deviation). For seven repetitions, this is a multiplier of 3.143. The resulting value is finally compared to the spike level in the sample. If the spike level is within five times the calculated MDL then the procedure is considered successful. If not, the spike level in the sample is adjusted, and the study is repeated.

8.5 Method Selection

TraceAnalysis will use EPA approved methodology for the analysis of environmental samples whenever such methods are available. If the client has not specified an approved method, TraceAnalysis will select a recognized and validated method for use.

9 0 Equipment

An extensive scope of services, which TraceAnalysis provides to its clients, requires significant capital investment The laboratory furnishes all items of equipment required for the correct performance of tests.

9.0 List of Equipment

A list of all major equipment is included in Appendix J for the El Paso lab and Appendix K for the Lubbock lab It is not intended to be a compilation of all equipment in use, but simply a summary of the significant instrumentation dedicated to providing clients with on-time, quality data.

9 1 Instrument Preventive Maintenance

All instruments and equipment receive routine preventive maintenance, which is recorded in instrument specific maintenance logs Routine maintenance ensures that the equipment is operating under optimum conditions, reducing the possibility of instrument malfunction. Preventative maintenance procedures including lubrication, source cleaning, detector cleaning, and the frequency of such maintenance are performed according to the procedures recommended in the manufacturer's instrument user manual. Chromatographic carrier gas purification traps, injector liners, and injector septa are replaced on a regular basis.

9 2 Maintenance

Maintenance must be performed when the instrument begins to degrade as evidenced by the degradation of peak resolution, shift in calibration curves, decreased sensitivity, or failure to meet one or another of the quality control criteria. Precision and accuracy data are examined for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance actions are also recorded in logs located by the major pieces of equipment and are kept in the laboratories at all times. The laboratories also maintain adequate supplies of spare parts such as GC columns, syringes, septa, injection port liners, and other consumable parts to minimize potential instrument downtime. In the event of equipment malfunction that cannot be readily resolved by laboratory personnel, service is obtained from the instrument vendor or manufacturer. Major repairs performed by the vender are also recorded and the field service technician's report is retained on file.

9.3 Out of Service Instruments

Any item of equipment which has been subjected to overloading, or mishandling, or which gives suspect results, or has been shown by verification, or otherwise to be defective, shall be taken out of service. At the time the instrument is taken out of service it will be clearly identified and wherever possible stored at a specified place until it has been repaired and shown by calibration, verification or test to perform satisfactorily. The laboratory shall examine the effect of this defect on previous tests and notify the customer of any discrepancies in their reports.

10 0 Reagents, Solvents, Gases, and Outside Supplies

10 0 Reagents

All reagents are prepared using, at a minimum, ACS reagent grade chemicals. Preparation information is recorded in the reagent log in the wet chemistry lab.

10 1 Solvents and Acids

Solvents and acids used are ultra high purity typically surpassing those recommended in actual analytical methods. For volatile organics, purge and trap grade methanol is used. For extractable organics, pesticide grade or Optima ™ grade solvents are used. For metals, trace metals grade acids are used

10 2 Gases

Carrier gases (He) used on gas chromatographs is UHP grade except for the GC/MS systems which use a research grade of carrier gas Make-up and other gases used on gas chromatographs are selected according to manufacturer's specifications.

10 3 Outside Supplies

Although rare, if the laboratory procures outside supplies, they will not be used until they are inspected and verified as compliant to standard specifications relevant to tests concerned.

10.4 Reagent and Reference Material Storage

10.4.1 Reagent Storage

All reagents and chemicals are stored in appropriate areas of the laboratory where they are most commonly used Corrosive and flammable chemicals are stored in approved cabinets. Ionic salts and other dry chemicals are stored on shelves in the wet chemistry lab.

10.4.2 Reference Material Storage

Standards and reference materials are stored in the areas of the laboratory where used by analysts. A standards refrigerator or freezer designated for its use is in each area. Temperature logs are maintained for standards refrigerators and freezers.

11.0 Glassware Specifications

All laboratory volumetric glassware (pipettes and flasks) is Class A. When preparing standards and reagents, Class A volumetric glassware must be used.

11.0 Glassware Cleaning

All dirty laboratory glassware is cleaned and processed by the Support Services department. EPA approved cleaning and baking procedures are followed Details of glassware cleaning are addressed in the glassware processing SOP.

12.0 Calibration Procedures

12.0 Introduction

Analytical instruments and equipment used to obtain measurements or record data to be used for calculations of analytical results are calibrated at a frequency and in a manner such that accuracy and reproducibility are consistent with the manufacturer's specifications for proper instrument operation, and the calibration is in compliance with the analysis method requirements.

Laboratory measurements are based upon comparisons to results obtained for the analysis of reference standards analyzed by the same method. The results obtained for the analysis of calibration standards are used to prepare calibration curves or calculate calibration factors. The results of the sample analysis are quantified using either internal or external calibration techniques. Typically, calibration is achieved by the analysis of five calibration standards for organics and three calibration standards for inorganics at concentration levels set forth in the referenced method.

12.1 Calibration Frequency

Recalibration of instrumentation is performed at specified time intervals, when indicated by the continuous verification procedures, or when required by the contract-required method. Calibration procedures are method specific. Consult the appropriate SOP for details regarding initial and continuous calibration.

12.2 Secondary Reference

Where applicable, another source standard from an alternate accredited vendor is used to check the calibration of the instruments. If a second vender is not available, then another lot from the same vender is acceptable. If another lot is not available then another analyst can make a secondary reference for the first analyst using the same vender and same lot.

12.3 Calibration Records

Each analyst maintains calibration files for the methods performed. This file includes date of calibration, calibration plots, calibration raw data and a unique identifier of the calibration. Data is also present showing tractability to standard reference materials.

12.4 Traceability of Calibration Reference Materials

All instruments are calibrated using standard solutions of known concentrations. Where applicable, the standards are prepared from certified reference materials traceable to NIST or from reference materials whose concentration has been verified against NIST traceable materials. Certificates of Analysis from standards vendors are kept on file by the Quality Assurance Officer. Thermometers and balances are calibrated annually, or sooner as needed, using NIST traceable thermometers and weights. Daily verification of balance calibration is described in the balance calibration verification SOP. Balances, NIST weights and thermometers are serviced by certified technicians annually.

12.5 Standards Preparation Records

Calibration standards are prepared from commercially available traceable stock standard solutions The identity of the stock solution, intermediate solution, preparation procedure, solvent lot, date, preparer, expiration date, and identity of the calibration standard are recorded in a standards preparation logbook The entry is dated and signed by the analyst.

12.6 Acceptance of a Standard Curve

The laboratory calibration procedure utilized must meet or exceed the method calibration criteria for analyses performed In the event that calibration criterion are not attained, a recalibration is attempted. If the calibration fails again, the analysis is halted and corrective action is taken. The calibration procedure in the method is followed for each specific analysis. Calibration records are documented on computer printouts, in the analysis logbook, and/or on bench sheets where applicable

12.7 Initial Calibration Verification

The initial calibration verification (ICV) is performed to determine if the calibration curve that has just been generated is valid. It is a check upon the accuracy of the individual calibration standards used to perform the calibration. The ICV solution is prepared form a different lot number or obtained from a different manufacturer than that of the calibration standards.

12.8 Continuing Calibration Verification

The continuing calibration verification (CCV) is used to ascertain that the initial calibration is still holding and correct as the instrument is used to process samples. For instruments that incorporate analyte identification into the procedure such as retention time matching from a gas chromatograph or spectral matching from a mass spectrometer, the CCV also serves to determine that the identification criteria are still being met. The source of the CCV could be one of the calibration standards

13.0 Environmental Lead Program

13 0 Personel for lead program

There are specific personnel requirements for the Environmental Lead Program All Trace Analysis personnel working on the Lead Program shall meet the following minimum requirements

All personnel must read and sign all applicable Standard Operating Procedures (SOPs) prior to participation in the Environmental Lead Program.

13.0.1 Technical Manager

- College degree in chemistry or a related science minimum of 3 years of non-academic analytical laboratory experience of which at least 2 years shall be metals analysis experience
- Must be on-site at least 50% of the time.

13.0.2 Quality Manager

- College degree in a basic or applied science
- 1 year of non-academic analytical chemistry experience
- Training in statistics

OR

- College degree in other than the basic or applied sciences
- Minimum of 4 years of nonacademic chemistry experience
- Training in statistics

The same person can fill both the technical and quality manager positions as long as he/she does not act in the position as the sample analyst/technician analyzing the samples or act as the immediate supervisor of the analyst/technician involved with the analysis of the samples.

