APPENDIX TO THE QUALITY ASSURANCE PROJECT PLAN FOR THE REVISED REMEDIAL DESIGN AND REMEDIAL ACTION (GEOSYNTEC CONSULTANTS, AUGUST 1996)

April 1997

900293

LAW

ENGINEERING AND ENVIRONMENTAL SERVICES

LAW ENVIRONMENTAL, INC.

NATIONAL LABS DIVISION - PENSACOLA BRANCH

GENERIC QUALITY ASSURANCE PLAN

LAW ENVIRONMENTAL, INC.

NATIONAL LABS DIVISION - PENSACOLA BRANCH

GENERIC QUALITY ASSURANCE PLAN

Prepared By:

Law Environmental, Inc.
National Labs Division - Pensacola Branch
7215 Pine Forest Road
Pensacola, Florida 32526-3908

September 01,1992

1.0 TITLE PAGE

LAW ENVIRONMENTAL, INC.
GENERIC QUALITY ASSURANCE PLAN

Prepared By:

Law Environmental, Inc., National Labs Division (LENL)

9 Sept 1992

James M.G. Tucci Date
Laboratory Manager
Law Environmental, Inc.
National Labs - Pensacola Branch

9/9/92

Burnie D. Fuson Date
QA/QC Coordinator
Law Environmental, Inc.
National Labs - Pensacola Branch

QA Manual No.

September 01, 1992

2.0 TABLE OF CONTENTS

Section		Page	Revision Number	Date
1.	Title Page with Approval Signatures	1-1	No. 4	09/01/92
2.	Table of Contents	2-1	No. 5	09/16/92
3.	Statement of Policy	3-1	Original	01/01/90
4.	Branch Organization, QA/QC Organization and Responsibilities	4-1	No. 16	09/01/92
5.	QA Objectives for Measurement Data in Terms of Precision, Accuracy, Completeness, Representativeness and Comparability	5-1	No. 2	01/10/91
6.	Sampling Procedures	6-1	No. 3	09/01/92
7.	Sample Chain of Custody	7-1	No. 2	09/02/92
8.	Calibration Procedures and Frequency	8-1	No. 2	09/02/92
9.	Analytical Procedures	9-1	No. 2	09/02/92
10.	Data Reduction, Validation, and Reporting	10-1	No. 2	09/02/92
11.	Field and Laboratory Quality Control Checks	11-1	No. 2	09/03/92
12.	Performance and Systems Audits	12-1	No. 2	09/03/92
13.	Preventative Maintenance	13-1	No. 2	09/03/92
14.	Specific Procedures Used to Assess Data Precision, Accuracy, and Completeness	14-1	No. 2	09/03/92
15.	Corrective Actions	15-1	No. 3	09/03/92
16.	Quality Assurance Reports to Management	16-1	No. 1	09/03/92
17.	Resumes of Key Personnel	17-1	No. 8	09/20/92
18.	Equipment List	18-1	No. 3	09/08/92

LIST OF APPENDICES

Section		Page	Revision Number	Date
A	Maintenance of Intra-Laboratory Custody	A-1	No. 2	09/08/92
B	Sample Bottle Preparation	B-1	No. 2	09/08/92
C	LENL Standard Sampling Equipment Cleaning Procedures from "Engineering Support Branch SOP and QA Manual," USEPA, Region IV, April 1, 1986	C-1	No. 2	09/14/92
D	LENL Standard Laboratory Glassware Cleaning Procedures	D-1	No. 1	09/15/92
E	Laboratory Bench Sheets	E-1	No. 2	09/14/92

LIST OF FIGURES

4-1	Law Companies Group, Inc. Organization Chart	4-1	No. 2	02/28/92
4-2	LENL-Pensacola Organization Chart	4-2	No. 16	09/02/92
4-3	Facility Floor Plan	4-14	No. 16	09/01/92
6-1	Example of Analytical Sample Manifest Form	6-41	No. 2	05/16/90
6-2	Example of Standard Analytical Request Form	6-43	No. 2	05/16/90
6-3	Analytical Sample Container Label	6-44	No. 2	05/16/90
6-4	Sample Collection Flowchart	6-48	No. 3	09/01/92
7-1	Shipping Case and Seal Number Label	7-4	No. 2	09/16/92
7-2	Example of Chain-of-Custody Form	7-8	No. 2	09/16/92

LIST OF FIGURES (CONTINUED)

Section		Page	Revision Number	Date
7-3	Sample Receipt and Log-in Flow Chart	7-9	No. 1	05/16/90
8-1	Analytical Reagent Label	8-3	No. 2	09/02/92
11-1	Intra-Lab Chain-of-Custody Form for Inorganics	11-2	No. 2	09/03/92
11-2	Intra-Lab Chain-of-Custody Form for Organics	11-3	No. 2	09/03/92
11-3	Furnace Atomic Absorption Analysis Scheme	11-16	No. 2	09/03/92
15-1	Quality Assurance Corrective Action Request and Routing Form	15-4	No. 3	09/03/92

LIST OF TABLES

5-1	Precision and Accuracy Data	5-2	No. 2	01/10/91
6-1	Required Containers, Preservation Techniques and Holding Times	6-10	No. 3	09/01/92
6-2	Table References	6-19	No. 3	09/01/92
6-3	Specific Field Analtyical Techniques	6-29	No. 3	09/01/92
8-1	DFTPP Key Ions and Abundance Criteria	8-6	No. 2	09/02/92
8-2	BFB Key Ions and Abundance Criteria	8-7	No. 2	09/02/92
9-1	Standard Analytical Procedures for Organic Parameters	9-2	No. 2	09/02/92

LIST OF TABLES (CONTINUED)

Section		Page	Revision Number	Date
9-2	Standard Analytical Procedures for Inorganic Parameters	9-3	No. 2	09/02/92
9-3	Extraction/Digestion Methods Used for Metals and Organics	9-5	No. 2	09/02/92
11-1	Surrogate Spiking Compounds for GC Analyses	11-9	No. 2	09/03/92
11-2	Percent Spike Recovery Limits for Semi-Volatiles	11-11	No. 2	09/03/92
11-3	Percent Spike Recovery Limits for Volatiles	11-14	No. 2	09/03/92
13-1	Routine Maintenance Schedule for AA Spectrophotometer	13-3	No. 2	09/03/92
13-2	Routine Maintenance Schedule for ICP	13-4	No. 2	09/03/92
13-3	Routine Maintenance Schedule for GC	13-6	No. 2	09/03/92
13-4	Routine Maintenance Schedule for GC/MS	13-8	No. 2	09/03/92

LIST OF EXHIBITS

A-1	Intra-Lab Chain of Custody Form for Inorganics	A-5	No. 2	09/08/92
A-2	Intra-Lab Chain of Custody Form for Organics	A-6	No. 2	09/08/92

3.0 STATEMENT OF POLICY

It is the policy of Law Environmental National Laboratories to provide legally and scientifically defensible analytical data to clients. This document describes the quality assurance program utilized by Law in providing analytical chemistry laboratory services. The management and staff of Law are committed to providing and maintaining a carefully controlled analytical program which ensures the consistent generation of accurate data. The program is intended to integrate the functions of quality planning, quality assessment, quality improvement efforts and quality control to meet client's requirements.

Detailed written analytical procedures are used to ensure strict adherence to published analytical methodologies throughout the laboratory. Bench-level quality control measures with well-defined acceptance criteria are included in each analytical procedure utilized by the laboratory. Laboratory records and quality control data are monitored by management on a regular basis.

Every element of data acquisition and analysis, from sample collection to final data reporting, has associated with it degrees of error. The primary purpose of a "total quality assurance program" is the optimization of conditions whereby the introduction of error can be either precluded or substantially reduced. The operating procedures and quality control checks practiced in this laboratory and outlined in this manual are implemented to minimize the total error associated with data generation. No number can be affixed to total error; however, analytical performance is measurable, thus definable and controllable.

Law strives consistently to update analytical equipment and procedures and to expand and train our staff in order to provide the highest level of services to our clients.

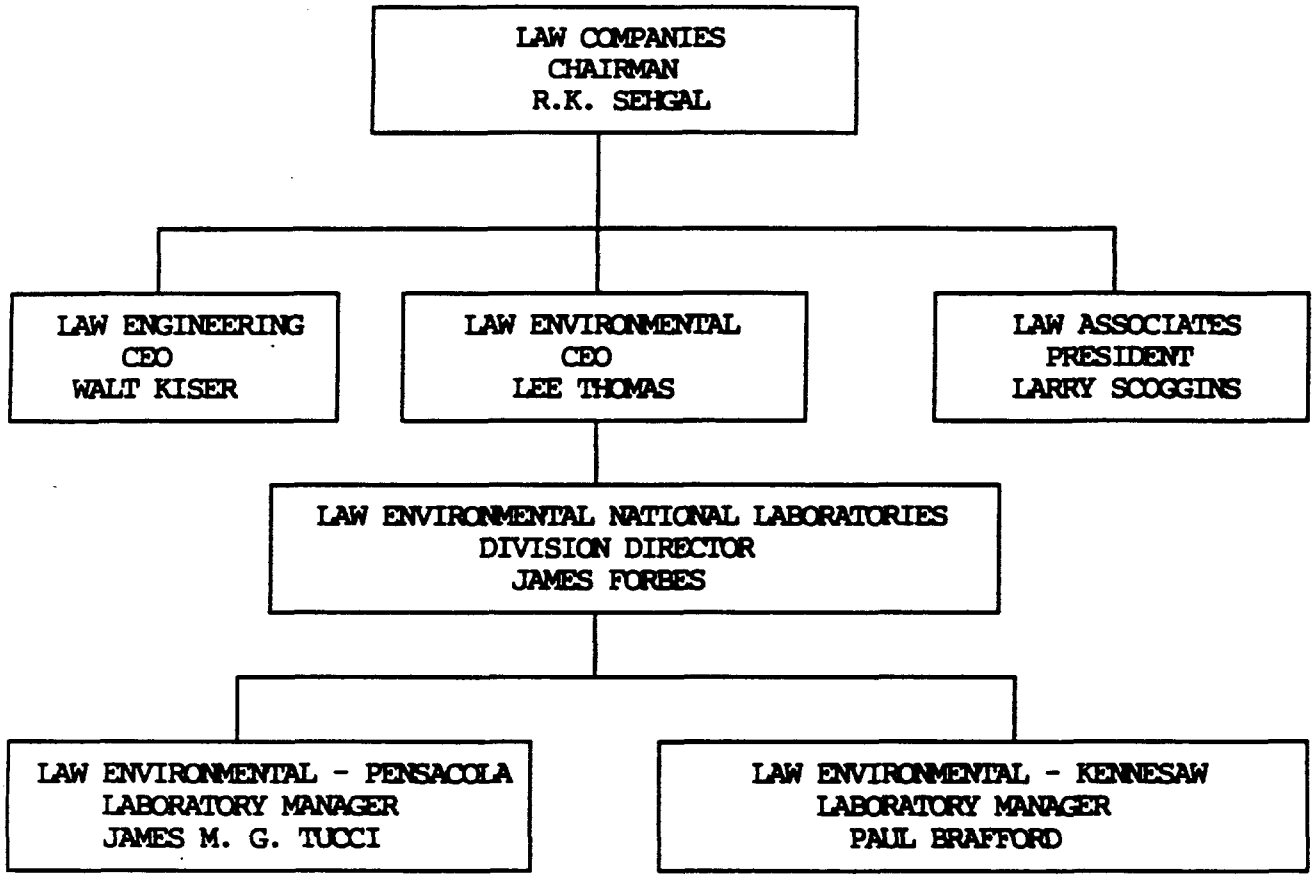
4.0 BRANCH LABORATORY ORGANIZATION, QA/QC ORGANIZATION AND RESPONSIBILITIES

Law Environmental - Pensacola Branch operates within the Law Environmental National Laboratory Division. The Division Director reports directly to the CEO, Law Environmental, Inc. (Figure 4-1). Figure 4-2 illustrates the Pensacola Branch laboratory management organization. The Laboratory Manager is directly responsible for laboratory operations and reports to the Division Director. The QA/QC Coordinator is responsible for quality assurance review and quality control monitoring and programs of laboratory data and reports directly to the Division Director.

Within Law's laboratory structure, quality control (QC) activities are practiced and enforced by analysts and laboratory management. QC activities are the checks performed on a routine basis to assure and document the quality of generated data. Quality Assurance (QA) is the responsibility of the Laboratory Manager and QA/QC Coordinator and comprises those periodic audits

and system performance checks which ensure the appropriate QC is being practiced.