13.0.3 Senior Inorganic Chemist/ Spectroscopist

- Must have a bachelor's degree in chemistry or related field
- Minimum of one year of non-academic experience in metals analysis

13.0.4 ICP - 40 hour in-house training course with an experienced spectroscopist, or satisfactory completion of an ICP short course

13.0.5 FLAA - 20 hour in-house training course with an experienced spectroscopist, or satisfactory completion of an FLAA short course

13.0.6 GFAA - 20 hour in-house training course with an experienced spectroscopist, or satisfactory completion of an GFAA short course

13.0.7 Analyst/Technician

13 0.7.1 Digestions

- 12 hour in-house training course with an experienced analyst/technician

- Initial Demonstration of Capability(IDC):

  - digestion of four replicate samples with the average of the recoveries within the method specified acceptance limits

  - IDCs must be performed for each matrix of interest

  - Successful digestion of a blind sample

  - Three months of digestion experience is required for independent operation

13 0 7 2 Instrumentation

13 0.7 2.1 ICP- 40 hour in-house training course with an experienced spectroscopist, or satisfactory completion of an ICP short course

13.0.7.2.2 FLAA - 20 hour in-house training course with an experienced spectroscopist, or satisfactory completion of an FLAA short course

13 0.7.2.3 GFAA - 20 hour in-house training course with an experienced spectroscopist, or satisfactory completion of an GFAA short course

13.0.7.2.4 Six months of experience is required for independent operation

Analysts/Technicians may work on samples submitted for Pb analysis under NLLAP as long as the following conditions are met:

- Successful completion of IDCs, SRMs, or proficiency testing samples
- At least 50% of the experience period stated above has been met
- The immediate supervisor or instructor is physically present 70% of the time in their work area when they are preparing and/or analyzing samples

14.0 Facility and Safety Requirements

Extraction and instrumentation areas are kept separate with individual HVAC units to minimize cross-contamination. Each area has a fire extinguisher and emergency notification device. Eye wash stations, safety shower, and a fire blanket are accessible to all areas. Ventilation hoods are located in all areas where chemicals are used for sample extraction and preparation purposes. Safety storage cabinets are located in area where flammable chemicals, acids, or corrosives are stored. Safety meetings are conducted by the Safety Officer and all employees are required to be present for these meetings.

15.0 Laboratory Quality Control

15 0 Purpose and Applicability

This procedure provides an overview of the quality control (QC) measures used to assess and control analytical processes at TraceAnalysis Specific information on quality control checks for individual laboratory departments is provided in TraceAnalysis SOPs for individual analysis methods.

15.1 Responsibilities

15.1.1 Quality Assurance Department

The Quality Assurance Department shall establish and publish acceptance limits for quality control checks and assist laboratory personnel in updating variable limits annually, at a minimum.

15.1.2 Laboratory Analysts

Laboratory analysts shall compare the results of quality control checks to the published acceptance limits, and shall take appropriate corrective measures whenever acceptance limits are exceeded. Corrective measures shall be documented.

15 2 Daily Quality Control

NOTE: The following discussion of the daily quality control program is general in nature. The test specific requirements of the methods, as outlined in TraceAnalysis SOPs, supersede these general requirements. In addition, client or project-specific QC requirements may supersede those specified in this QA Plan.

15.2.1 Quality Control Checks

The daily quality control program includes a variety of QC checks inserted in the analysis process by analysts These checks include instrument tuning or sensitivity checks, continuing calibration or calibration verification standard, and lab control sample results are calculated as percent recovery. Method blank results are evaluated for the presence/absence of laboratory contaminants. These quality control checks monitor the accuracy of the analytical procedure in the absence of matrix interference. The decision to accept or reject analytical results is based on these quality control results.

15.2.2 Acceptance/Rejection Limits for QC

Acceptance limits for these checks are taken from EPA methods or are established by TraceAnalysis from actual QC data. If these checks fail to meet acceptance limits, corrective action is required before continuation of analysis and/or reporting of the data. The corrective action taken for each out-of-control event must be described in the analysis log and approved by the data reviewer. In addition, a nonconformance/ corrective action form is completed and kept with the raw data.

15.2.3 Matrix Spikes

One in ten (one in twenty samples for GC analysis) of a similar matrix is analyzed in duplicate and as a matrix spike, or as a duplicate matrix

spikes, to evaluate matrix effects on analyte recovery. Accuracy is calculated as percent recovery of the matrix spike. Precision is calculated as the relative percent difference (RPD) of duplicates or matrix spike duplicates

15 2 4 Acceptance/Rejection Limits for MS/MSD

Acceptance limits for these checks are also taken from EPA methods or are established internally by TraceAnalysis. If matrix spike recovery fails to meet acceptance limits and the analytical system yielded acceptable results for calibration standards, lab control samples, and surrogate standards, the sample is re-extracted and analyzed again. If matrix spike recovery fails to meet acceptance limits again, the associated sample results are qualified to indicate the probable presence of matrix interference. If precision acceptance criteria are exceeded, reanalysis of the duplicates and all of the positive samples in the batch is required. The corrective action taken is described in the analysis log and approved by the data reviewer. In addition, a nonconformance/corrective action form is completed and kept with the raw data.

15.3 Acceptance Limits

Acceptance limits for the daily QC program are taken from EPA methods or are established by TraceAnalysis from actual data as described in this section. Acceptance limits are calculated and summarized annually, at a minimum, and distributed to laboratory operations personnel by the Quality Assurance Officer. Current QC acceptance limits are listed in the Statement of Limits

15 3.1 Fixed Limits

In general, acceptance limits for GC, GC/MS and metals analyses for tuning, initial and continuing calibration, method blanks, and precision and accuracy of matrix spikes and duplicates or duplicate matrix spikes are based on acceptance limits established in EPA methods.

15.3.2 Variable Limits

Variable limits are based on laboratory-generated data and are updated annually, at a minimum.

Acceptance limits for percent recovery of lab control samples and GC and GC/MS surrogate standards are calculated from actual QC data. The mean (x) and standard deviation (s) are calculated from the most recently generated percent recovery data A minimum of 20 values is necessary to establish limits. Outliers are excluded from the calculation of acceptance limits. Control charts are available for these parameters.

Acceptance limits are calculated as follows, where (x) represents the individual values and (n) is the number of values

Parameter	Symbol	Formula
Upper Control	UCL	x + 3s
Upper Warning Limit	UWL	x + 2s
Center Line (mean)	x	$(\Sigma\chi i)/n$
Lower Warning Limit	LWL	x – 2s
Lower Control Limit	LCL	x – 3s

If the data generated are insufficient to calculate acceptance limits and the method does not provide acceptance criteria, the following limits will apply:

- Inorganic Chemistry: 75-125% recovery
- Metals: 75-125% recovery (water), 50-150% recovery (soil)
- Organic chemistry-Volatiles: 75-125% recovery
- Organic chemistry Base-neutrals and extractables: 50-150% recovery
- Organic chemistry-Acids: 25-125% recovery
- Other analysis: 75-125% recovery

Acceptable relative percent difference (RPD) of duplicate analyses is ≤20% for duplicate results greater than 10 times the method detection limit (MDL). When one or both results are ≤10 times the MDL, the RPD acceptance range is ≤67%.

Acceptance limits will be updated annually at a minimum, when 20 or more new values have been generated. The summary of acceptance limits is revised and distributed to the appropriate lab groups after each update.

15.4 Reporting Limits

Reporting limits are generated based on a factor of 2-10 times the calculated MDL depending on the confidence level of the analysis. Reporting limits are available to the client by request.

16.0 Data Collection, Reduction, and Reporting

16 0 Purpose and Applicability

This section defines the TraceAnalysis procedures for data collection, reduction, entry into the LIMS, validation, and reporting. All data is collected, reduced, entered, validated, and reported in accordance with this procedure unless an alternate scheme is outlined in a project-specific plan.

16.1 Responsibilities

16.1.1 Analysts

Analysts conduct data collection and reduction in accordance with this procedure

16.1.2 Supervisors

Laboratory Supervisors review data, assist in corrective action procedures

16.1.3 Quality Assurance

The QA Department reviews laboratory raw data and quality control data

16 1 4 Director

The Laboratory Director reviews and signs final reports before sending them to clients.

16.2 Data Collection

16.2.1 Sample Preparation and Analysis

Sample preparation and analytical activities are documented in sufficient detail to allow the analysis to be recreated. The information must be recorded in a laboratory notebook or on preprinted worksheets, or retrievable from instrument output. This includes the following at a minimum:

- The analytical activity being performed (i.e. the specific analytical method or preparation method performed)
- The person(s) performing the activity and the date and time that the activity was initiated.
- Instrument parameters, including instrument identification and settings. Instrument settings may be referenced to previous documentation of instrument parameters.
- The analytical sequence must be documented (i.e. the chronological order of analysis). The following data for each sample, standard, and QC check ran in the analytical sequence must be recorded and/or retrievable from an instrument printout (quantitation report, etc.)
- QC sample type identification if QC sample
- Dilution

- Sample aliquot/final volume
- Instrument reading
- Units for all variables are specified, preferably in column headings
- TraceAnalysis sample number
- Final result
- Percent recovery and RPD
- The calibration curve from which data are quantified, identified by instrument and date ran, or by reference to a notebook and page number or a filename, if the initial calibration is included in the analytical run.
- Identification of the source of standards used for calibration, calibration verification, lab control samples, and matrix spikes referenced to a standards prep notebook and page number.
- Notes regarding any anomalies (e.g. change in color, formation of precipitate, sample foaming) or difficulties (e g. instrument malfunction) encountered during analysis.
- The notebook identification number on each page.

16.2 2 Data Recording and Error Correction

All handwritten data must be recorded using indelible ink. When an error in any hard copy documentation of data is corrected, the person making the correction draws a single line through the erroneous data so as not to obscure the original entry. He/she then writes his/her initials, the date, and the correct information, if applicable, adjacent to the error.

16.3 Data Reduction

16 3.1 Qualitative Identification

Qualitative identification of organic compounds is performed according to retention time matching. Second column confirmation by GC is performed upon request or when specified by the requested method.

16.3.2 Quantitation

The equations used to calculate final results are specified in the appropriate laboratory methods and SOPs. In general, the following rules concerning blank correction, reporting limits, significant figures, and rounding rules apply to those calculations.

16.3.2.1 Blank Correction

Blank correction is not allowed except for analytical procedures or methods that require blank correction.

16.3.2.2 Significant Figures and Rounding Rules

All calculation results are rounded to the correct number of digits (usually 2) as the final calculation step. No result is rounded before reaching the final answer, even in a lengthy calculation.

To round a number, first determine the number of digits to be reported (the reportable figures, usually 2). Determine whether the digit to the immediate right of the right-most reportable figure is greater than, equal to, or less than 5. Ignore any digits further to the right unless the number is 5. If the number is greater than 5, round up (e.g. 1.66 is rounded to 1.7). If the number is less than 5, truncate after the last reportable figure (e.g. 1.64 is rounded to 1.6). If the number is 5 and is followed by other non zero digits, then we add one to the preceding digit (e.g. 1.653 and 1.6501 will both round to 1.7). If the digit after the point of round off is a 5 and no other digits follow the 5, then we drop the 5 if the preceding digit is even and add one to the preceding digit if it is odd (e.g. 1.65 is rounded to 1.6 and 1.75 is rounded to 1.8).

Round results at the end of calculations to two digits as follows, with the exceptions noted:

- If the initial concentration of the sample is less than the reporting limit, express the reporting limit as 2 digits (e.g. <1.0 mg/L).
- If the initial concentration of the sample is above the reporting limit, and if expressed in scientific notation its exponent would be equal to that of the reporting limit expressed in scientific notation, report the result to 2 digits. (For example, if the reporting limit is 1.0 mg/L, the initial concentration is 5.148 mg/L and no dilutions were made, report the result as 5.1 mg/L.)
- If the initial concentration is above the reporting limit, and is expressed in scientific notation its exponent would be greater than that of the reporting limit expressed in scientific notation, report the result to 2 digits. (For example, if the reporting limit is 1.0 mg/L, and the initial concentration is 51.480 mg/L and no dilutions were made, report the result as 51 mg/L.)

  Note: for quality control checks and PE samples, express results, recoveries, and relative percent differences using at lest three significant figures whenever possible.

16.3.3 Evaluation

The quality control data for each batch or analytical run are evaluated against acceptance limits. Whenever a quality control result exceeds acceptance limits, corrective action is required before turning in data for the batch or analytical run for data review. Corrective actions are

recorded in the analysis log and on a nonconformance/corrective action form.

16 4 Data Validation

16.4.1 Data Review

Following data reduction and before data entry, the raw data associated with the analytical run analysis log, instrument output (quantitation reports, chromatograms, spectra), calibration curves, etc. are forwarded to the Quality Assurance Officer for data review. The review encompasses the correctness, acceptability, and completeness of the following elements of data generation and handling. (All elements are not applicable to all tests.)

- Instrument tuning
- Initial Calibration
- Continuing calibration/calibration verification
- Calibration Blanks
- Method or preparation blanks
- Surrogate and/or lab control sample recovery
- Qualitative identifications
- Quantitation, including units and reportable figures
- Precision of duplicates
- Recovery of matrix spikes
- Holding Times
- Data qualifiers
- Data Entry

When unacceptable calibration or quality control check is generated, the data reviewer ensures that appropriate corrective action was taken before approving the data. Any defects are corrected. Raw data are corrected as necessary. If corrective action cannot be taken, the samples are qualified appropriately.

Upon approval of the data, the reviewer initials the lab notebook, page(s), worksheet(s), or instrument printout, and indicates approval of the data, which allows the data to proceed to data entry and final report generation. Following data review and approval, preliminary results may be provided to the client when necessary. The results must be clearly labeled as being preliminary and subject to change upon completion of laboratory review.

16.4.2 Data Entry

Following data evaluation and review, the sample results and QC data are entered into the LIMS system by data entry personnel.

16.4.3 Data Reporting

Following data review, data are available for report preparation through the LIMS. The report consists of a lab analysis report and a quality control report. On most reports, the QC information is available on the same page as the lab analysis report. The lab analysis report contains the following information:

- A title, e.g. "Test Report"
- Name and address of laboratory
- An Order Identification Number
- Name and address of client
- Project information
- Matrix identification
- Characterization and condition of the test item
- Date sampled and date of sample receipt
- Date of performance of tests
- Identification of test method used
- Result and units for each analyte for each sample
- Any comments about the sample or results (e g. matrix effect)
- A signature and title of person accepting responsibility for the content of the report

If requested by the client, results from organics analyses which fall between the method detection limit and the reporting limit may be reported with a flag indicating that the result is an estimate. Additionally, results quantitated over the standard range will also be reported with a flag indicating that the result is an estimate.

16.4.4 Quality Control Reporting

The quality control report contains the following information as applicable to the analyses:

- Supplemental information, including method reference, date and time of preparation (if applicable) and analysis, analyst
- Surrogate standard recoveries

- Method blank results
- Matrix spike and duplicate or matrix spike duplicate results

If any quality control sample result does not meet the applicable acceptance criteria, a footnote or comment shall be included with the result in order to explain the nonconformance and corrective action taken, if appropriate The quality control report may be further supplemented with initial and continuing calibration data and/or raw data upon request.

16 4 5 Final Report Review

After the LIMS report is printed, it is forwarded, with any supplemental information, including reviewed data sheets, to the Laboratory Director, who compiles and reviews the report, ensuring that all deliverables are correct. Errors and inconsistencies that are not evident in the initial review may become apparent when each result is evaluated in light of the results obtained for the other parameters: Specifically the following are observed:

- Units and reportable figures
- Interparametric relationships (e.g. TDS/specific conductance, TOC/BOD/COD, dissolved/total, anion/cation balance, where appropriate)
- Reasonableness of results given the available information about the sample
- Method references
- Any problems with the data must be corrected before the final report is approved

16.5 Records Retention

All records of raw data, audits, quality control, and laboratory procedures are maintained in various files and notebooks throughout the lab. At the end of each year they are transferred to storage and kept five years.

All records of client sample analysis are maintained in client files. These records include copies of the original signed results, a copy of the chain-of-custody, and all raw data associated with the results. These records are transferred to storage at the end of the year and are retained for five years.

16.6 Confidentiality of Deliverables

The laboratory delivers the reports to specified contact listed on the chain-of-custody accompanying the samples. Where clients require transmission of test results by telephone, facsimile or other electronic or electromagnetic means, staff will follow documented procedures that ensure that the requirements are met and that confidentiality is preserved.

17.0 Corrective Action

17 0 Initiation and Completion of Correction

If, because of an audit or QC sample analysis, a system defect is discovered, corrective action is implemented. The analyst, section supervisor, Quality Assurance Officer, or Laboratory Director may initiate the action and will participate in the corrective action. If previously reported data are affected by a situation requiring correction, the matter will be acted upon by the Quality Assurance Officer and Laboratory Director.

The steps that may comprise a closed-loop corrective action system are as follows:

- Define the problem
- Assign responsibilities for problem investigation
- Investigate and determine the cause of the problem
- Check all calculations
- Re-analyze the sample
- Verify the integrity of the spiking solution, laboratory control sample, or calibration standard
- Check instrument and operating conditions to preclude the possibility of malfunctions or operator error
- Determine the corrective action(s) necessary to eliminate the problem
- Assign and accept responsibilities for implementing the corrective action
- Establish the effectiveness of the corrective action and implement the correction
- Verify and document that the corrective action has eliminated the problem, using a nonconformance/corrective action report form. See Appendix L.

Depending on the nature of the problem, the corrective action implemented may be formal or informal. In either case, occurrence of the problem, the corrective action employed, and verification that the problem has been eliminated must be documented.

18.0 Performance Evaluations and System Audits

18 0 Internal Audits

The records, logbooks, and data files of each laboratory department are audited annually, at a minimum, by the Quality Assurance Department. The data is reviewed for completeness, accuracy, and adherence to standard operating procedures. Random project files are evaluated for compliance to procedures throughout the analytical process. There is review of all logbooks and records to ensure appropriate documentation of analyses are being recorded in the proper manner For any deficiencies generated during the internal audit, the Managing Director will have the responsibility of responding to the deficiencies within 30 days and implementing any necessary corrective actions. If the internal audit uncovers data of doubtful quality, the laboratory will take immediate corrective action and will notify, in writing any client whose work has been affected.