Figure 4-1. LAW COMPANIES GROUP, INC. ORGANIZATION CHART



LAW ENVIRONMENTAL, INC.
NATIONAL LABORATORIES DIVISION
PENSACOLA ORGANIZATION CHART

James M. G. Tucci
Laboratory Manager

Administrative
- K. Emmons-Branch Admin
- S. Waite-Receptionist

Burnie D. Fuson
QA/QC Officer

Client Services
- K. Silvia-C.S. Rep
- C. Hooper-Data Mgt. Spec

Facilities Engineer
- B. Schwerdtfeger

Sample Rec/Mgt
- S. Taber-Supervisor
- N. Ginkel-Tech
- N. Upton-Tech
- M. Hinton-Tech

Inorganic Lab
- G. St. Pere-Supervisor
- M. Cortez-Analyst/Prep Tec
- C. High-ICP. Operator
- J. Macauley-Furn. Operator
- F. Deang-Furn. Operator
- R. Forbes-C.V. Mercury
- R. Gonzalez-Prep Tech

GC/MS Lab
- B.D. Hunt-Supervisor
- K. Greene-Chemist
- D. Harman-Chemist
- W. Drew-Chemist
- J. Jernigan-Tech

MIS Dept
- D. Abbott-Supervisor
- C. Hatcher-Proj. Mgr CERCLA/CLP
- J. Hendrix-Data Mgt Spec
- J. Gregory-Proj. Mgr-USACE
- P. Harmon-Data Mgt Spec
- A. Harber-Proj Mgr. AFCEE
- C. Lightner-Word/Data Proc I
- T. Sartain-Word/Data Proc I

GC Lab
- C.B. Causey-Supervisor
- E. Austin-Chemist
- L. Oetinger-Chemist
- T. Parker-Chemist
- G. Tacheny-Chemist
- A. Phelps-Chemist

Organic
- C. Oliver-Supervisor
- T. Willard-Tech
- M. Gillette-Tech
- S. Braatz-Tech
- B. Jordan-Tech
- M. Fant-Tech
- B. Blanchard-Tech

4.1 QUALITY ASSURANCE PLAN DESCRIPTION

Utilization of a well-tested and uniform quality assurance program is essential to insure that any analytical or environmental monitoring program or site investigation produces reliable and legally defensible results. Quality assurance encompasses all actions taken by Law Environmental, Inc. to achieve accurate and reliable results for all of its programs and projects. The purpose of this quality assurance document is to insure the scientific reliability and compatibility of the laboratory data generated by Law. Therefore, to insure that valid data are being generated by Law, as well as to also insure that the validity of this data can be demonstrated at a later date through the use of written field and laboratory records, Law will adhere to the quality assurance procedures outlined below.

4.2 PHILOSOPHY AND GENERAL OBJECTIVES

It is the philosophy of Law that all data generated by our laboratories will meet or exceed the minimum requirements for good laboratory practices established by the EPA as presented in The Handbook for Analytical Quality Control in Water and Wastewater Laboratories, the protocols established by EPA under

the Contract Laboratory Program (CLP) for organic and inorganic analyses, the test methods for evaluating solid waste (EPA SW846) and the methods for chemical analysis of water and waste (EPA 600).

Our goal is, that for all quantitative data produced, we will demonstrate the level of accuracy and precision associated with a specific sample and analyte. We are further committed to providing the corporate resources needed to make sure that the quality control program will not be compromised, even during periods of high workload.

Specifically, Law is committed to a quality control system which utilizes proven published methodologies which have been retested within our laboratory. In addition, our hiring selection policy and training program are designed to promote excellence in the performance of our analysts.

Finally, our system is based on sets of predetermined limits for acceptance and rejection of all data. To insure that the system is functioning as designed and improvements are made to it as necessary, Law is committed to quarterly audits and feedback to top management.

The specific objectives of the quality control program are as follows:

1. Estimate the level of quality of each analytical system in a timely, efficient, and cost-effective manner;

2. Provide a predetermined program for the acceptance or rejection of analytical data;

3. Provide a controlled, traceable link through the entire determination process (sample collection through reporting);

4. Provide a system which is able to assist in early recognition of deficiencies which might affect the quality of data;

5. Provide a system in which the laboratory can take and document action necessary to correct problems and insure the validity of reported laboratory data; and

6. Have in place a quality assurance audit program to insure that the plan, as established, is implemented and needed updates are made.

4.3 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The objective of data collection is to support the analytical programs of our various clients and to produce data that are scientifically sound, defensible, and, ultimately, acceptable as evidence in court.

The statistical treatments of data by Law are generally in accordance with current scientific concepts elucidated in standard references. Precision is a statistical term which describes the closeness of agreement between individual measured values of a given analyte in a given matrix at a given concentration of analyte using a specified analytical method. Precision is normally expressed in statistical terms, such as the standard deviation of the values about their mean, or as the coefficient of variation (CV), which is the standard deviation of the mean expressed as a percentage of the mean. Bias is similarly a statistical parameter which describes the deviation, with algebraic sign, of the mean value of many determinations of the analyte from its "true" value. This true value must either be known independently or determined by another independent method which is known to have no bias itself.

The precision and accuracy of environmental sample analysis are greatly dependent on the sample matrix and the level of analyte concentration, both of which determine what values of precision and accuracy (bias) are acceptable for the use intended. This dependence of precision and accuracy descriptors in analyses upon

matrix and concentration requires the chemists involved to use professional judgment as to the range of values acceptable for repeat determinations of the same sample. Horwitz, Kamps, and Boyer (1980) have shown this precision vs. concentration relationship to hold for a large number of methods, matrices, and analytes involved in regulatory programs. A list of all the individual analyses conducted by Law in all the possible matrices would be unmanageably large and of little practical value. Although all such measurements are highly dependent on the nature of the matrix, the analyte, and the methods employed, in general the following procedures apply.

All data generated within established concentration ranges for a particular analyte will be compared to developed Shewhart Control Charts, and they must meet pre-established quality control criteria for accuracy and precision. Completeness and comparability of data are insured by adherence to a standard data-set protocol and checklist of data required to be available on laboratory report sheets for each type of analysis conducted. Each parameter data book must contain all data and calculations associated with each independent determination. These include

such things as sample weight(s), dilution factor(s), applicable determinative measurements such as titration values, spectrometer readings, injection quantities, peak height or area readings from chromatograms, and standard(s) identity and concentrations, as well as all calculations related to each final value reported. Each laboratory report sheet will be checked and initialed by a second competent scientist other than the person who did the analysis to insure completeness of data and correctness of all calculations in the report. For the occasional project involving very critical samples on which serious action is contemplated, the entire set of analyses on the same sample(s) will be independently audited by a special project quality assurance officer. All work sheets, chromatograms, spectra, etc., associated with every analysis will be present in the parameter data book. These will give instrument operation parameters and details of instrument set-up, such as columns used, mobile and stationary phases and concentrations, temperatures, detectors, spectrometer type, wavelengths, etc., as applicable for the type analysis. All work sheets will bear a unique laboratory number identifying that sample, relating the laboratory data sheets to

the sample. Each sheet will be recorded with dates and times and bear the laboratory analyst's initials.

Having a representative sample of the original sample is insured by following the sampling procedures in the EPA Manual for Analytical Quality Control for Pesticides (EPA-600/1-79-008). Representatives of the analytical sample is assured by thorough mixing (shaking, blending, or stirring) of the field sample prior to each weighing of an analytical subsample from the field sample.

4.4 QA/QC RESPONSIBILITIES

Specific authorities and responsibilities of the QA/QC Coordinator include:

1. Implement QA program as stated in this manual.
2. Enforcement of safety standards and operating procedures.
3. Coordinating and auditing the technical and peer review of deliverables.
4. Issuing recommendations and orders as required for corrective action for all aspects of QA work which does not meet Law standards.

5. Identifying out-of-control situations to the Laboratory Manager and analysts.

6. Providing guidance for chemistry QA/QC program development.

7. Interacting with EPA and Client QA personnel about certification of Law laboratory and coordinating QA compliance as required.

8. Informing Law staff and management about new techniques and programs for QA and safety.

9. Coordinating development of project QA plans as required.

10. Providing historical QA reports for each method to the Branch Manager.

11. Preparing the Laboratory's QA/QC Manual.

Specific QA/QC responsibilities of the Laboratory Manager include:

1. Enforcing the QC requirements of the Chemistry Division QA/QC Plan within the laboratory.

2. Interacting with QA/QC Coordinator to resolve QA/QC problems.

3. Ensuring laboratory certification and round-robin samples are satisfactorily completed.

4. Assisting in writing of the Laboratory's QA/QC Manual.

5. Issuing of QA/QC Manual to each employee and meeting with them to assure full knowledge on the analysts part.

6. Approving any changes to the Laboratory's QA/QC Manual or standard operating procedures.

Specific QA/QC responsibilities of analysts include:

1. Following the Laboratory's QA/QC Plan and any specific QA/QC criteria and checks on a project.

2. Recording all observation and analytical data in the appropriate laboratory notebook signed by the analyst and countersigned by the QA/QC Coordinator or another analyst.

3. Documenting the analytical method demanded by the project and any deviation from standard methods in their laboratory notebook.

4. Ensuring the EPA certified proper standards, blanks, and QC samples are included in each analysis batch as specified by the project QA plan.

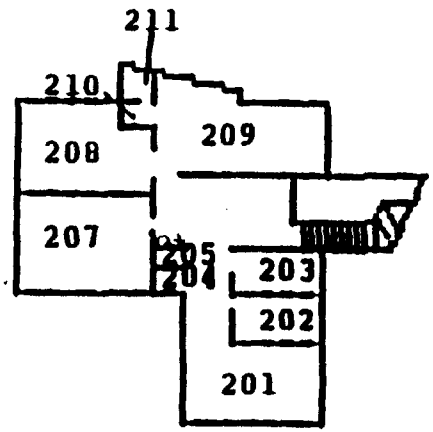
5. Analyzing the appropriate standard at the end of the analytical run sequence to assure that the samples have not adversely affected the quality of the instrument.

6. Checking calculations, data, and QC data before review by the appropriate supervisor, QA/QC Coordinator and/or the Laboratory Manager.

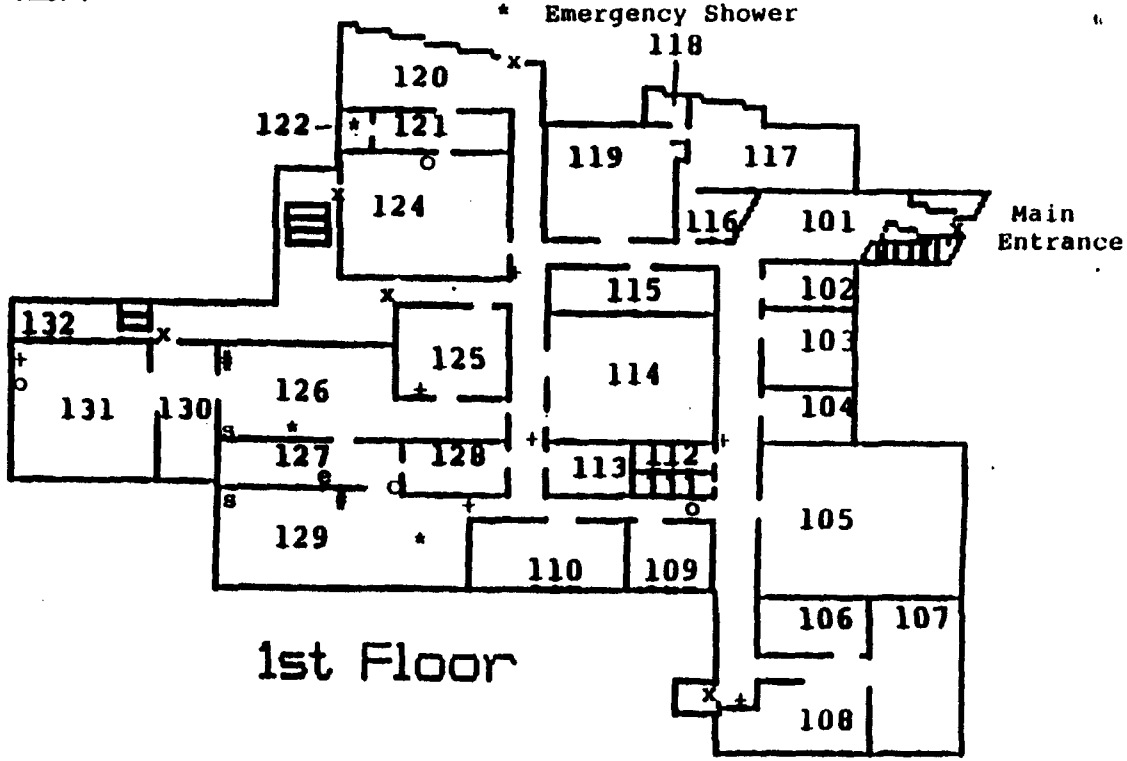
Figure 4-3.