18.1 External Audits

TraceAnalysis is audited as required by regulatory agencies to maintain laboratory certifications and approvals. Commercial clients with laboratory audition programs typically conduct on-site audits and perform data audits on a project-specific basis. These audits are conducted by the client or a consulting firm specializing in this service and operating under contract to the client.

18 2 Performance Evaluations

TraceAnalysis participates in the USEPA semi-annual wastewater (WP series) Performance Evaluation Studies. Trace also participates in client-sponsored performance evaluations by analyzing QC samples prepared and submitted by commercial clients in conjunction with their own QA program.

19 0 Quality Assurance Reporting

19 0 Reports to Director

Through quality reports to the Laboratory Director, it is ensured that management personnel are informed of situations, which could affect the performance of the laboratory. Reports are provided by the Quality Assurance Officer to the Laboratory Director. This report addresses the quality assurance activities including details of corrective actions implemented, audit results, and QC summary information.

In addition to the QA reports, monthly meetings are used to communicate to the laboratory's management staff pertinent information related to QA/QC issues.

20.0 Training

20.0 Introduction

This section of the QA Plan describes the TraceAnalysis program for training in areas where quality is affected. Specific areas where training must be documented include:

- Analytical methods training
- Quality assurance/quality control (QA/QC) training
- Safety Training

Other types of training also occur but are not at this time required to meet the requirements of the quality assurance program, these include such subjects as computer training, continuing education, and seminars.

20.1 Analytical Methods Training

All analysts are trained and supervised in performing specific analytical procedures before working unsupervised. The laboratory section supervisors are responsible for training within their work groups. A supervisor or senior analyst typically conducts the training, using method-specific analytical SOPs as training guides.

A training record is used to document the trainee's proficiency in performing the procedure. For some methods, analyst proficiency is also demonstrated through the analysis of standard materials, with documentation retrievable from the lab notebook and raw data.

Each section supervisor will determine the frequency of retraining, based on revisions to the SOPs or the methods themselves.

20.2 QA/QC Training

The Quality Assurance Officer (QAO) conducts training of new hires in general QA/QC principles. The QAO determines the frequency of retraining, based on deficiencies determined during performance evaluation or systems audits. Additionally, the QAO may provide project-specific training before the laboratory analyzes samples for a major project or a project with specific QA/QC or analytical requirements.

A training record is used to document each trainee's attendance at a given training session.

20.3 Safety Training

The laboratory Safety Officer conducts training of new hires in the TraceAnalysis safety program and Chemical Hygiene Plan. Annually all employees are given safety training, which includes the following subjects:

- Safety and Chemical Hygiene Plan
- Fire Safety

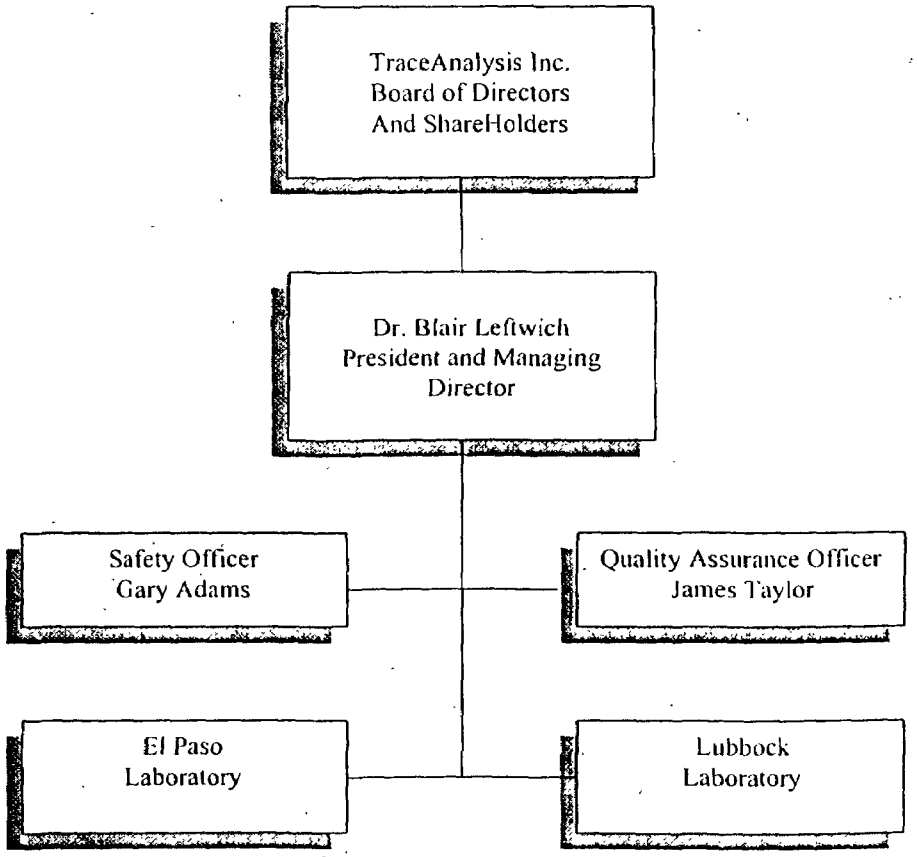
In addition, selected employees are trained annually in respirator use, waste handling/hazardous materials, and/or first aid/CPR. The Safety Officer also

conducts other safety-related training as needs arise. A training record is used to document each trainee's attendance at a given training session.

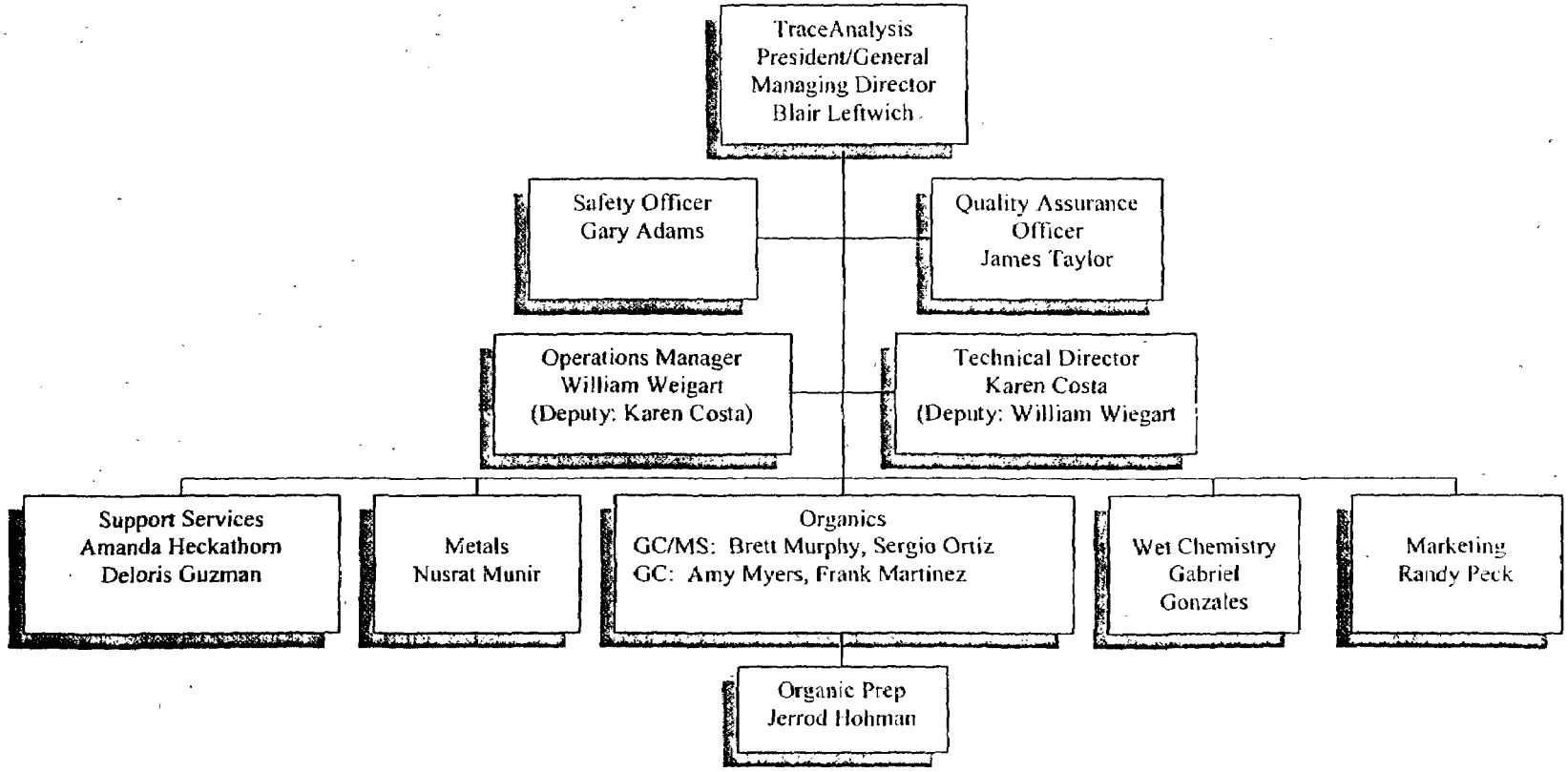
20 4 Training Records

Records are maintained documenting each employee's training in analytical methods, QA/QC principles, and safety. Training records shall specify the trainee, trainer, date, and subject of the training session. The results of proficiency testing, where applicable, should be included. Each employee has a training file in which he/she is responsible for updating.

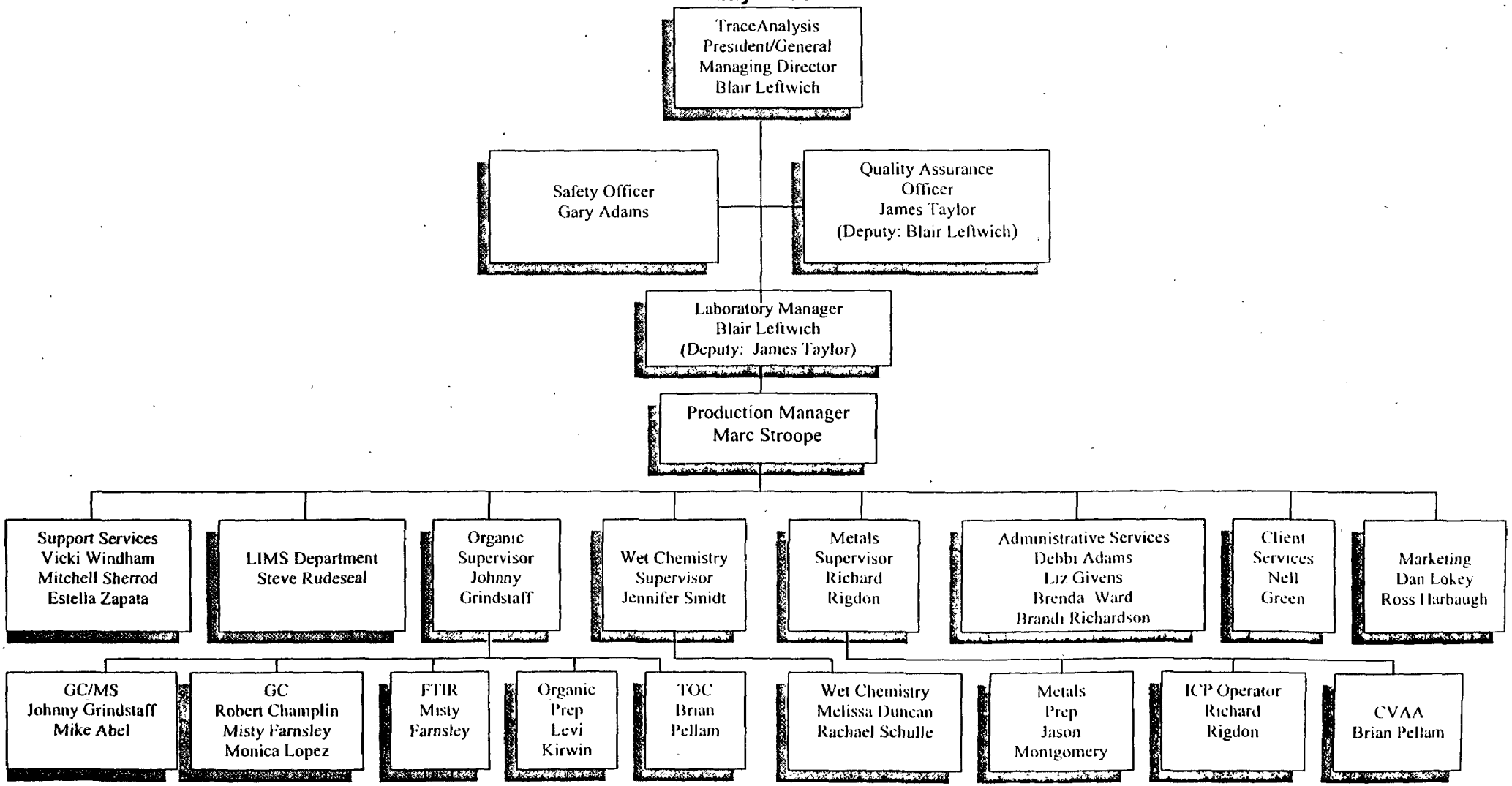
Appendix A
TraceAnalysis Inc.
Organizational Chart



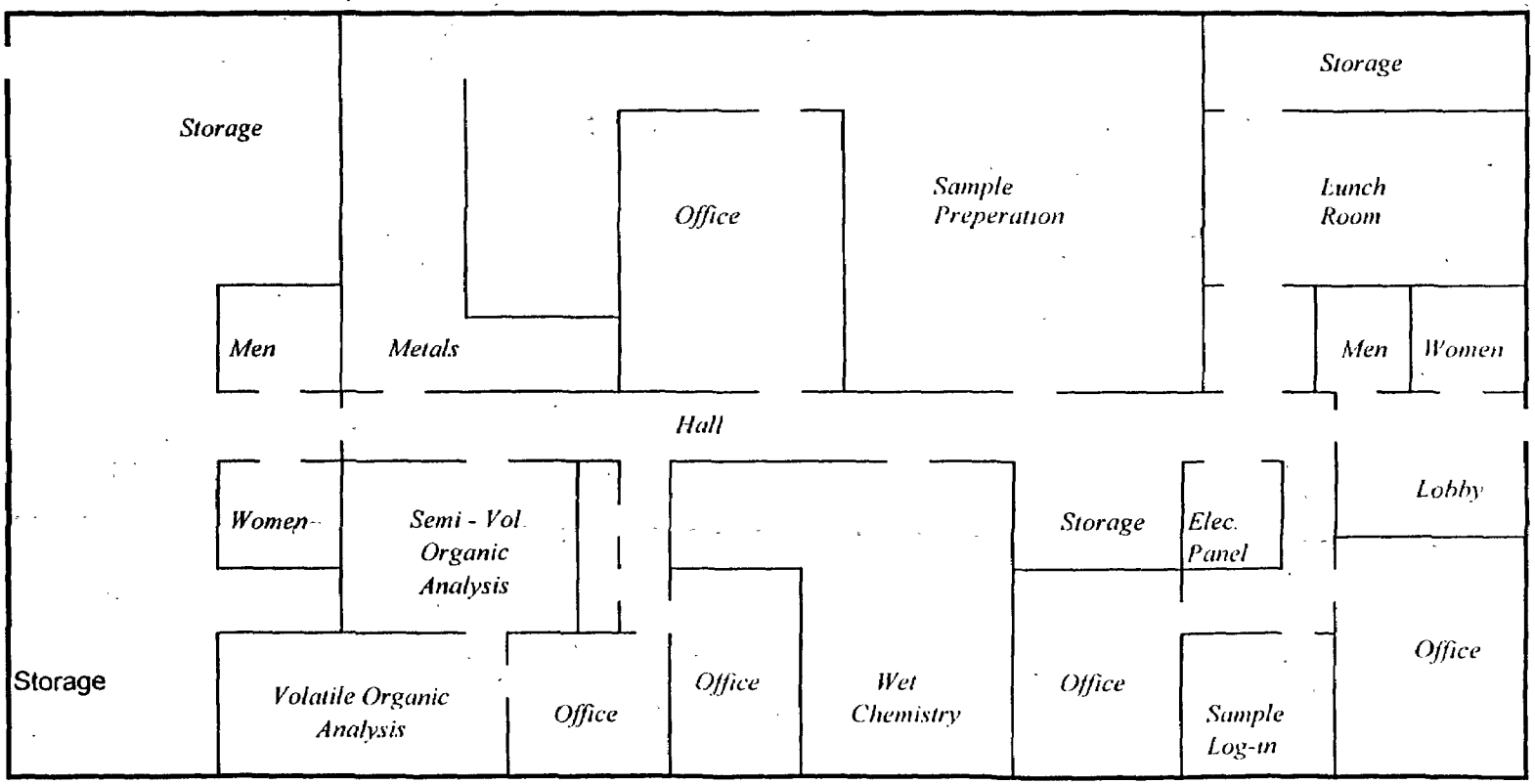
Appendix B
TraceAnalysis
El Paso Laboratory
Organizational Chart
May 1999