Law Environmental, Inc.
National Laboratories
Pensacola Branch

- ‖ Fire Blanket
- o First Aid Kit
- x Emergency Exit
- + Fire Extinguisher
- s Spill Control Kit
- e Eye Wash Station
- * Emergency Shower



2nd Floor

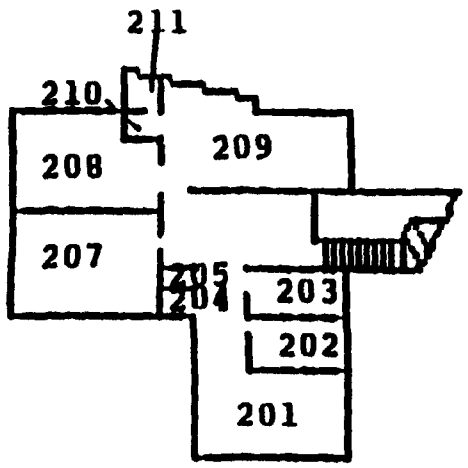


1st Floor

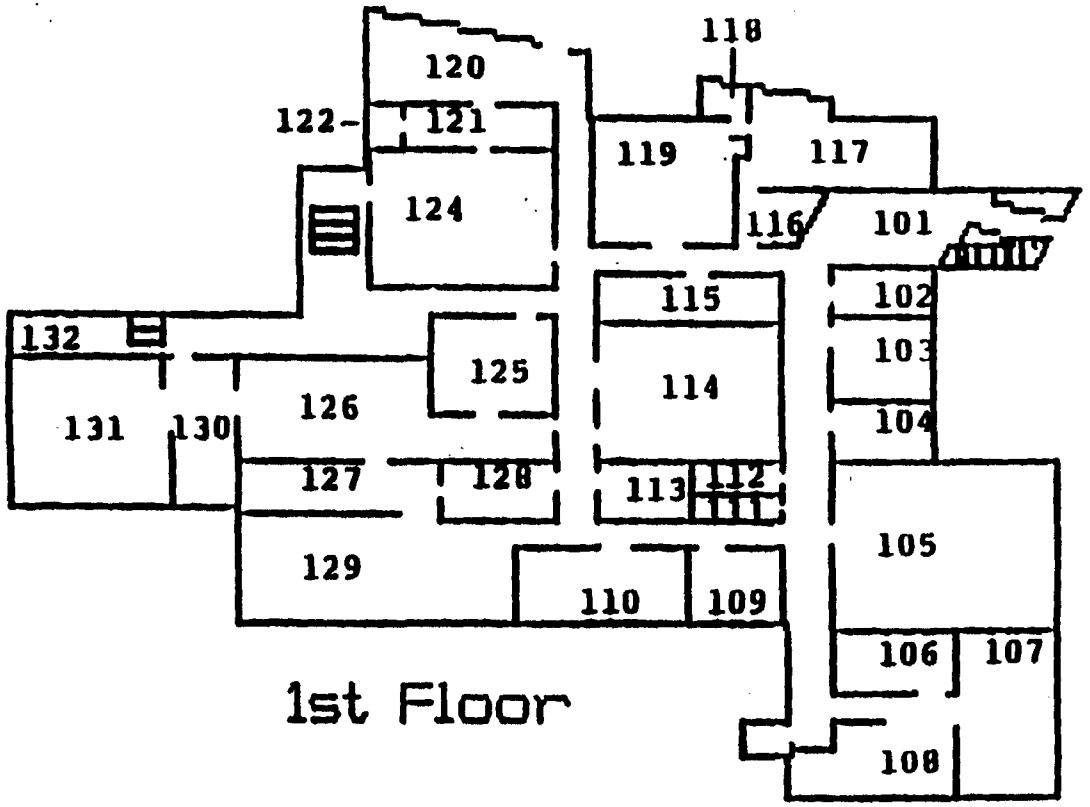
Fire Department/Ambulance - 911
Law Emergency Coordinator - James Tucci - 904/968-5009
Law Alternate Coordinator - Gary St. Pere - 904/478-4744
National Response Center - 800-424-8802
Division of Emergency Management - 904/488-1320
Department of Environmental Regulation - 904/436-8300

FIGURE 4-3. CONTINUED

Law Environmental, Inc.
National Laboratories
Pensacola Branch



2nd Floor



1st Floor

ATTACHMENT

1ST FLOOR

101	Reception Area
102	Administration
103	QA/QC Officer
104	Electrical/Phone Room
105	Advanced Spectroscopy
106	GC Supervisor
107	GC
108	GC
109	Standards Prep.
110	Glassware Washroom
111	Ladies' Room
112	Men's Room
113	Gas Cylinder Storage
114	Gas Chromatography/LC/Hydrocarbon
115	Copy Room
116	Administration
117	Laboratory Manager
118	Restroom
119	Conference Room
120	Breakroom
121	Storage Area
122	Bath/Shower Area
124	Inorganic Prep.
125	Organic Prep.
126	Organic Prep. - Solids
127	Organic Prep. - Clean-up
128	Glassware Washroom/TCLP Prep.
129	Organic Prep. - Liquid
130	Sample Storage/Walk-in Cooler
131	Sample Receipt
132	Hazardous Waste Storage

2ND FLOOR

201	MIS CERCLA
202	Administration
203	Administration
204	Ladies' Room
205	Men's Room
207	COE
208	AFCEE
209	Administration
210	Washroom
211	Restroom

5.0 QA OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, COMPLETENESS, REPRESENTATIVENESS, AND COMPARABILITY

The methods cited in Table 5-1 and 9-1 are standard U.S. Environmental Protection Agency (EPA) analytical procedures for the analysis of water and soil samples. EPA Contract Laboratory Program (CLP), EPA performance evaluation studies, and Law historical data are used as the basis for developing acceptance criteria for assuring the precision, and accuracy, and completeness of test results. The criteria used are given in Table 5-1. Calculations, definitions, and methods used to gather precisions, accuracy, and completeness data are given in Section 14.0. Appendix A is the Law standard operation procedure (SOP) for the maintenance of field and inter/intra laboratory sample chain of custody. Appendix B is the Law SOP for sample container preparation. Appendices C and D are the Law SOP for field and laboratory cleaning procedures respectively.

TABLE 5-1. PRECISION AND ACCURACY DATA

PARAMETER	METHOD	UNITS	MATRIX	DL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Aluminum	EPA 200.7, 6010	ug/L	Water	27	20	75-125	98
		mg/Kg	Soil	5.4	20	75-125	98
Aluminum	EPA 202.2	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Antimony	EPA 200.7, 6010	ug/L	Water	23	20	75-125	98
		mg/Kg	Soil	4.6	20	75-125	98
Antimony	EPA 204.2, 7041	ug/L	Water	1.68	20	75-125	98
		mg/Kg	Soil	0.336	20	75-125	98
Arsenic	EPA 200.7, 6010	ug/L	Water	24	20	75-125	98
		mg/Kg	Soil	4.8	20	75-125	98
Arsenic	EPA 206.2, 7060	ug/L	Water	1.70	20	75-125	98
		mg/Kg	Soil	0.340	20	75-125	98
Barium	EPA 200.7, 6010	ug/L	Water	5	20	75-125	98
		mg/Kg	Soil	1.0	20	75-125	98
Barium	EPA 208.2	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Beryllium	EPA 200.7, 6010	ug/L	Water	0.1	20	75-125	98
		mg/Kg	Soil	0.02	20	75-125	98
Beryllium	EPA 210.2, 7091	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Boron	EPA 200.7, 6010	ug/L	Water	NR	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Cadmium	EPA 200.7, 6010	ug/L	Water	4	20	75-125	98
		mg/Kg	Soil	0.8	20	75-125	98

PARAMETER	METHOD	UNITS	MATRIX	DL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Cadmium	EPA 213.2, 7131	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Calcium	EPA 200.7, 6010	ug/L	Water	93	20	75-125	98
		mg/Kg	Soil	18.6	20	75-125	98
Chromium	EPA 200.7, 6010	ug/L	Water	6	20	75-125	98
		mg/Kg	Soil	1.2	20	75-125	98
Chromium	EPA 218.2, 7191	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Cobalt	EPA 200.7, 6010	ug/L	Water	5	20	75-125	98
		mg/Kg	Soil	1.0	20	75-125	98
Cobalt	EPA 219.2, 7201	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Copper	EPA 200.7, 6010	ug/L	Water	1	20	75-125	98
		mg/Kg	Soil	0.2	20	75-125	98
Copper	EPA 220.2	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Iron	EPA 200.7, 6010	ug/L	Water	11	20	75-125	98
		mg/Kg	Soil	2.2	20	75-125	98
Iron	EPA 236.2	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98

PARAMETER	METHOD	UNITS	MATRIX	DL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Lead	EPA 200.7, 6010	ug/L	Water	17	20	75-125	98
		mg/Kg	Soil	3.4	20	75-125	98
Lead	EPA 239.2, 7421	ug/L	Water	1.41	20	75-125	98
		mg/Kg	Soil	0.282	20	75-125	98
Magnesium	EPA 200.7, 6010	ug/L	Water	171	20	75-125	98
		mg/Kg	Soil	34.2	20	75-125	98
Manganese	EPA 200.7, 6010	ug/L	Water	1	20	75-125	98
		mg/Kg	Soil	0.2	20	75-125	98
Manganese	EPA 243.2	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Mercury	EPA 200.7, 6010	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Mercury	EPA 245.1, 7470	ug/L	Water	0.2	20	75-125	98
(cold vapor)	EPA 7471	mg/Kg	Soil	NA	20	75-125	98
Molybdenum	EPA 200.7, 6010	ug/L	Water	NR	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Molybdenum	EPA 246.2, 7481	ug/L	Water	NR	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Nickel	EPA 200.7, 6010	ug/L	Water	9	20	75-125	98
		mg/Kg	Soil	1.8	20	75-125	98
Nickel	EPA 249.2	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Potassium	EPA 200.7, 6010	ug/L	Water	216	20	75-125	98
		mg/Kg	Soil	43.2	20	75-125	98

PARAMETER	METHOD	UNITS	MATRIX	DL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Selenium	EPA 200.7, 6010	ug/L	Water	52	20	75-125	98
		mg/Kg	Soil	10.4	20	75-125	98
Selenium	EPA 270.2, 7740	ug/L	Water	1.16	20	75-125	98
		mg/Kg	Soil	0.232	20	75-125	98
Silver	EPA 200.7, 6010	ug/L	Water	2	20	75-125	98
		mg/Kg	Soil	0.4	20	75-125	98
Silver	EPA 272.1	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Sodium	EPA 200.7, 6010	ug/L	Water	289	20	75-125	98
		mg/Kg	Soil	57.8	20	75-125	98
Sodium	EPA 273.2	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Thallium	EPA 200.7, 6010	ug/L	Water	22	20	75-125	98
		mg/Kg	Soil	4.4	20	75-125	98
Thallium	EPA 279.2, 7841	ug/L	Water	1.76	20	75-125	98
		mg/Kg	Soil	0.352	20	75-125	98
Tin	EPA 200.7, 6010	ug/L	Water	24	20	75-125	98
		mg/Kg	Soil	4.8	20	75-125	98
Tin	EPA 282.2	ug/L	Water	NR	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98
Vanadium	EPA 200.7, 6010	ug/L	Water	3	20	75-125	98
		mg/Kg	Soil	0.6	20	75-125	98
Vanadium	EPA 286.2, 7911	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98

PARAMETER	METHOD	UNITS	MATRIX	DL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Zinc	EPA 200.7, 6010	ug/L	Water	2	20	75-125	98
		mg/Kg	Soil	0.4	20	75-125	98
Zinc	EPA 289.2	ug/L	Water	NA	20	75-125	98
		mg/Kg	Soil	NA	20	75-125	98

*These values were detemined by graphite furnace.

NA = Not Available; detection limits vary on percent solid calculations.
NR = Not Run; detection limits not established at this time.

1. If sample or duplicate result is <5 x CRDL, then the difference between the sample and duplicate must be ± CRDL.

2. If the original sample result is 4x the spike solution added prior to digestion, percent recovery will be flagged as Not Applicable.

PARAMETER	METHOD	UNITS	MATRIX	MDL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Bromodichloromethane	EPA 601	ug/L	Water	0.10	20	42-172	98
Bromoform	EPA 601	ug/L	Water	0.20	21	13-159	98
Bromomethane	EPA 601	ug/L	Water	1.18	36	D-144	97
Carbon tetrachloride	EPA 601	ug/L	Water	0.12	20	43-143	98
Chlorobenzene	EPA 601	ug/L	Water	0.25	18	38-150	98
Chloroethane	EPA 601	ug/L	Water	0.52	17	46-137	97
2-Chloroethyl vinyl ether	EPA 601	ug/L	Water	0.13	35	14-186	95
Chloroform	EPA 601	ug/L	Water	0.05	19	49-133	98
Chloromethane	EPA 601	ug/L	Water	0.08	52	D-193	97
Dibromochloromethane	EPA 601	ug/L	Water	0.09	24	24-191	98
1,2-Dichlorobenzene	EPA 601	ug/L	Water	0.15	13	D-208	98
1,3-Dichlorobenzene	EPA 601	ug/L	Water	0.32	26	7-187	98
1,4-Dichlorobenzene	EPA 601	ug/L	Water	0.24	20	42-143	98
Dichlorodifluoromethane	EPA 601	ug/L	Water	1.81	20	45-136	95
1,1-Dichloroethane	EPA 601	ug/L	Water	0.07	14	47-132	98
1,2-Dichloroethane	EPA 601	ug/L	Water	0.03	15	51-147	98
1,1-Dichloroethene	EPA 601	ug/L	Water	0.13	29	28-167	98
trans-1,2-Dichloroethene	EPA 601	ug/L	Water	0.10	17	38-155	98

PARAMETER	METHOD	UNITS	MATRIX	MDL	PRECISION MAX RPD	ACCURACY % R. RANGE	% COMPLETENESS
1,2-Dichloropropene	EPA 601	ug/L	Water	0.04	23	44-156	98
cis-1,3-Dichloropropene	EPA 601	ug/L	Water	0.34	32	22-178	98
trans-1,3-Dichloropropene	EPA 601	ug/L	Water	0.20	32	22-178	98
Methylene chloride	EPA 601	ug/L	Water	0.25	21	25-162	98
1,1,2,2-Tetrachloroethene	EPA 601	ug/L	Water	0.03	23	8-184	98
Tetrachloroethene	EPA 601	ug/L	Water	0.03	18	26-162	98
1,1,1-Trichloroethane	EPA 601	ug/L	Water	0.03	20	41-138	98
1,1,2-Trichloroethane	EPA 601	ug/L	Water	0.02	19	39-136	98
Trichloroethene	EPA 601	ug/L	Water	0.12	23	35-146	98
Trichlorofluoromethane	EPA 601	ug/L	Water	NA	26	21-156	98
Vinyl chloride	EPA 601	ug/L	Water	0.18	27	28-163	97

MDL = Method Detection Limit
D = Detected; result must be greater than zero.
NA = Not Available presently. Values will be updated for water and soil when sufficient data is obtained from LENL analyses.