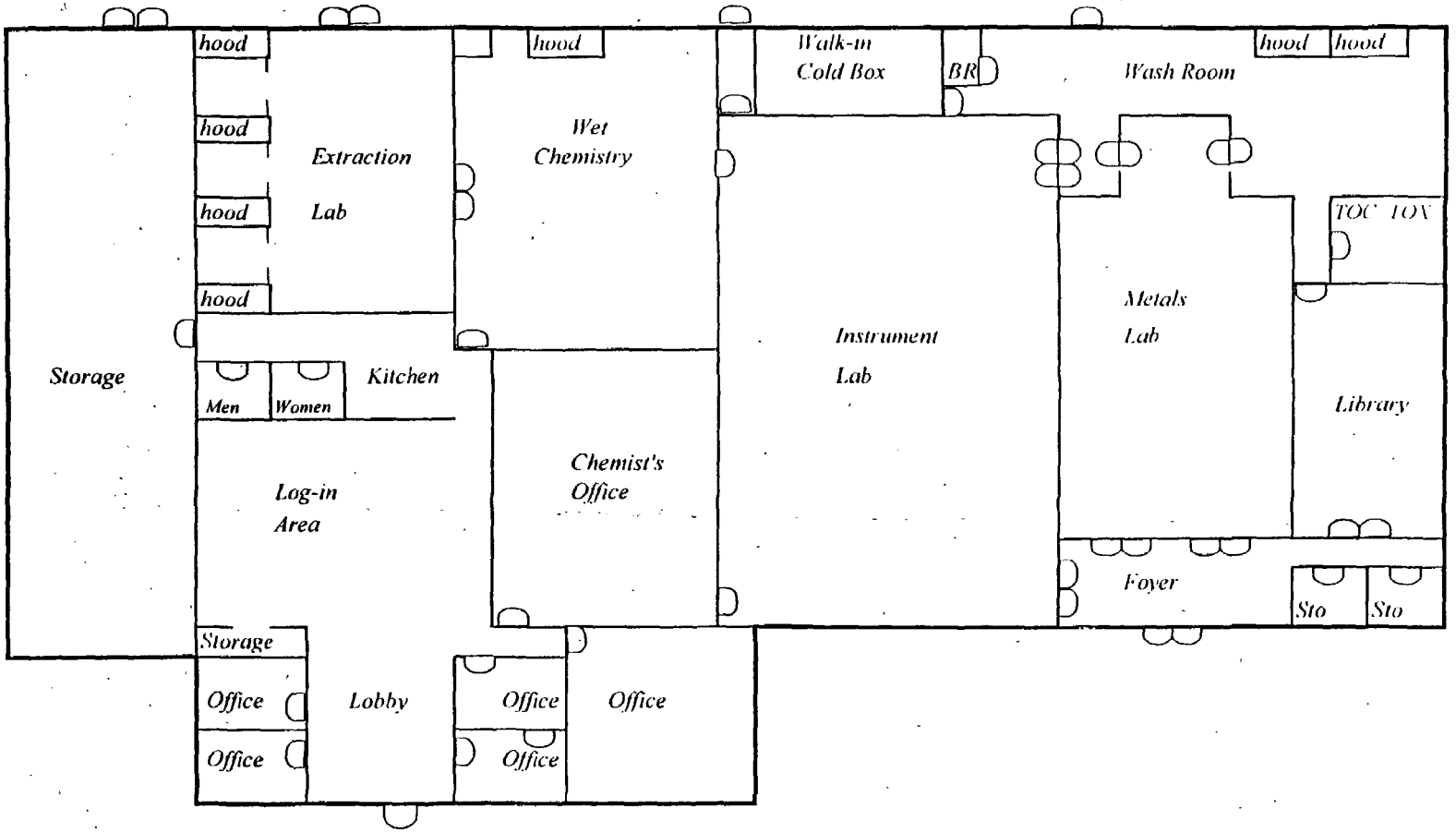
Appendix C
TraceAnalysis
Lubbock Lab
Organization Chart
May 1999



Appendix D
El Paso Laboratory
Floor Plan



Appendix E
Lubbock Laboratory
Floor Plan



Appendix F

TraceAnalysis, Inc.

Sample Bottle Order Form

Sample kits and regular shipping costs provided at no charge
Please allow 5 days for shipping
For overnight shipping, please include your carrier account number
All sample kits include chain of custody, labels, custody seals,
return airbill, permanent marker, and plastic bags for ice
All coolers received must be 4°C and will be noted on chain of custody

Date Ordered _____ Date Needed _____

Send to _____ Location _____

Attention _____

Phone # _____ Project # _____

Analysis	Number of Samples Solid	Number of Samples H_2O	Analysis	Number of Samples Solid	Number of Samples H_2O
BTEX			VOCs		
TPH			SVOCs		
PAH			Metals		
TDS			TCLP (Metals, Vol, SV)		
Lead			RCI		
Other					

Special Instructions: _____

Trip Blank: Yes ____ No ____ Equipment Blank: Yes ____ No ____

Field Blank: Yes ____ No ____

Lab Use Only

Date Sent: Ice Chest # Packed by

Courier Used:

Appendix G
TraceAnalysis Maximum Hold Times AND Preservative for Aqueous Matrices

Name	Container	Preservative	Holding Time	Sample Size mL	Source
Microbiology					
Coliform, Fecal and Total	P,G (Sterile)	Cool 4°C, 0.008% $Na_2S_2O_3$[2]	6 hours	100	A
Coliform, Fecal and Total	P (Sterile)	Cool 4°C, 0.1 mL of 10% $Na_2S_2O_3$[2]	30 hours from time of collection	100	D
Inorganics					
Acidity	P,G(B)	Cool 4°C	14 days	100	A,C
Alkalinity	P,G	Cool 4°C	14 days	200	A,C,D
Ammonia	P,G	Cool 4°C, H_2SO_4 to pH<2	28 days	500	A,C
Biochemical oxygen demand (BOD)	P,G	Cool 4°C	48 hours	1000	A,C
Boron	P, PFTE, or Quartz	HNO_3 to pH<2	6 months	100	A
Bromide	P,G	None required	28 days	100	A,C
Biochemical oxygen demand, carbonaceous (CBOD)	P,G	Cool 4°C	48 hours	1000	A,C
Chemical oxygen demand (COD)	P,G	Cool 4°C, H_2SO_4 to pH<2	28 days	100	A,C
Chloride	P,G	None required	28 days	100	A,B,C,D
Chlorine, total residual	P,G	None required	Analyze immediately	500	A,C
Color	P,G	Cool 4°C	48 hours	500	A,C,D
Cyanide, total and amenable to chlorination	P,G	Cool 4°C, NaOH to pH>12, 0.6g ascorbic acid in the prescence of residual chlorine	14 days 24 hours if sulfide is present	1000	A,B,D
Cyanide, total	P,G	Add NaOH to pH>12, refrigerate in dark. If sample is chlorinated check SM 4500-CN for pretreatment	14 days 24 hours if sulfide is present	1000	C
Cyanide, amenable to chlorination	P,G	Add 100 mg $Na_2S_2O_3$ per Liter of sample	14 days 24 hours if sulfide is present	1000	C
Fluoride	P	None required	28 days	300	A,C,D

Name	Container	Preservative	Holding Time	Sample Size mL	Source
Hardness	P,G	HNO_3 to pH<2, H_2SO_4[1] to pH<2	6 months	100	A,C
Hydrogen ion (pH)	P,G	None required	Analyze immediately	50	A,C,D
Hydrogen ion (pH)	P,G	None required	24 hours	50	B
Iodide	P,G	Cool 4°C	Analyze immediately	500	H
Kjeldahl and organic nitrogen	P,G	Cool 4°C, H_2SO_4 to pH<2	28 days	500	A,C
Chromium VI (hexavalent chromium)	P(A),G(A)	Cool 4°C	24 hours	300	A,B,C
Mercury	P(A),G(A)	HNO_3 to pH<2	28 days	100	A,B,C,D
Metals, except boron, chromium VI and mercury	P(A),G(A)	HNO_3 to pH<2 **NOTE**: For dissolved metals filter immediately then add HNO_3 to pH<2	6 months	500	A,B,C,D
Nitrate (chlorinated)	P,G	Cool 4°C	28 days	100	A,D
Nitrate	P,G	Cool 4°C	48 hours	100	A,B,C
Nitrate-nitrite	P,G	Cool 4°C, H_2SO_4 to pH<2	28 days	100	A,C
Nitrite	P,G	Cool 4°C	48 hours	100	A,C,D
Oil and grease (O&G)	G	Cool 4°C, HCl to pH<2[4]	28 days	1000	A,B,C
Organic carbon, total (TOC)	P,G	Cool 4°C, H_2SO_4 to pH<2[4], store in dark. Free chlorine must be removed before preserving.	28 days	100	A,B,C
Orthophosphate	P,G	Filter immediately, Cool 4°C	48 hours	100	A,D
Orthophosphate	G(A)	Filter immediately, Cool 4°C	48 hours	100	C
Oxygen, dissolved probe	G bottle and top	None required	Analyze immediately	300	A,C
Phenols	G only (P,G only with Standard Methods)	Cool 4°C, H_2SO_4 to pH<2	28 days	500	A,C
Phosphorous, Total	P,G	Cool 4°C, H_2SO_4 to pH<2	28 days	100	A
Residue, Total (TS)	P,G	Cool 4°C	7 days	200	A,C
Residue, Filterable (TDS)	P,G	None required	7 days	200	A,C,D
Residue, Nonfilterable (TSS)	P,G	None required	7 days	200	A,C
Residue, Settleable	P,G	None required	48 hours		A

TraceAnalysis Maximum Hold Times AND Preservative for Solid Matrices

Name	Container	Preservative	Holding Time	Sample Size	Source
Inorganics					
Inorganic analytes (except hexavalent chromium and mercury)	P(A),G(A)	Cool 4°C	6 months	4 oz.	B
Chromium, hexavalent	P(A),G(A)	Cool 4°C	One month to extraction, 4 days after extraction to analysis	4 oz.	B
Mercury	P(A),G(A)	Cool 4°C	28 days	4 oz.	B
Metals (except chromium VI and mercury)	P(A),G(A)	Cool 4°C	6 months	4 oz.	B
Organics					
Volatiles	G, PTFE lined cap Method 5035: 40mL vials with septum and stirring bar.	Cool 4°C	14 days	4 oz.	B
Chlorinated Pesticides and PCBs	G, PTFE lined cap	Cool 4°C	14 days to extract 40 days after extract to analysis	4 oz.	B
Base/Neutral and Acid Semi-Volatile Compounds	G, PTFE lined cap	Cool 4°C	14 days to extract 40 days after extract to analysis	4 oz.	B

P = Plastic
G = Glass
P(A) or G(A) = rinsed with 1 + 1 HNO_3
PTFE = teflon

B = EPA SW-846 Rev 3 December 1996

Appendix H

Chain-of-Custody

Page_____of_____

6701 Aberdeen Ave, Ste 9
Lubbock, Texas 79424
Tel (806) 794-1296
Fax (806) 794-1298
1 (800) 378-1296

TraceAnalysis, Inc.

4725 Ripley Dr Ste A
El Paso Texas 79922 1028
Tel (915) 585-3443
Fax (915) 585 4944
1 (888) 588-3443

CHAIN-OF-CUSTODY AND ANALYSIS REQUEST

LAB Order ID # _____

Company Name | Phone #

Address (Street, City, Zip) | Fax #

Contact Person

Invoice to
(If different from above)

Project #. | Project Name

Project Location | Sampler Signature

ANALYSIS REQUEST
(Circle or Specify Method No.)

LAB # (LAB USE ONLY)	FIELD CODE	# CONTAINERS	Volume/Amount	MATRIX: WATER	SOIL	AIR	SLUDGE	PRESERVATIVE METHOD: HCL	HNO3	ICE	NONE	SAMPLING: DATE	TIME	MTBE 8021B/602	BTEX 8021B/602	TPH 418.1/TX1005	PAH 8270C	Total Metals Ag As Ba Cd Cr Pb Se Hg 6010B/200.7	TCLP Metals Ag As Ba Cd Cr Pb Se Hg	TCLP Volatiles	TCLP Semi Volatiles	TCLP Pesticides	RCI	GC-MS Vol. 8260B/624	GC/MS Semi. Vol. 8270C/625	PCBs 8082/608	Pesticides 8081A/608	BOD, TSS, pH							Turn Around Time if different from standard	Hold

Relinquished by: Date. Time. | Received by Date Time

Relinquished by Date Time. | Received by Date Time

Relinquished by. Date Time | Received at Laboratory by Date Time

LAB USE ONLY

Intact Y / N

Headspace Y / N

Temp _____ °

Log-in Review _____

REMARKS:

Carrier # _____

Submittal of samples constitutes agreement to Terms and Conditions listed on reverse side of COC

Appendix I

Sample Test Methods

Parameter	Method
Alkalinity	2320B
Ammonia	350.3
BOD	5210B
Bromide	300.0
Chloride	300.0
Chloride	4500-Cl B
Chlorine,Res.	4500-Cl B
Chromium VI	3500-Cr D
COD	5220C
Conductance	2510B
Cyanide (Amenable)	4500-CN CEG
Cyanide (Total)	4500-CN CE
Cyanide (Wk. & Diss.)	4500-CN CEI
Fluoride	300.0
MBAS	5540c
Nitrate-N	300.0
Nitrite-N	300.0
Oil & Grease	5520B
Oil & Grease	413.2
pH	4500-H^+
Phenol	420.1
Phosphate-P (Ortho)	4500-P E
Dissolved Solids	2540C
Fixed & Vol. Solids	2540E
Settleable Solids	2540F
Suspended Solids	2540D
Sulfate	300.0
Sulfate	4500-SO_4
Sulfide,Tot.	4500-S^- E
Turbidity	2130B

GFAA Parameter	Method
Antimony	3113B/7041
Arsenic	3113B/7060
Beryllium	3113B/7091
Cadmium	3113B/7131
Chromium	3113B/7191
Copper	3113B/7211
Lead	3113B/7421
Selenium	3113B/7740
Silver	3113B/7761
Thallium	3113B/7841

Flame Parameters

Copper	3111B/7210
Potassium	3111B/7610
Sodium	3111B/7770
Strontium	3111D/7780

Cold Vapor Parameters

Mercury	3112B/7470/7471

Parameter	Method
Aromatic Volatile	602/8020
Organochlorine Pesticides	608/8080
Fuel HC	Mod. 8015
BTEX	Mod. 8020
Total Petroleum Hydrocarbons(IR)	418.1
Total Petroleum Hydrocarbons(Grav.)	418.1
Total Petroleum Hydrocarbons(GC)	1005

Appendix J
EQUIPMENT LIST
TRACEANALYSIS-EL PASO

GC/MS	Inservice Date	Serial Number
HP 5971 MSD	11/98	3223A424453
HP 5890 Series II GC	11/98	3118A02421
OI Analytical 4560 Sample Concentrator	02/99	A220276
OI Analytical MPM-16 Multipurging Module	11/98	6217236
HP 5971 MSD	11/98	3222A03727
HP Model 5890 Series II GC	11/98	3121A36087
HP Autosampler	11/98	3120A26712
HP 7673 Controller	11/98	0004815
Computer	11/98	
Monitor	11/98	CA877MI01160
HP Laserjet 5L	11/98	JPBJ074958
GC		
HP 5890 Series II Gas Chromatograph	1990	3108A33868
OI 4430 PID & Lamp power Supply	1990	11206-1-93
Tekmar LSC 2000 Purge and Trap Unit	1990	91141011
Tekmar Aquatek 50 Autosampler	6/98	92128016
Computer (shared)	1/99	
HP Laserjet 6L (shared)	03/99	AF22819
HP 5890 Series II Gas Chromatograph	06/98	2921A24125
OI 4430 PID & Lamp power Supply	06/98	89-315
Tekmar LSC 2000 Purge and Trap Unit	06/98	4430 R A
Tekmar ALS 2050 Autosampler	1990	91142025
Computer (shared)	1/99	
HP Laserjet 6L (shared)	03/99	AF22819
HP GC 5890 FID	03/98	2643A10392
5890 Series II	1993	3223A42439
Computer		
Laserjet Printer 1100	01/99	USBH007190
ICP		
Leeman DRE	10/98	150-00140
Autosampler	10/98	150-00071
Water Cooler	10/98	150-00142
Leeman Labs Computer	10/98	
CTX Color Monitor	10/98	
Panasonic Printer	10/98	

AA	Inservice Date	Serial Number
Perkin Elmer AA/GFAA	1995	150993
PE Graphite Furnace/Zeeman Furance Model	1995	8283
Water Cooler	1995	4204
EDL System 2	1995	
DEC-PC 433 dxLP Computer	1995	
Digital Monitor	1995	
Okidata Printer	1995	
PE 2380 AA	1990	129031
Varion Vapor Generation Accessory 76	1990	
IR		
PE FTIR 1310	1991	135805
Wet Chem		
Bausch & Lomb Spectronic 21	1990	0602372F
Orion DO meter Model # 860	1991	09100106
Orion pH Meter Model # 720A	1994	011134
Orion Conductivity Meter Model #160	1991	09100106
Hach COD Reactor Model #45600	03/98	900702785
AND FR-300 MKII		8400105
Dionex DX 120 Ion Chromatograph	02/99	99020311
AS40 Automated Sampler	02/99	99020042
Advanced Chromatography Model CMA-1	1990	825010
Autoion Controller Conductivity Detector Model COM-1	1990	824744
Dionex Analytical Pump	1990	82111E871201
Flashpoint Tester 1152800	1991	01044
Labconco Rapid Kjeldahl System	01/98	216486
MISC		
NES/AB Refrigerated recirculator Koolflow HX-150	1992	92DML 17000-01
Fisher Scientific Isotemp 500 Series Oven Model 5165	01/98	71200584
KOCH Refrigerator Model A-1	01/98	L84608
Honeywell Temp. Control		5001058
Baxter Drying Oven DX-41	1991	1990017
Precision-180 Series Water Bath		
Thermolyne Type 2200 Hot Plate		

PREP	Inservice Date	Serial Number
Thermolyde Maxi Mix II (vortexer) 37600	1998	871971249688
Zymark Turbovap II ZW 8002	1992	04023
VIRTIS Virsonic 300 - Sonicator		VO1170
TCLP Tumbler	1990	1224
Environmental Express Hot Block Digester		