PARAMETER	METHOD	UNITS	MATRIX	MDL	PRECISION MAX RPD	ACCURACY %R, RANGE	% COMPLETENESS
Benzene	EPA 602	ug/L	Water	0.2	21	39-150	98
Chlorobenzene	EPA 602	ug/L	Water	0.2	17	55-135	98
1,2-Dichlorobenzene	EPA 602	ug/L	Water	0.4	22	37-154	98
1,3-Dichlorobenzene	EPA 602	ug/L	Water	0.4	19	50-141	98
1,4-Dichlorobenzene	EPA 602	ug/L	Water	0.3	20	42-143	98
Ethylbenzene	EPA 602	ug/L	Water	0.2	26	32-160	98
Toluene	EPA 602	ug/L	Water	0.2	18	46-148	98

MDL = Method Detection Limit

PARAMETER	METHOD	UNITS	MATRIX	MDL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
2,4-D	EPA 615	ug/L	Water	1.2	13	55-94	97
2,4,5-T	EPA 615	ug/L	Water	0.2	15	63-107	97
2,4,5-TP	EPA 615	ug/L	Water	0.2	14	63-108	97

MDL = Method Detection Limit

PARAMETER	METHOD	UNITS	MATRIX	MDL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Aldrin	EPA 608	ug/L	Water	0.004	20	42-122	98
alpha-BHC	EPA 608	ug/L	Water	0.003	23	37-134	98
beta-BHC	EPA 608	ug/L	Water	0.006	33	17-147	98
delta-BHC	EPA 608	ug/L	Water	0.009	25	19-140	98
gamma-BHC (Lindane)	EPA 608	ug/L	Water	0.004	22	32-127	98
Chlordane (technical)	EPA 608	ug/L	Water	0.014	18	45-119	97
4,4'-DDD	EPA 608	ug/L	Water	0.011	27	31-141	98
4,4'-DDE	EPA 608	ug/L	Water	0.004	28	30-145	98
4,4'-DDT	EPA 608	ug/L	Water	0.012	31	25-160	98
Dieldrin	EPA 608	ug/L	Water	0.002	16	36-146	98
Endosulfan I	EPA 608	ug/L	Water	0.014	18	45-153	97
Endosulfan II	EPA 608	ug/L	Water	0.004	47	0-202	97
Endosulfan sulfate	EPA 608	ug/L	Water	0.066	24	26-144	95
Endrin	EPA 608	ug/L	Water	0.006	24	30-147	98
Endrin aldehyde	EPA 608	ug/L	Water	0.023	25	30-150	95
Heptachlor	EPA 608	ug/L	Water	0.003	16	34-111	98
Heptachlor epoxide	EPA 608	ug/L	Water	0.083	25	37-142	98
Toxaphene	EPA 608	ug/L	Water	0.24	20	41-126	95

PARAMETER	METHOD	UNITS	MATRIX	MDL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
PCB-1016	EPA 608	ug/L	Water	0.065	15	50-114	95
PCB-1221	EPA 608	ug/L	Water	0.065	35	15-178	95
PCB-1232	EPA 608	ug/L	Water	0.065	31	10-215	95
PCB-1242	EPA 608	ug/L	Water	0.065	21	39-150	95
PCB-1248	EPA 608	ug/L	Water	0.065	25	38-158	95
PCB-1254	EPA 608	ug/L	Water	0.08	17	29-131	95
PCB-1260	EPA 608	ug/L	Water	0.08	39	8-127	95

MDL = Method Detection Limit
D = Detected; result must be greater than zero
NA = Not Available presently. Values will be updated for water and soil when sufficient data is obtained from LENL analyses.

PARAMETER	METHOD	UNITS	MATRIX	MDL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Benzene	EPA 624	ug/L	Water	2	25	37-151	98
Bromodichloromethane	EPA 624	ug/L	Water	2	20	35-155	98
Bromoform	EPA 624	ug/L	Water	2	17	45-169	98
Bromomethane	EPA 624	ug/L	Water	5	58	D-242	97
Carbon tetrachloride	EPA 624	ug/L	Water	2	11	70-140	98
Chlorobenzene	EPA 624	ug/L	Water	2	26	37-160	98
Chloroethane	EPA 624	ug/L	Water	6	29	14-230	97
2-Chloroethyl vinyl ether	EPA 624	ug/L	Water	10	84	D-305	95
Chloroform	EPA 624	ug/L	Water	1	18	51-138	98
Chloromethane	EPA 624	ug/L	Water	10	58	D-273	97
Dibromochloromethane	EPA 624	ug/L	Water	2	17	53-149	98
1,2-Dichlorobenzene	EPA 624	ug/L	Water	5	30	18-190	98
1,3-Dichlorobenzene	EPA 624	ug/L	Water	5	18	59-156	98
1,4-Dichlorobenzene	EPA 624	ug/L	Water	5	30	18-190	98
1,1-Dichloroethane	EPA 624	ug/L	Water	2	16	59-155	98
1,2-Dichloroethane	EPA 624	ug/L	Water	2	21	49-155	98
1,1-Dichloroethene	EPA 624	ug/L	Water	5	43	D-234	97

PARAMETER	METHOD	UNITS	MATRIX	MDL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
trans-1,2-Dichloroethene	EPA 624	ug/L	Water	4	19	54-156	98
1,2-Dichloropropane	EPA 624	ug/L	Water	2	45	D-210	98
cis-1,3-Dichloropropene	EPA 624	ug/L	Water	1	52	D-227	98
trans-1,3-Dichloropropene	EPA 624	ug/L	Water	2	34	17-183	98
Ethyl benzene	EPA 624	ug/L	Water	2	26	37-162	98
Methylene chloride	EPA 624	ug/L	Water	5	32	D-221	98
1,1,2,2-Tetrachloroethane	EPA 624	ug/L	Water	3	20	46-157	98
Tetrachloroethene	EPA 624	ug/L	Water	3	16	64-148	98
Toluene	EPA 624	ug/L	Water	2	22	47-150	98
1,1,1-Trichloroethane	EPA 624	ug/L	Water	3	21	52-162	98
1,1,2-Trichloroethane	EPA 624	ug/L	Water	2	18	52-150	98
Trichloroethene	EPA 624	ug/L	Water	3	12	71-157	98
Trichlorofluoromethane	EPA 624	ug/L	Water	5	34	17-181	98
Vinyl chloride	EPA 624	ug/L	Water	9	65	D-251	97

MDL = Method Detection Limit
D = Detected; result must be greater than zero

PARAMETER	METHOD	UNITS	MATRIX	MDL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Acenaphthene	EPA 625	ug/L	Water	1	21	47-145	98
Acenaphthylene	EPA 625	ug/L	Water	1	26	33-145	98
Aldrin	EPA 625	ug/L	Water	1	43	D-166	98
Anthracene	EPA 625	ug/L	Water	1	27	27-133	98
Benzidine	EPA 625	ug/L	Water	25	NA	NA	95
Benzo(a)anthracene	EPA 625	ug/L	Water	1	26	33-143	98
Benzo(b)fluoranthene	EPA 625	ug/L	Water	2	29	24-159	98
Benzo(k)fluoranthene	EPA 625	ug/L	Water	2	35	11-162	98
Benzo(ghi)perylene	EPA 625	ug/L	Water	2	51	D-219	98
Benzo(a)pyrene	EPA 625	ug/L	Water	2	32	17-163	98
Benzyl butyl phthalate	EPA 625	ug/L	Water	1	53	D-152	98
alpha-BHC	EPA 625	ug/L	Water	2	50	D-250	95
beta-BHC	EPA 625	ug/L	Water	2	30	24-149	98
delta-BHC	EPA 625	ug/L	Water	2	93	D-110	98
gamma-BHC (Lindane)	EPA 625	ug/L	Water	2	50	D-250	95
Bis(2-chloroethoxy)methane	EPA 625	ug/L	Water	2	26	33-184	98
Bis(2-chloroethyl)ether	EPA 625	ug/L	Water	2	35	12-158	98
Bis(2-chloroisopropyl)ether	EPA 625	ug/L	Water	1	25	36-166	98

PARAMETER	METHOD	UNITS	MATRIX	MDL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Bis(2-ethylhexyl)phthalate	EPA 625	ug/L	Water	1	36	8-158	98
4-Bromophenyl phenyl ether	EPA 625	ug/L	Water	2	16	53-127	98
Chlordane	EPA 625	ug/L	Water	5	50	D-500	97
4-Chloro-3-methylphenol	EPA 625	ug/L	Water	3	29	22-147	98
2-Chloronaphthalene	EPA 625	ug/L	Water	2	13	60-118	98
2-Chlorophenol	EPA 625	ug/L	Water	2	28	23-134	98
4-Chlorophenyl phenyl ether	EPA 625	ug/L	Water	2	30	25-158	98
Chrysene	EPA 625	ug/L	Water	1	33	17-168	98
4,4'-DDD	EPA 625	ug/L	Water	2	66	D-145	95
4,4'-DDE	EPA 625	ug/L	Water	1	39	4-136	98
4,4'-DDT	EPA 625	ug/L	Water	4	65	D-203	95
Dibenzo(a,h)anthracene	EPA 625	ug/L	Water	2	59	D-227	97
Di-n-butyl phthalate	EPA 625	ug/L	Water	1	39	1-118	98
1,2-Dichlorobenzene	EPA 625	ug/L	Water	1	24	32-129	98
1,3-Dichlorobenzene	EPA 625	ug/L	Water	2	41	D-172	98
1,4-Dichlorobenzene	EPA 625	ug/L	Water	2	29	20-124	98
3,3'-Dichlorobenzidine	EPA 625	ug/L	Water	9	47	D-262	97
2,4-Dichlorophenol	EPA 625	ug/L	Water	2	21	39-135	98

PARAMETER	METHOD	UNITS	MATRIX	MDL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Dieldrin	EPA 625	ug/L	Water	2	26	29-136	98
Diethyl phthalate	EPA 625	ug/L	Water	1	52	D-114	98
2,4-Dimethylphenol	EPA 625	ug/L	Water	4	22	32-119	98
Dimethyl phthalate	EPA 625	ug/L	Water	1	105	D-112	98
2,4-Dinitrophenol	EPA 625	ug/L	Water	15	42	D-191	95
2,4-Dinitrotoluene	EPA 625	ug/L	Water	2	21	39-139	98
2,6-Dinitrotoluene	EPA 625	ug/L	Water	2	19	50-158	98
Di-n-octyl phthalate	EPA 625	ug/L	Water	2	37	4-146	98
Endosulfan I	EPA 625	ug/L	Water	3	NA	NA	95
Endosulfan II	EPA 625	ug/L	Water	3	NA	NA	95
Endosulfan sulfate	EPA 625	ug/L	Water	3	63	D-107	97
Endrin	EPA 625	ug/L	Water	3	50	D-250	95
Endrin aldehyde	EPA 625	ug/L	Water	10	73	D-209	95
Fluoranthene	EPA 625	ug/L	Water	1	28	26-137	98
Fluorene	EPA 625	ug/L	Water	2	13	59-121	98
Heptachlor	EPA 625	ug/L	Water	4	50	D-192	97
Heptachlor epoxide	EPA 625	ug/L	Water	2	28	26-155	98
Hexachlorobenzene	EPA 625	ug/L	Water	2	43	D-152	98

PARAMETER	METHOD	UNITS	MATRIX	MDL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Hexachlorobutadiene	EPA 625	ug/L	Water	2	26	24-116	98
Hexachlorocyclopentadiene	EPA 625	ug/L	Water	2	100	0-500	95
Hexachloroethane	EPA 625	ug/L	Water	2	17	40-113	98
Indeno(1,2,3-cd)pyrene	EPA 625	ug/L	Water	2	50	0-171	97
Isophorone	EPA 625	ug/L	Water	2	33	21-196	98
2-Methyl-4,6-dinitrophenol	EPA 625	ug/L	Water	9	26	0-181	95
Naphthalene	EPA 625	ug/L	Water	1	30	21-133	98
Nitrobenzene	EPA 625	ug/L	Water	2	27	35-180	98
2-Nitrophenol	EPA 625	ug/L	Water	4	27	29-182	98
4-Nitrophenol	EPA 625	ug/L	Water	4	44	0-132	95
N-Nitrosodimethylamine	EPA 625	ug/L	Water	10	100	0-500	95
N-Nitrosodiphenylamine	EPA 625	ug/L	Water	1	50	0-250	98
N-Nitrosodi-n-propylamine	EPA 625	ug/L	Water	2	44	0-230	98
PCB-1016	EPA 625	ug/L	Water	30	50	0-500	97
PCB-1221	EPA 625	ug/L	Water	30	50	0-500	97
PCB-1232	EPA 625	ug/L	Water	30	50	0-500	97
PCB-1242	EPA 625	ug/L	Water	30	50	0-500	97
PCB-1248	EPA 625	ug/L	Water	30	50	0-500	97

PARAMETER	METHOD	UNITS	MATRIX	MDL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
PCB-1254	EPA 625	ug/L	Water	50	50	D-500	95
PCB-1260	EPA 625	ug/L	Water	50	43	D-164	95
Pentachlorophenol	EPA 625	ug/L	Water	6	30	14-176	98
Phenanthrene	EPA 625	ug/L	Water	1	15	54-120	98
Phenol	EPA 625	ug/L	Water	2	35	5-112	98
Pyrene	EPA 625	ug/L	Water	1	15	52-115	98
Toxaphene	EPA 625	ug/L	Water	200	50	D-500	95
1,2,4-Trichlorobenzene	EPA 625	ug/L	Water	2	21	44-142	98
2,4,6-Trichlorophenol	EPA 625	ug/L	Water	3	22	37-144	98

MDL = Method Detection Limit
D = Detected; result must be greater than zero
NA = Not Available presently. Values will be updated for water and soil when sufficient data is obtained from LENL analyses.

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Bromodichloromethane	EPA 8010	ug/L	Water	0.5	20	42-172	98
		ug/Kg	Soil	1.0	20	42-172	96
Bromoform	EPA 8010	ug/L	Water	1.0	21	13-159	98
		ug/Kg	Soil	2.0	21	13-159	96
Bromomethane	EPA 8010	ug/L	Water	5.9	36	D-144	97
		ug/Kg	Soil	11.8	36	D-144	95
Carbon tetrachloride	EPA 8010	ug/L	Water	1.3	20	43-143	98
		ug/Kg	Soil	1.2	20	43-143	96
Chlorobenzene	EPA 8010	ug/L	Water	1.3	18	38-150	98
		ug/Kg	Soil	2.5	18	38-150	96
Chloroethane	EPA 8010	ug/L	Water	2.6	17	46-137	97
		ug/Kg	Soil	5.2	17	46-137	95
Chloroform	EPA 8010	ug/L	Water	0.3	19	49-133	98
		ug/Kg	Soil	0.5	19	49-133	96
2-Chloroethyl vinyl ether	EPA 8010	ug/L	Water	0.7	35	14-186	98
		ug/Kg	Soil	1.3	35	14-186	96
Chloromethane	EPA 8010	ug/L	Water	0.4	52	D-193	98
		ug/Kg	Soil	0.8	52	D-193	96
Dibromochloromethane	EPA 8010	ug/L	Water	0.5	24	24-191	98
		ug/Kg	Soil	0.9	24	24-191	96
Dibromomethane	EPA 8010	ug/L	Water	5.5	50	D-250	95
		ug/Kg	Soil	11.0	50	D-250	95
1,2-Dichlorobenzene	EPA 8010	ug/L	Water	0.8	13	D-208	98
		ug/Kg	Soil	1.5	13	D-208	96

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R, RANGE	% COMPLETENESS
1,3-Dichlorobenzene	EPA 8010	ug/L	Water	1.6	26	7-187	98
		ug/Kg	Soil	3.2	26	7-187	96
1,4-Dichlorobenzene	EPA 8010	ug/L	Water	1.2	20	42-143	98
		ug/Kg	Soil	2.4	20	42-143	96
Dichlorodifluoromethane	EPA 8010	ug/L	Water	9.1	50	0-500	95
		ug/Kg	Soil	18.1	50	0-500	95
1,1-Dichloroethane	EPA 8010	ug/L	Water	0.4	14	47-132	98
		ug/Kg	Soil	0.7	14	47-132	96
1,2-Dichloroethane	EPA 8010	ug/L	Water	0.2	15	51-147	98
		ug/Kg	Soil	0.3	15	51-147	96
1,1-Dichloroethylene	EPA 8010	ug/L	Water	0.7	29	28-167	98
		ug/Kg	Soil	1.3	29	28-167	96
trans-1,2-Dichloroethylene	EPA 8010	ug/L	Water	0.5	17	38-155	98
		ug/Kg	Soil	1.0	17	38-155	96
Dichloromethane	EPA 8010	ug/L	Water	1.3	21	25-162	98
		ug/Kg	Soil	2.5	21	25-162	96
1,2-Dichloropropane	EPA 8010	ug/L	Water	0.2	23	44-156	98
		ug/Kg	Soil	0.4	23	44-156	96
cis-1,3-Dichloropropylene	EPA 8010	ug/L	Water	1.7	32	22-178	98
		ug/Kg	Soil	3.4	32	22-178	96
trans-1,3-Dichloropropylene	EPA 8010	ug/L	Water	1.0	32	22-178	98
		ug/Kg	Soil	2.0	32	22-178	96
1,1,2,2-Tetrachloroethane	EPA 8010	ug/L	Water	0.2	23	8-184	98
		ug/Kg	Soil	0.3	23	8-184	96

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
1,1,1,2-Tetrachloroethane	EPA 8010	ug/L	Water	0.3	50	D-250	98
		ug/Kg	Soil	0.5	50	D-250	96
Tetrachloroethylene	EPA 8010	ug/L	Water	0.2	18	26-162	98
		ug/Kg	Soil	0.3	18	26-162	96
1,1,1-Trichloroethane	EPA 8010	ug/L	Water	0.2	20	41-138	98
		ug/Kg	Soil	0.3	20	41-138	96
1,1,2-Trichloroethane	EPA 8010	ug/L	Water	0.1	19	39-136	98
		ug/Kg	Soil	0.2	19	39-136	96
Trichloroethylene	EPA 8010	ug/L	Water	0.6	23	35-146	98
		ug/Kg	Soil	1.2	23	35-146	96
Trichlorofluoromethane	EPA 8010	ug/L	Water	0.5	26	21-156	98
		ug/Kg	Soil	1.0	26	21-156	96
Trichloropropane	EPA 8010	ug/L	Water	2.5	50	D-250	95
		ug/Kg	Soil	5.0	50	D-250	95
Vinyl chloride	EPA 8010	ug/L	Water	0.9	27	28-163	97
		ug/Kg	Soil	1.8	27	28-163	95

NA = Not Available presently. Values will be updated for water and soil when sufficient data is obtained from LENL analyses.

D = Detected; result must be greater than zero

Determination of Practical Quantitation Limits (PQL) for various matrices:[a]

Matrix	Factor
Water miscible liquid waste	50
High-level soil & sludge	50-500
Non-aqueous organic liquid	5000

PQL = (PQL for water) x (Factor)

(a) Sample PQLs are highly matrix dependent. The PQLs listed herein are provided for guidance and may not be achievable.

For non-aqueous samples, the factor is on a wet-weight basis.

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Benzene	EPA 8020	ug/L	Water	1.0	21	39-150	98
		ug/Kg	Soil	2.0	21	39-150	96
Chlorobenzene	EPA 8020	ug/L	Water	1.0	17	55-135	98
		ug/Kg	Soil	2.0	17	55-135	96
1,4-Dichlorobenzene	EPA 8020	ug/L	Water	1.5	20	42-143	98
		ug/Kg	Soil	3.0	20	42-143	96
1,3-Dichlorobenzene	EPA 8020	ug/L	Water	2.0	19	50-141	98
		ug/Kg	Soil	4.0	19	50-141	96
1,2-Dichlorobenzene	EPA 8020	ug/L	Water	2.0	22	37-154	98
		ug/Kg	Soil	4.0	22	37-154	96
Ethyl Benzene	EPA 8020	ug/L	Water	1.0	26	32-160	98
		ug/Kg	Soil	2.0	26	32-160	96
Toluene	EPA 8020	ug/L	Water	1.0	18	46-148	98
		ug/Kg	Soil	2.0	18	46-148	96
Xylenes	EPA 8020	ug/L	Water	1.0	20	40-150	98
		ug/Kg	Soil	2.0	20	40-150	96

NA = Not Available presently. Values will be updated for water and soil when sufficient data is obtained from LENL analyses.

Determination of Practical Quantitation Limits (PQL) for various matrices:[a]

Matrix	Factor
Water miscible liquid waste	50
High-level soil and sludge	50-500
Non-aqeous organic liquid	5000

PQL = (PQL for water) x (Factor)

(a) Sample PQLs are highly matrix dependent. The PQLs listed herein are provided for guidance and may not always be achievable.

For non-aqueous samples, the factor is on a wet-weight basis.

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Aldrin	EPA 8080	ug/L	Water	0.04	20	42-122	98
		ug/Kg	Soil	1.33	20	42-122	96
alpha-BHC	EPA 8080	ug/L	Water	0.03	23	37-134	98
		ug/Kg	Soil	1.00	23	37-134	96
beta-BHC	EPA 8080	ug/L	Water	0.06	33	17-147	98
		ug/Kg	Soil	2.00	33	17-147	96
delta-BHC	EPA 8080	ug/L	Water	0.09	25	19-140	98
		ug/Kg	Soil	3.00	25	19-140	96
gamma-BHC (Lindane)	EPA 8080	ug/L	Water	0.04	22	32-127	98
		ug/Kg	Soil	1.33	22	32-127	96
Chlordane (technical)	EPA 8080	ug/L	Water	0.14	18	45-119	97
		ug/Kg	Soil	4.67	18	45-119	95
4,4'-DDD	EPA 8080	ug/L	Water	0.11	27	31-141	98
		ug/Kg	Soil	3,67	27	31-141	96
4,4'-DDE	EPA 8080	ug/L	Water	0.04	28	30-145	98
		ug/Kg	Soil	1.33	28	30-145	96
4,4'-DDT	EPA 8080	ug/L	Water	0.12	31	25-160	98
		ug/Kg	Soil	4.00	31	25-160	96
Dieldrin	EPA 8080	ug/L	Water	0.02	16	36-146	98
		ug/Kg	Soil	0.67	16	36-146	96
Endosulfan I	EPA 8080	ug/L	Water	0.14	18	45-153	97
		ug/Kg	Soil	4.67	18	45-153	95
Endosulfan II	EPA 8080	ug/L	Water	0.04	47	0-202	97
		ug/Kg	Soil	1.33	47	0-202	95

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Endosulfan sulfate	EPA 8080	ug/L	Water	0.66	24	26-144	95
		ug/Kg	Soil	22.00	24	26-144	95
Endrin	EPA 8080	ug/L	Water	0.06	24	30-147	98
		ug/Kg	Soil	2.00	24	30-147	96
Endrin aldehyde	EPA 8080	ug/L	Water	0.23	50	D-250	98
		ug/Kg	Soil	7.67	50	D-250	96
Heptachlor	EPA 8080	ug/L	Water	0.03	16	34-111	98
		ug/Kg	Soil	1.00	16	34-111	96
Heptachlor epoxide	EPA 8080	ug/L	Water	0.83	25	37-142	98
		ug/Kg	Soil	27.67	25	37-142	96
Methoxychlor	EPA 8080	ug/L	Water	1.76	25	25-150	98
		ug/Kg	Soil	58.67	25	25-150	96
Toxaphene	EPA 8080	ug/L	Water	2.40	20	41-126	95
		ug/Kg	Soil	80.00	20	41-126	95
PCB-1016	EPA 8080	ug/L	Water	0.65	15	50-114	95
		ug/Kg	Soil	21.67	15	50-114	95
PCB-1221	EPA 8080	ug/L	Water	0.65	35	15-178	95
		ug/Kg	Soil	21.67	35	15-178	95
PCB-1232	EPA 8080	ug/L	Water	NA	31	10-215	95
		ug/Kg	Soil	NA	31	10-215	95
PCB-1242	EPA 8080	ug/L	Water	0.65	21	39-150	95
		ug/Kg	Soil	21.67	21	39-150	95
PCB-1248	EPA 8080	ug/L	Water	0.65	25	38-158	95
		ug/Kg	Soil	21.67	25	38-158	95

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
PCB-1254	EPA 8080	ug/L	Water	0.80	17	29-131	95
		ug/Kg	Soil	26.67	17	29-131	95
PCB-1260	EPA 8080	ug/L	Water	0.80	39	8-127	95
		ug/Kg	Soil	26.67	39	8-127	95

NA = Not Available presently. Values will be updated for water and soil when sufficient data is obtained from LENL analyses.

Determination of Practical Quantitation Limits (PQL) for various matrices:[a]

Matrix	Factor
Low-level soil by sonication with GPC clean-up	2
High-level soil & sludges by sonication	30
Non-aqeous organic liquid	600

PQL = (PQL for soil) x (Factor)

(a) Sample PQLs are highly matrix-dependent. The PQLs listed herein are provided for guidance and may not always be achievable.

For non-aqueous samples, the factor is on a wet-weight basis.