Data Systems

LIMS System
Hewlett Packard Chem Station/Enviroquant

Appendix K
EQUIPMENT LIST
TRACEANALYSIS-LUBBOCK

	Inservice Date	Serial Number
GC's		
Perkin-Elmer Auto System GC (FID)(PID)	10/96	610N2081901
OI 4560 Concentrator	8/92	H415460312
OI Autosampler 4551	6/95	
Okidata Printer		77113288
Perkin-Elmer Auto System GC (FID)	8/92	610N2081902
OI 4560 Purge and Trap	8/92	H415460313
OI 4551 Autosampler	6/95	B507451758
Okidata Printer		79102546
Perkin-Elmer Auto System (ECD x 2)	8/92	610N0040401
Okidata Printer		77111241
Perkin-Elmer Auto System (ECD x 2)	8/92	610N2081903
Okidata Printer		6A221474
Perkin-Elmer Auto System (FID)	8/92	610N1082103
Thermedics Detection EZ Flash	1/99	981909
Perkin-Elmer Auto System	8/92	610N2060611
Perkin-Elmer Auto System (FID)	10/96	610N0090502
HNU SYSTEMS Photoionizer		101178
GC Computer Network:		
Turbo Chrom Computer		
Reprocess Computer		
Chemist Computer		
PE Nelson Link Box Series 600		5131110092
PE Nelson Link Box Series 600		5131110111
HP Laserjet 1100		USBH006678
HP Laserjet 1100		USBH006634
GC/MS		
Hewlett Packard 5973	02/98	US72010688
HP6890 Series GC System	02/98	US00009847
HP GC Autosampler Controller	02/98	US74703946
HP 6890 Series Injector	02/98	US74704264
HP Vectra XA Computer	02/98	US72460303
HP Laserjet 5 Printer	02/98	USKB212499
Hewlett Packard 5971A	8/92	3050A01784
HP 5890 Series II GC	8/92	3033A32538
HP 5971A Mass Selection Detective	8/92	3050A01784
HP 7673 Injector	8/92	3120A27994
MCS Computer		

HP Laserjet 5L Printer		JPCL017284
	Inservice Date	Serial Number
Hewlett Packard 5973	2/98	US72070693
HP 6890 QC System	2/98	US00009866
HP VectraXA5/166DT	2/98	KP71629828
HP Laserjet Printer	2/98	USHB487261
Hewlett Packard 5971A	8/92	3188A03479
H.P. 5890 Gas Chromatography Series II	8/92	3203A41107
O.I. DPM-16 Sampler	8/92	C420411195
O.I 4560 Concentrated	8/92	3188A03479
HP LaserJet Printer		IPCD004708
FTIR		
Perkin-Elmer 1625 Series FTIR	8/92	260F945
Computer		
Okidata Printer		
AA		
Perkin-Elmer 4100 ZL Furnace	8/92	6167
ICP		
Leeman DRE-ICP	12/97	111-00015-1
Power Supply	12/97	PS-7048
Recerculating Chiller	12/97	S-1097-801
Air Compressor	12/97	AK-6002
Auto Sampler	12/97	7036
Leeman Computer	12/97	2419
Citizen GSX-190	12/97	AU780890
PE Optima 3000 XL	12/98	069N5042501
Autosampler AS90	12/98	9026
Nes-Lab Recirculating Chiller CFT-33	12/98	198184024
Gast Air Compressor	12/98	SML 150906
Computer Pentium II	01/99	
HP Laserjet 1100	01/99	USDG015523
Cetac Ultrasonic Nebulizer 5000AT+	01/96	049704AT+G
Mercury Analyzer		
CETAC M 6000A	3/97	129601MAS
ASX500	3/97	049624ASX
Perimax 12/4 Peristalic Pump	3/97	03010425
Addonics MON-C142 Computer	3/97	MC142105101R1
Panasonic KX-P2023	3/97	6LMBVF85880

IC	Inservice Date	Serial Number
Dionex DX 50 IC:		
CD 20 Conductivity Detector	2/98	98010134
GP 40 Gradient Pump	2/98	97120585
LC 30 Chromatography Oven	2/98	98010560
AS 40 Automated Sampler	2/98	95120074
Dell Computer	2/98	
HP LaserJet 6L	2/98	JPHF014521
Misc.		
Fisher Scientific pH meter 50	08/92	C0005908
Hanna Instruments Conductivity Meter	08/92	1087300
YSI Model 50B Dissolved Oxygen Meter		92G040596
Hach DR/2010 Spectrophotomenter	11/98	981000010902
International Equipment Company 2K Centrifuge	08/92	71653831
Emerson Vacuum Pump Motor		0692A
Emerson Vacuum Pump Motor		0692B
TOX Analyzer		
Mitssubishi 10Σ:		
Mitsubishi 10Σ - R	8/92	75R02913
Mitsubishi 10Σ - C	8/92	75C02913
TOC Analyzer		
Shimadzu TOC-500	8/92	28807132
UV/VIS Spec		
Hitachi U1100	8/92	0459-001
Prep		
Zymark Turbo Vap II Sample Concentrator	9/96	TV9622N6870
CEM MDS 2000 Microwave Digestion System	8/96	U1131
Environmental Express Hot Block		980327-127TS
Tumbler A.O. Smith	8/92	327P896
Tumbler MOD# 3240-12-BRE	8/97	1709
Fugikin Pressure Filter		
Seperatory Funnel I Shaker Apparatus		
Sonic Dismembrator		
Sonic Dismembrator		
Balances		
OHAUS Precision Standard Scale	09/98	13931
OHAUS Model C-305-S Scale	08/92	50501

Denver Instument Company XE Series Balance	08/92	B044136
LIMS Computer System	Inservice Date	Serial Number
JCW Computer		
Okidata Microline 320 Turbo Printer		711B2038521
HP Laserjet 5L		
FAX		
DEX 855	03/98	7098011199

Data Systems

Sample Master LIMS System
6 Computers
TurboChrome Data System
Hewlett Packard Chem Station/Enviroquant

Appendix L

TRACEANALYSIS, INC. - Lubbock, TX Report ID # _____

NONCONFORMANCE/CORRECTIVE ACTION REPORT FORM

PART I : ORIGINATOR

DATE/TIME: _____

ANALYST: _____ LOGBOOK/PAGE: _____

DEPT./TEST: _____ PREP PAGE: _____

PREP. ANALYST. _____

DESCRIPTION OF NONCONFORMANCE

CORRECTIVE ACTION.

AS LEFT.

REPORTED BY: _____ DATE: _____

PART 2: DEPARTMENT SUPERVISOR

SUPERVISOR'S COMMENTS OR RECOMMENDATIONS

APPROVED BY: _____ DATE: _____

PART 3: QA DEPARTMENT

QA DEPARTMENT'S COMMENTS:

NC/NA CLOSED BY: _____ DATE: _____

FORWARD ORIGINAL TO NC/CA LOGBOOK
COPIES TO CLIENTS FILE AND RAW DATA

Appendix M

LIST OF ACRONYMS/ABBREVIATIONS

AA	Atomic Absorption
ACS	American Chemical Society
AES	Atomic emission spectroscopy
ASTM	American Society for Testing Materials
BFB	4-bromofluorobenzene
BNA	Base/neutral acid
BOD	Biological oxygen demand
CCC	Continuing calibration check
CCV	Continuing calibration verification
CFR	Code of Federal Regulations
CVAA	Cold vapor atomic absorption
DFTPP	Decafluorotriphenylphosphine
DQO	Data quality objectives
ECD	Electron capture detector
EOX	Extractable organic halogens
EPA	Environmental Protection Agency
FID	Flame ionization detector
FTIR	Fourier transform Infrared
GC	Gas chromatograph
GFAA	Graphite Furnace Atomic Absorption
GC/MS	Gas Chromatograph/mass spectroscopy
HDPE	High density polyethylene
ICP	Inductively coupled plasma
ICP-AES	Inductively coupled plasma/atomic emission spectroscopy
ICV	Initial calibration verification
ID	Identification
IDC	Initial demonstration of competence (samples)
IDL	Instrument detection limit
IPC	Instrument performance check
ISE	Ion-selective electrode
LCS	Laboratory control samples
LCSD	Laboratory control samples duplicate
LIMS	Laboratory information management system
MDL	Method detection limit
MS	Matrix spike
MSA	Multiple standard addition
MSD	Matrix spike duplicate
NBS	National Bureau of Standards (now NIST)
NC/CA	Non conformance/corrective action
ND	Non-detected
NIST	National Institute for Standards and Technology (formerly NBS)
NTIS	National Technical Information Service
PAH	Polynuclear aromatic hydrocarbons
PCB	Polychlorinated biphenyl
PDS	Post-digestion spikes
PE	Performance evaluation
PID	Photoionization detector
QA	Quality assurance
QAO	Quality Assurance Officer
QAPjP or QAPP	Quality assurance project plan
QC	Quality control
QCS	Quality control sample

%R	Percent recovery
RCRA	Resource Conservation and Recovery Act
RPD	Relative percent difference
RRF	Relative response factors
RRT	Relative retention time
RSD	Relative standard deviation
SOP	Standard operating procedures
SPCC	System performance check compounds
SPE	Solid phase extraction
SVO	Semivolatile organic
SVOC	Semivolatile organic compound
TAT	Turn-around time
TCL	Target compound list
TCLP	Toxicity characteristic leaching procedure
TICs	Tentatively identified compounds
TRPH	Total recoverable petroleum hydrocarbons
USEPA	United States Environmental Protection Agency
UV	Ultraviolet
VOA	Volatile organic analysis
VOC	Volatile organic compound
WP	Water Pollution (PE Sample)