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R, RANGE	% COMPLETENESS
2,4-D	EPA 8150	ug/L	Water	1.2	13	55-94	97
		ug/Kg	Soil	24	13	55-94	95
2,4,5-T	EPA 8150	ug/L	Water	0.2	15	63-107	97
		ug/Kg	Soil	10	15	63-107	95
2,4,5-TP (Silvex)	EPA 8150	ug/L	Water	0.2	14	63-108	97
		ug/Kg	Soil	8.5	14	63-108	95

PQL = Practical Quantitation Limit

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Acetone	EPA 8260	ug/L	Water	10	50	0-500	95
		ug/Kg	Soil	10	50	0-500	95
Acetonitrile	EPA 8260	ug/L	Water	100	50	0-500	95
		ug/Kg	Soil	100	50	0-500	95
Allyl chloride	EPA 8260	ug/L	Water	10	50	0-500	98
		ug/Kg	Soil	10	50	0-500	96
Benzene	EPA 8260	ug/L	Water	2	25	37-151	98
		ug/Kg	Soil	2	25	37-151	96
Bromodichloromethane	EPA 8260	ug/L	Water	2	20	35-155	98
		ug/Kg	Soil	2	20	35-155	96
Bromoform	EPA 8260	ug/L	Water	2	17	45-169	98
		ug/Kg	Soil	2	17	45-169	96
Bromomethane	EPA 8260	ug/L	Water	5	58	0-242	97
		ug/Kg	Soil	5	58	0-242	95
2-Butanone	EPA 8260	ug/L	Water	100	50	0-500	95
		ug/Kg	Soil	100	50	0-500	95
n-Butyl alcohol	EPA 8260	ug/L	Water	100	50	0-500	95
		ug/Kg	Soil	100	50	0-500	95
Carbon disulfide	EPA 8260	ug/L	Water	5	50	0-500	98
		ug/Kg	Soil	5	50	0-500	96

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Carbon tetrachloride	EPA 8260	ug/L	Water	2	11	70-140	98
		ug/Kg	Soil	2	11	70-140	96
Chlorobenzene	EPA 8260	ug/L	Water	2	26	37-160	98
		ug/Kg	Soil	2	26	37-160	96
Chloroethane	EPA 8260	ug/L	Water	6	29	14-230	98
		ug/Kg	Soil	6	29	14-230	96
2-Chloroethyl vinyl ether	EPA 8260	ug/L	Water	15	84	D-305	95
		ug/Kg	Soil	15	84	D-305	95
Chloroform	EPA 8260	ug/L	Water	1	18	51-138	98
		ug/Kg	Soil	1	18	51-138	96
Chloromethane	EPA 8260	ug/L	Water	10	58	D-273	97
		ug/Kg	Soil	10	58	D-273	95
Chloroprene	EPA 8260	ug/L	Water	50	50	D-250	95
		ug/Kg	Soil	50	50	D-250	95
Dibromochloromethane	EPA 8260	ug/L	Water	2	17	53-149	98
		ug/Kg	Soil	2	17	53-149	96
1,2-Dibromo-3-chloropropane	EPA 8260	ug/L	Water	15	50	D-250	95
		ug/Kg	Soil	15	50	D-250	95
1,2-Dibromoethane	EPA 8260	ug/L	Water	5	50	D-250	98
		ug/Kg	Soil	5	50	D-250	96
trans-1,4-Dichloro-2-butene	EPA 8260	ug/L	Water	10	50	D-250	97
		ug/Kg	Soil	10	50	D-250	95
Dichlorodifluoromethane	EPA 8260	ug/L	Water	20	50	D-250	95
		ug/Kg	Soil	20	50	D-250	95

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
1,1-Dichloroethane	EPA 8260	ug/L	Water	2	16	59-155	98
		ug/Kg	Soil	2	16	59-155	96
1,2-Dichloroethane	EPA 8260	ug/L	Water	2	21	49-155	98
		ug/Kg	Soil	2	21	49-155	96
1,1-Dichloroethene	EPA 8260	ug/L	Water	5	43	D-234	97
		ug/Kg	Soil	5	43	D-234	95
cis-1,2-Dichloroethene	EPA 8260	ug/L	Water	5	19	54-156	98
		ug/Kg	Soil	5	19	54-156	96
trans-1,2-Dichloroethene	EPA 8260	ug/L	Water	4	19	54-156	98
		ug/Kg	Soil	4	19	54-156	96
1,2-Dichloropropane	EPA 8260	ug/L	Water	2	45	D-210	98
		ug/Kg	Soil	2	45	D-210	96
cis-1,3-Dichloropropene	EPA 8260	ug/L	Water	1	52	D-227	98
		ug/Kg	Soil	1	52	D-227	96
trans-1,3-Dichloropropene	EPA 8260	ug/L	Water	2	34	17-183	98
		ug/Kg	Soil	2	34	17-183	96
1,4-Dioxane	EPA 8260	ug/L	Water	25	50	D-250	95
		ug/Kg	Soil	25	50	D-250	95
Ethyl acetate	EPA 8260	ug/L	Water	15	50	D-250	98
		ug/Kg	Soil	15	50	D-250	96
Ethylbenzene	EPA 8260	ug/L	Water	2	26	37-162	98
		ug/Kg	Soil	2	26	37-162	96
Ethyl ether	EPA 8260	ug/L	Water	5	50	D-250	98
		ug/Kg	Soil	5	50	D-250	96

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Ethyl methacrylate	EPA 8260	ug/L	Water	5	50	D-500	98
		ug/Kg	Soil	5	50	D-500	96
2-Hexanone	EPA 8260	ug/L	Water	3	50	D-500	98
		ug/Kg	Soil	3	50	D-500	96
Isobutyl alcohol	EPA 8260	ug/L	Water	100	50	D-500	95
		ug/Kg	Soil	100	50	D-500	95
Methacrylonitrile	EPA 8260	ug/L	Water	10	50	D-500	95
		ug/Kg	Soil	10	50	D-500	95
Methylene bromide	EPA 8260	ug/L	Water	5	50	D-500	98
		ug/Kg	Soil	5	50	D-500	96
Methylene chloride	EPA 8260	ug/L	Water	5	32	D-221	98
		ug/Kg	Soil	5	32	D-221	96
Methyl iodide	EPA 8260	ug/L	Water	5	50	D-500	98
		ug/Kg	Soil	5	50	D-500	96
Methyl methacrylate	EPA 8260	ug/L	Water	30	50	D-500	95
		ug/Kg	Soil	30	50	D-500	95
4-Methyl-2-pentanone	EPA 8260	ug/L	Water	3	50	D-500	98
		ug/Kg	Soil	3	50	D-500	96
Pentachloroethane	EPA 8260	ug/L	Water	10	50	D-500	95
		ug/Kg	Soil	10	50	D-500	95
Propionitrile	EPA 8260	ug/L	Water	50	50	D-500	95
		ug/Kg	Soil	50	50	D-500	95
Styrene	EPA 8260	ug/L	Water	2	50	10-250	95
		ug/Kg	Soil	2	50	10-250	95

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R, RANGE	% COMPLETENESS
1,1,1,2-Tetrachloroethane	EPA 8260	ug/L	Water	3	50	10-250	98
		ug/Kg	Soil	3	50	10-250	96
1,1,2,2-Tetrachloroethane	EPA 8260	ug/L	Water	3	20	46-157	98
		ug/Kg	Soil	3	20	46-157	96
Tetrachloroethene	EPA 8260	ug/L	Water	3	16	64-148	98
		ug/Kg	Soil	3	16	64-148	96
Toluene	EPA 8260	ug/L	Water	2	22	47-150	98
		ug/Kg	Soil	2	22	47-150	96
1,1,1-Trichloroethane	EPA 8260	ug/L	Water	3	21	52-162	98
		ug/Kg	Soil	3	21	52-162	96
1,1,2-Trichloroethane	EPA 8260	ug/L	Water	2	18	52-150	98
		ug/Kg	Soil	2	18	52-150	96
Trichloroethane	EPA 8260	ug/L	Water	3	12	71-157	98
		ug/Kg	Soil	3	12	71-157	96
Trichlorofluoromethane	EPA 8260	ug/L	Water	5	34	17-181	98
		ug/Kg	Soil	5	34	17-181	96
1,2,3-Trichloropropane	EPA 8260	ug/L	Water	10	50	D-500	98
		ug/Kg	Soil	10	50	D-500	96
1,1,2-Trichlorotrifluoroethane	EPA 8260	ug/L	Water	5	50	D-500	98
		ug/Kg	Soil	5	50	D-500	96
Vinyl acetate	EPA 8260	ug/L	Water	10	50	D-250	95
		ug/Kg	Soil	10	50	D-250	95
Vinyl chloride	EPA 8260	ug/L	Water	9	65	D-251	97
		ug/Kg	Soil	9	65	D-251	95

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R, RANGE	% COMPLETENESS
Xylenes (Total)	EPA 8260	ug/L	Water	1	30	25-200	98
		ug/Kg	Soil	1	30	25-200	96

NA = Not Available presently. Values will be updated for water and soil when sufficient data is obtained from LENL analyses.
D = Detected; must be greater than zero.
PQL = Practical Quantitation Limit

Sample PQLs are highly matrix-dependent. The PQLs listed herein are provided for guidance and may not always be achievable.

PQLs listed for soil/sediment are based on wet-weight. Normally data is reported on a dry-weight basis; therefore, PQLs will be higher, based on the percent moisture in each sample.

PQLs for Other Matrices	Factor
Water miscible liquid waste	50
High-level soil & sludges	50-500
Non-aqueous organic liquid	5000

PQL = (PQL for water) x (Factor)

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Acenaphthene	EPA 8270	ug/L	Water	5	21	47-145	98
		mg/Kg	Soil	0.14	21	47-145	96
Acenaphthylene	EPA 8270	ug/L	Water	5	26	33-145	98
		mg/Kg	Soil	0.15	26	33-145	96
Acetophenone	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
2-Acetylaminofluorene	EPA 8270	ug/L	Water	30	50	D-500	98
		mg/Kg	Soil	1.00	50	D-500	96
Aldrin	EPA 8270	ug/L	Water	4	43	D-166	97
		mg/Kg	Soil	0.14	43	D-166	95
4-Aminobiphenyl	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Aniline	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Anthracene	EPA 8270	ug/L	Water	5	27	27-133	98
		mg/Kg	Soil	0.15	27	27-133	96
Aramite	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.15	50	D-250	96
Aroclor-1016	EPA 8270	ug/L	Water	50	50	D-500	97
		mg/Kg	Soil	1.67	50	D-500	95
Aroclor-1221	EPA 8270	ug/L	Water	50	50	D-500	97
		mg/Kg	Soil	1.67	50	D-500	95
Aroclor-1232	EPA 8270	ug/L	Water	50	50	D-500	97
		mg/Kg	Soil	1.67	50	D-500	95

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Aroclor-1242	EPA 8270	ug/L	Water	50	50	D-500	97
		mg/Kg	Soil	1.67	50	D-500	95
Aroclor-1248	EPA 8270	ug/L	Water	50	50	D-500	97
		mg/Kg	Soil	1.67	50	D-500	95
Aroclor-1254	EPA 8270	ug/L	Water	75	50	D-500	95
		mg/Kg	Soil	2.50	50	D-500	95
Aroclor-1260	EPA 8270	ug/L	Water	75	43	D-164	95
		mg/Kg	Soil	2.50	43	D-164	95
Benz[a]anthracene	EPA 8270	ug/L	Water	3	26	33-143	98
		mg/Kg	Soil	0.09	26	33-143	96
Benzidine	EPA 8270	ug/L	Water	25	50	D-500	95
		mg/Kg	Soil	0.82	50	D-500	95
Benz[b]fluoranthene	EPA 8270	ug/L	Water	10	29	24-159	98
		mg/Kg	Soil	0.33	29	24-159	96
Benz[k]fluoranthene	EPA 8270	ug/L	Water	10	35	11-162	98
		mg/Kg	Soil	0.33	35	11-162	96
Benzoic acid	EPA 8270	ug/L	Water	27	50	D-500	95
		mg/Kg	Soil	0.88	50	D-500	95
Benzo[ghi]perylene	EPA 8270	ug/L	Water	10	51	D-219	98
		mg/Kg	Soil	0.32	51	D-219	96
Benzo[a]pyrene	EPA 8270	ug/L	Water	7	32	17-163	98
		mg/Kg	Soil	0.22	32	17-163	96
Benzyl alcohol	EPA 8270	ug/L	Water	6	50	D-250	97
		mg/Kg	Soil	0.18	50	D-250	95

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY % R. RANGE	% COMPLETENESS
alpha-BHC	EPA 8270	ug/L	Water	6	50	D-250	95
		mg/Kg	Soil	0.20	50	D-250	95
beta-BHC	EPA 8270	ug/L	Water	7	30	24-149	98
		mg/Kg	Soil	0.23	30	24-149	96
gamma-BHC (Lindane)	EPA 8270	ug/L	Water	6	50	D-250	95
		mg/Kg	Soil	0.20	50	D-250	95
delta-BHC	EPA 8270	ug/L	Water	6	93	D-110	95
		mg/Kg	Soil	0.20	93	D-110	95
Bis(2-chloroethoxy)methane	EPA 8270	ug/L	Water	6	26	33-184	98
		mg/Kg	Soil	0.20	26	33-184	96
Bis(2-chloroethyl)ether	EPA 8270	ug/L	Water	6	35	12-158	98
		mg/Kg	Soil	0.20	35	12-158	96
Bis(2-chloroisopropyl)ether	EPA 8270	ug/L	Water	6	25	36-166	98
		mg/Kg	Soil	0.20	25	36-166	96
Bis(2-ethylhexyl)phthalate	EPA 8270	ug/L	Water	5	36	8-158	98
		mg/Kg	Soil	0.14	36	8-158	96
4-Bromophenyl phenyl ether	EPA 8270	ug/L	Water	5	16	53-127	98
		mg/Kg	Soil	0.14	16	53-127	96
Butyl benzyl phthalate	EPA 8270	ug/L	Water	3	53	D-152	97
		mg/Kg	Soil	0.10	53	D-152	95

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
alpha-Chlordane	EPA 8270	ug/L	Water	20	50	0-250	97
		mg/Kg	Soil	0.67	50	0-250	95
gamma-Chlordane	EPA 8270	ug/L	Water	20	50	0-250	97
		mg/Kg	Soil	0.67	50	0-250	95
p-Chloroaniline	EPA 8270	ug/L	Water	4	50	0-250	97
		mg/Kg	Soil	0.12	50	0-250	95
Chlorobenzilate	EPA 8270	ug/L	Water	10	50	0-250	98
		mg/Kg	Soil	0.33	50	0-250	96
p-Chloro-m-cresol	EPA 8270	ug/L	Water	7	29	22-147	98
		mg/Kg	Soil	0.22	29	22-147	96
1-Chloronaphthalene	EPA 8270	ug/L	Water	10	13	60-118	98
		mg/Kg	Soil	0.33	13	60-118	96
2-Chloronaphthalene	EPA 8270	ug/L	Water	6	13	60-118	98
		mg/Kg	Soil	0.18	13	60-118	96
2-Chlorophenol	EPA 8270	ug/L	Water	4	28	23-134	98
		mg/Kg	Soil	0.12	28	23-134	96
4-Chlorophenyl phenyl ether	EPA 8270	ug/L	Water	6	30	25-158	98
		mg/Kg	Soil	0.19	30	25-158	96
Chrysene	EPA 8270	ug/L	Water	3	33	17-168	98
		mg/Kg	Soil	0.10	33	17-168	96
m-Cresol	EPA 8270	ug/L	Water	10	29	22-147	98
		mg/Kg	Soil	0.33	29	22-147	96

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
o-Cresol	EPA 8270	ug/L	Water	4	29	22-147	98
		mg/Kg	Soil	0.14	29	22-147	96
p-Cresol	EPA 8270	ug/L	Water	7	29	22-147	98
		mg/Kg	Soil	0.21	29	22-147	96
Cyclohexanone	EPA 8270	ug/L	Water	20	50	D-250	97
		mg/Kg	Soil	0.67	50	D-250	95
4,4'-DDD	EPA 8270	ug/L	Water	4	66	D-145	95
		mg/Kg	Soil	0.13	66	D-145	95
4,4'-DDE	EPA 8270	ug/L	Water	5	39	4-136	98
		mg/Kg	Soil	0.16	39	4-136	96
4,4'-DDT	EPA 8270	ug/L	Water	10	65	D-203	95
		mg/Kg	Soil	0.32	65	D-203	95
Diallate	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
Dibenz[a,j]acridine	EPA 8270	ug/L	Water	20	50	D-500	97
		mg/Kg	Soil	0.67	50	D-500	95
Dibenz[a,h]anthracene	EPA 8270	ug/L	Water	10	59	D-227	98
		mg/Kg	Soil	0.33	59	D-227	96
Dibenzofuran	EPA 8270	ug/L	Water	10	25	D-250	98
		mg/Kg	Soil	0.09	25	D-250	96
Di-n-butylphthalate	EPA 8270	ug/L	Water	4	39	1-118	98
		mg/Kg	Soil	0.12	39	1-118	96
1,2-Dichlorobenzene	EPA 8270	ug/L	Water	5	24	32-129	98
		mg/Kg	Soil	0.17	24	32-129	96

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
1,3-Dichlorobenzene	EPA 8270	ug/L	Water	7	41	D-172	98
		mg/Kg	Soil	0.23	41	D-172	96
1,4-Dichlorobenzene	EPA 8270	ug/L	Water	6	29	20-124	98
		mg/Kg	Soil	0.18	29	20-124	96
3,3'-Dichlorobenzidine	EPA 8270	ug/L	Water	20	47	D-262	97
		mg/Kg	Soil	0.67	47	D-262	95
2,4-Dichlorophenol	EPA 8270	ug/L	Water	6	21	39-135	98
		mg/Kg	Soil	0.20	21	39-135	96
2,6-Dichlorophenol	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Dieldrin	EPA 8270	ug/L	Water	7	26	29-136	98
		mg/Kg	Soil	0.22	26	29-136	96
Diethylphthalate	EPA 8270	ug/L	Water	5	52	D-114	98
		mg/Kg	Soil	0.15	52	D-114	96
Dimethoate	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
p-(Dimethylamino)azobenzene	EPA 8270	ug/L	Water	20	50	D-500	97
		mg/Kg	Soil	0.67	50	D-500	95
7,12-Dimethylbenz[a]-anthracene	EPA 8270	ug/L	Water	10	50	D-500	97
		mg/Kg	Soil	0.33	50	D-500	95
3,3'-Dimethylbenzidine	EPA 8270	ug/L	Water	50	50	D-500	95
		mg/Kg	Soil	1.67	50	D-500	95

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY % R. RANGE	% COMPLETENESS
alpha,alpha-Dimethylphen-ethylamine	EPA 8270	ug/L	Water	20	50	D-250	97
		mg/Kg	Soil	0.67	50	D-250	95
2,4-Dimethylphenol	EPA 8270	ug/L	Water	10	22	32-119	98
		mg/Kg	Soil	0.33	22	32-119	96
Dimethylphthalate	EPA 8270	ug/L	Water	4	105	D-112	95
		mg/Kg	Soil	0.13	105	D-112	95
1,3-Dinitrobenzene	EPA 8270	ug/L	Water	20	50-25	D-250	97
		mg/Kg	Soil	0.67	50-25	D-250	95
4,6-Dinitro-o-cresol	EPA 8270	ug/L	Water	25	26	D-181	95
		mg/Kg	Soil	0.81	26	D-181	95
2,4-Dinitrophenol	EPA 8270	ug/L	Water	43	42	D-191	95
		mg/Kg	Soil	1.41	42	D-191	95
2,4-Dinitrotoluene	EPA 8270	ug/L	Water	7	21	39-139	98
		mg/Kg	Soil	0.23	21	39-139	96
2,6-Dinitrotoluene	EPA 8270	ug/L	Water	7	19	50-158	98
		mg/Kg	Soil	0.21	19	50-158	96
Dinoseb	EPA 8270	ug/L	Water	10	25	D-250	98
		mg/Kg	Soil	0.33	25	D-250	96
Di-n-octylphthalate	EPA 8270	ug/L	Water	9	37	4-146	98
		mg/Kg	Soil	0.30	37	4-146	96
Diphenylamine	EPA 8270	ug/L	Water	5	50	D-250	98
		mg/Kg	Soil	0.15	50	D-250	96

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
1,2-Diphenylhydrazine	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
Disulfoton	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
Endosulfan I	EPA 8270	ug/L	Water	6	50	D-250	95
		mg/Kg	Soil	0.20	50	D-250	95
Endosulfan II	EPA 8270	ug/L	Water	8	50	D-250	95
		mg/Kg	Soil	0.25	50	D-250	95
Endosulfan sulfate	EPA 8270	ug/L	Water	7	63	D-107	97
		mg/Kg	Soil	0.22	63	D-107	95
Endrin	EPA 8270	ug/L	Water	9	50	D-250	97
		mg/Kg	Soil	0.29	50	D-250	95
Endrin aldehyde	EPA 8270	ug/L	Water	50	73	D-209	95
		mg/Kg	Soil	1.67	73	D-209	95
Endrin ketone	EPA 8270	ug/L	Water	10	75	D-500	98
		mg/Kg	Soil	0.33	75	D-500	96
Ethyl methanesulfonate	EPA 8270	ug/L	Water	10	50	D-500	97
		mg/Kg	Soil	0.33	50	D-500	95
Famphur	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
Fluoranthene	EPA 8270	ug/L	Water	4	28	26-137	98
		mg/Kg	Soil	0.13	28	26-137	96
Fluorene	EPA 8270	ug/L	Water	7	13	59-121	98
		mg/Kg	Soil	0.21	13	59-121	96

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Heptachlor	EPA 8270	ug/L	Water	12	50	D-192	97
		mg/Kg	Soil	0.38	50	D-192	95
Heptachlor epoxide	EPA 8270	ug/L	Water	7	28	26-155	98
		mg/Kg	Soil	0.23	28	26-155	96
Hexachlorobenzene	EPA 8270	ug/L	Water	6	43	D-152	98
		mg/Kg	Soil	0.20	43	D-152	96
Hexachlorobutadiene	EPA 8270	ug/L	Water	6	26	24-116	98
		mg/Kg	Soil	0.19	26	24-116	96
Hexachlorocyclopentadiene	EPA 8270	ug/L	Water	10	50	D-500	95
		mg/Kg	Soil	0.33	50	D-500	95
Hexachlorodibenzo-p-dioxins	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
Hexachlorodibenzofurans	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
Hexachloroethane	EPA 8270	ug/L	Water	7	17	40-113	98
		mg/Kg	Soil	0.22	17	40-113	96
Hexachlorophene	EPA 8270	ug/L	Water	50	25	D-250	95
		mg/Kg	Soil	1.67	25	D-250	95
Hexachloropropene	EPA 8270	ug/L	Water	10	25	D-250	98
		mg/Kg	Soil	0.33	25	D-250	96
Indeno(1,2,3-cd)pyrene	EPA 8270	ug/L	Water	10	50	D-171	97
		mg/Kg	Soil	0.33	50	D-171	95
Isodrin	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Isophorone	EPA 8270	ug/L	Water	7	33	21-196	98
		mg/Kg	Soil	0.22	33	21-196	96
Isosafrole	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
Kepone	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
Methapyrilene	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Methoxychlor	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
3-Methylcholanthrene	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Methyl methanesulfonate	EPA 8270	ug/L	Water	20	50	D-250	95
		mg/Kg	Soil	0.67	50	D-250	95
1-Methylnaphthalene	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
2-Methylnaphthalene	EPA 8270	ug/L	Water	4	50	D-250	98
		mg/Kg	Soil	0.12	50	D-250	96
Methyl parathion	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Naphthalene	EPA 8270	ug/L	Water	3	30	21-133	98
		mg/Kg	Soil	0.08	30	21-133	96
1,4-Naphthoquinone	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
1-Naphthylamine	EPA 8270	ug/L	Water	30	50	0-500	97
		mg/Kg	Soil	1.00	50	0-500	95
2-Naphthylamine	EPA 8270	ug/L	Water	30	50	0-250	97
		mg/Kg	Soil	1.00	50	0-250	95
2-Nitroaniline	EPA 8270	ug/L	Water	5	50	0-250	95
		mg/Kg	Soil	0.17	50	0-250	95
3-Nitroaniline	EPA 8270	ug/L	Water	13	50	0-500	95
		mg/Kg	Soil	0.41	50	0-500	95
4-Nitroaniline	EPA 8270	ug/L	Water	16	50	0-500	95
		mg/Kg	Soil	0.54	50	0-500	95
Nitrobenzene	EPA 8270	ug/L	Water	10	27	35-180	98
		mg/Kg	Soil	0.33	27	35-180	96
2-Nitrophenol	EPA 8270	ug/L	Water	10	27	29-182	98
		mg/Kg	Soil	0.33	27	29-182	96
4-Nitrophenol	EPA 8270	ug/L	Water	12	44	0-132	95
		mg/Kg	Soil	0.40	44	0-132	95
4-Nitroquinoline 1-oxide	EPA 8270	ug/L	Water	50	50	0-500	95
		mg/Kg	Soil	1.67	50	0-500	95
N-Nitrosodi-n-butylamine	EPA 8270	ug/L	Water	10	50	0-250	98
		mg/Kg	Soil	0.33	50	0-250	96
N-Nitrosodiethylamine	EPA 8270	ug/L	Water	10	50	0-250	98
		mg/Kg	Soil	0.33	50	0-250	96
N-Nitrosodimethylamine	EPA 8270	ug/L	Water	20	75	0-500	95
		mg/Kg	Soil	0.67	75	0-500	95

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
N-Nitrosodiphenylamine	EPA 8270	ug/L	Water	5	50	D-250	97
(as Diphenylamine)		mg/Kg	Soil	0.15	50	D-250	95
N-Nitrosodi-n-propylamine	EPA 8270	ug/L	Water	6	44	D-230	98
		mg/Kg	Soil	0.19	44	D-230	96
N-Nitrosomethylethylamine	EPA 8270	ug/L	Water	10	75	D-500	98
		mg/Kg	Soil	0.33	75	D-500	96
N-Nitrosomorpholine	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
N-Nitrosopiperidine	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
N-Nitrosopyrrolidine	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
5-Nitro-o-toluidine	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Parathion	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Pentachlorobenzene	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Pentachlorodibenzo-p-dioxins	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Pentachlorodibenzofurans	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Pentachloronitrobenzene	EPA 8270	ug/L	Water	20	50	D-250	97
		mg/Kg	Soil	0.67	50	D-250	95

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
Pentachlorophenol	EPA 8270	ug/L	Water	16	30	14-176	95
		mg/Kg	Soil	0.54	30	14-176	95
Phenacetin	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
Phenanthrene	EPA 8270	ug/L	Water	4	15	54-120	98
		mg/Kg	Soil	0.12	15	54-120	96
Phenol	EPA 8270	ug/L	Water	5	35	5-112	98
		mg/Kg	Soil	0.14	35	5-112	96
p-Phenylenediamine	EPA 8270	ug/L	Water	10	25	D-250	98
		mg/Kg	Soil	0.33	25	D-250	96
Phorate	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
2-Picoline	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
Pronamide	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
Pyrene	EPA 8270	ug/L	Water	3	15	52-115	98
		mg/Kg	Soil	0.08	15	52-115	96
Pyridine	EPA 8270	ug/L	Water	30	25	D-250	95
		mg/Kg	Soil	1.00	25	D-250	95
Safrole	EPA 8270	ug/L	Water	10	25	D-250	98
		mg/Kg	Soil	0.33	25	D-250	96
1,2,4,5-Tetrachlorobenzene	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
2,3,7,8-Tetrachlorodibenzo-p-dioxin	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Tetrachlorodibenzo-p-dioxins	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Tetrachlorodibenzofurans	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
2,3,4,6-Tetrachlorophenol	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Tetraethyl dithiopyrophosphate	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
Thionazin	EPA 8270	ug/L	Water	10	50	D-250	98
		mg/Kg	Soil	0.33	50	D-250	96
o-Toluidine	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
Toxaphene	EPA 8270	ug/L	Water	200	50	D-500	95
		mg/Kg	Soil	6.67	50	D-500	95
1,2,4-Trichlorobenzene	EPA 8270	ug/L	Water	7	21	44-142	98
		mg/Kg	Soil	0.22	21	44-142	96
2,4,5-Trichlorophenol	EPA 8270	ug/L	Water	9	50	D-250	98
		mg/Kg	Soil	0.28	50	D-250	96
2,4,6-Trichlorophenol	EPA 8270	ug/L	Water	8	22	37-144	98
		mg/Kg	Soil	0.24	22	37-144	96

PARAMETER	METHOD	UNITS	MATRIX	PQL	PRECISION MAX RPD	ACCURACY %R. RANGE	% COMPLETENESS
O,O,O-Triethyl phosphorothioate	EPA 8270	ug/L	Water	10	50	D-500	98
		mg/Kg	Soil	0.33	50	D-500	96
1,3,5-Trinitrobenzene	EPA 8270	ug/L	Water	20	50	D-500	97
		mg/Kg	Soil	0.66	50	D-500	95

NA = Not Available presently. Values will be updated for water and soil when sufficient data is obtained from LENL analyses.
D = Detected; must be greater than zero
PQL = Practical Quantitation Limit

PQLs listed for soil/sediment based on wet-weight. Normally data is reported on a dry-weight basis; therefore, PQLs will be higher based on the percent moisture in each sample. This is based on a 30-gram sample. PQLs for samples requiring gel permeation clean-up will be two times higher.

Sample PQLs are highly matrix-dependent. The PQLs listed herein are provided for guidance and may not always be achievable.

PQLs for Other Matrices	Factor
Medium-level soil & sludge by sonication	7.5 - 75
Non-aqueous organic liquid	100

PQL = (PQL for soil) x (Factor)

6.0 SAMPLING PROCEDURES

The importance of a well-planned, well-executed, and well-documented sampling program cannot be overstated. It is the foundation on which the analyses and, ultimately, all decisions are based. Valid results depend upon:

1. Ensuring that the sample taken is representative of the material or matrix being sampled;
2. Using proper sampling, sample handling, and preservation techniques;
3. Properly identifying the collected samples and documenting their collection in permanent field records;
4. Maintaining sample chain of custody; and
5. Properly packing and transporting the samples for laboratory analysis.

Law sampling procedures are in accordance to Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, USEPA Region IV, April 1, 1986.

The objectives of this section are to present:

1. General considerations that should be included in all sampling operations conducted by Law;

2. Specific Law standard sampling site selection and sample collection procedures for specific matrices; and

3. Law sampling quality assurance procedures.

6.1 SITE SAMPLING PLAN

A specific site sampling plan is developed for each study conducted at Law. Because site selection is the most important element in the analytical process, Law maintains the policy of complete and open communication between all parties involved in a particular investigation. We typically encourage the regulating, as well as the regulated, parties to comment on and ultimately agree on the developed site sampling plan.

In many cases, a great deal of study must be initiated prior to the completion of the site sampling plan. Information on the type of activities conducted at a site and where potential contamination might be, as well as locating potentially uncontaminated background sites, is critical. In the following section, we will generally present some of the techniques utilized and sample types collected to support each specific site sampling plan.

6.2 SELECTION OF PARAMETERS TO BE MEASURED

The parameters to be measured usually are dictated by the purpose of an investigation. They should be based on required monitoring conditions or on the field investigator's or requester's knowledge of the problem being investigated.

6.3 SELECTION OF SAMPLING EQUIPMENT

Equipment and materials used for sampling must be selected with consideration for the parameters of interest. Their use must not result in contamination of the sample with the parameters of concern or other artifacts at levels impacting the usage of the data. Equipment made with PVC may be used for most general inorganic parameters. Equipment made with Teflon and/or stainless steel is acceptable for both inorganic and organic parameters.

6.4 SPECIAL PARAMETER/SAMPLING TECHNIQUE CONSIDERATIONS

Some parameters require special handling to preclude losses through volatilization or absorption. Major considerations are as follows:

a. Volatile parameters may not be sampled by means employing a vacuum or which aerate the sample. They should be obtained by a bailer or pressurized pumping system. Every effort must be made to minimize perturbation of the sample during sampling and any compositing steps, and minimize exposure to sources which may lead to contamination (i.e., solvent bearing containers/processes, combustion engines, etc.).

b. Saturated/Heterogeneous Matrices - consideration must be given to those parameters for which the sample container is rinsed with the sample as to whether the sample matrix is saturated or heterogeneous. If there is a potential for bias due to the rinsing then skip the rinse and note the occurrence in the sampling field notes.

c. Dissolved parameters must be filtered in the field before the preservative is added. Filtration is performed by the use of one piece molded, in-line disposable cartridges or filter adapters with replaceable media. The filters are 0.45 micron pore size and are composed of noncontaminating synthetic fibers.

6.5 TYPES OF SAMPLES

6.5.1 Grab Sample

A grab sample is one individual sample collected at one instant in time. It normally is associated with water or wastewater sampling. However, soil, sediment, liquid hazardous waste samples, etc., also may be considered grab samples. Grab samples

are used to characterize the medium at a particular instant in time and are always associated with instantaneous water or wastewater flow data. Grab sampling is conducted when:

1. The water or wastewater stream is not continuous (e.g., batch discharges or intermittent flow);
2. The characteristics of the water or wastewater stream are known to be constant or nearly so;
3. The sample is to be analyzed for parameters whose characteristics are likely to change significantly with time (e.g., dissolved gases, bacteria, etc.);
4. The sample is to be collected for analysis of a parameter, such as oil and grease, where the compositing process could significantly affect the observed concentration; and
5. Data on maximum/minimum concentrations are desired for a continuous water or wastewater stream.

Parameters which are generally analyzed and for which samples will always be collected by Law on a grab basis or <u>in-situ</u> only include: pH, temperature, dissolved oxygen, sulfide, chloride residual, phenol, oil and grease, bacteria, volatile organics, hexavalent chromium, and other dissolved gases.

6.5.2 Composite Samples

There are two types of composite samples. They are timed composite and flow proportional composite samples. A timed composite sample is a compositing of at least eight discrete samples of equal volume and equal time interval for the compositing period. A flow proportional composite sample is a compositing of at least eight discrete samples collected proportional to the flow rate over the compositing period. Composite sampling is conducted when:

1. The water or wastewater stream is continuous;
2. The characteristics of the water or wastewater stream are not known to be constant;
3. Mass/unit time loading data are needed; and
4. A minimum number of samples are to be analyzed.

6.5.3 Areal Composite

Areal composite is a sample composited from individual grab samples collected over an areal or cross-sectional basis. Areal composites shall be made up of equal volumes of grab samples; each grab sample shall be collected in an identical manner.

Examples include sediment composites made up of quarter-point sediment samples from a stream, soil samples from grid points on a grid system, water samples collected at various depths at the same point or from quarter points in a stream, etc.

6.5.4 Split Sample

A split sample is a sample which has been portioned into two or more containers from a single sample container. Portioning assumes adequate mixing to ensure split samples are, for all practical purposes, identical. Split samples will be collected upon DER request.

6.5.5 Duplicate Sample

Duplicate samples are samples collected simultaneously from the same source under identical conditions and placed into separate containers.

6.5.6 Control Sample

A control sample is a sample collected upstream or upgradient from a source or site to isolate the effects of the source or site on the particular ambient medium being sampled.

6.5.7 Background Sample

A background sample is a sample collected from an area, water body, or site similar to the one being studied, but located in an area known or thought to be free from pollutants of concern.

6.6 WATER SAMPLING

Water samples typically consist of individual grab, composite, or areal composite samples. Sample containers used by Law are listed in Table 6-1. Container and preservative preparation procedures may be found in Appendix B. Below are descriptions of various types of water samples.

6.6.1 Lagoons and Pits Sampling

For routine confirmation of waste constituents or qualitative characterization of wastewater streams, a single grab sample may be collected. Factors such as the size of the impoundment, the nature of the waste, influent and effluent points, etc., may necessitate the collection of an area composite sample. In either case, the sample taken should be representative of the medium being sampled. For the collection of a sediment/bottom

sludge sample, individual grab samples may be collected at several points along the perimeter of the lagoon or pit, using a hand auger or shovel. The samples may then be composited.

TABLE 6.1. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES AND HOLDING TIMES

PARAMETER	CONTAINER(#1)	PRESERVATIVE	MAXIMUM HOLDING TIME (#3)
<u>Inorganic Tests</u>			
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
Biochemical oxygen demand, carbonaceous	P,G	Cool, 4°C	48 hours
Bromide	P,G	None required	28 days
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

TABLE 6.1. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES AND HOLDING TIMES (Continued)

PARAMETER	CONTAINER(#1)	PRESERVATIVE	MAXIMUM HOLDING TIME (#3)
Cyanide, total and amenable to chlorination	P,G	Cool, 4°C NaOH to pH >12 0.6g ascorbic acid (#6)	14 days (#9)
Fluoride	P	None required	28 days
Hardness	P,G	HNO_3 to pH <2	6 months
Kjeldahl Nitrogen	P,G	Cool, 4°C H_2SO_4 to pH <2	28 days
pH	P,G	None required	Analyze immediately
Turbidity	P,G	Cool, 4°C Store in dark	48 hours
<u>Metals</u>(4)			
Chromium VI	P,G	Cool, 4°C	24 hours
Mercury	P	HNO_3 to pH <2	28 days plastic
Mercury	G	HNO_3 to pH <2	13 days glass

TABLE 6.1. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES AND HOLDING TIMES (Continued)

PARAMETER	CONTAINER(#1)	PRESERVATIVE	MAXIMUM HOLDING TIME (#3)
Metals, Total			
Water	P,G	HNO_3 to pH <2	6 months
Soil/Sediment	P,G	Cool 4°C	6 months
Metals, Dissolved	P,G	Filter on site (#4) HNO_3 to pH <2	6 months 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 (Only)	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
Organic Halides	G, Amber (Tef.)	Cool, 4°C, Sodium Thiosulfate (#6)	7 days
Orthophosphate	P,G	Filter immediately Cool, 4°C	48 hours

TABLE 6.1. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES AND HOLDING TIMES (Continued)

PARAMETER	CONTAINER(#1)	PRESERVATIVE	MAXIMUM HOLDING TIME (#3)
Oxygen, dissolved, probe	--	--	Determine on site
Winkler	G,G Top	Fix on site & store in dark	8 hours
Phenols	G Only	Cool, 4°C H_2SO_4 to pH <2	28 days
Phosphorus, elemental	P,G	Cool, 4°C H_2SO_4	48 hours
Phosphorus, total	P,G	Cool, 4°C to pH <2	28 days
Residue, total	P,G		7 days
Residue, filterable	P,G	Cool, 4°C	7 days
Residue, non-filterable	P,G	Cool, 4°C	7 days
Residue, settleable	P,G	Cool, 4°C	48 hours
Residue, volatile	P,G	Cool, 4°C	7 days

TABLE 6.1. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES AND HOLDING TIMES (Continued)

PARAMETER	CONTAINER(#1)	PRESERVATIVE	MAXIMUM HOLDING TIME (#3)
Petroleum Hydrocarbons	G	Cool, 4°C HCL to pH <2	14 days/ water 28 days/ soil
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 & zinc acetate plus sodium hydroxide to pH >9	7 days
Sulfite	P,G	None required	Analyze immediately
Surfactants (MBAS)	P,G	Cool, 4°C	48 hours
Temperature	--	--	Determine on site

TABLE 6.1. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES AND HOLDING TIMES (Continued)

PARAMETER	CONTAINER(#1)	PRESERVATIVE	MAXIMUM HOLDING TIME (#3)
Organic Tests			
Nitrosamines-Water	G (Teflon lined cap)	Cool, 4°C store in dark 0.008% $Na_2S_2O_3$ (#6) (#12)	5 days to extract 40 days after extraction
Nitrosamines-Soils	G (Teflon	Cool, 4°C (#12)	10 days to extract 40 days after extraction
PCBs - Waters	G (Teflon lined cap)	Cool, 4°C pH 5-9 (#8) (#12)	5 days to extract 40 days after extraction
PCBs-Soils	G (Teflon	Cool,4°C (#12)	10 days to extract 40 days after extraction
Nitroaromatics and Isophorone-Waters	G (Teflon lined cap)	Cool, 4°C store in dark 0.008% $Na_2S_2O_3$ (#6) (#12)	5 days to extract 40 days after extraction
Nitroaromatics and Isophorone Soils	G (Teflon	Cool, 4°C (#12)	10 days to extract 40 days after extraction

TABLE 6.1. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES AND HOLDING TIMES (Continued)

PARAMETER	CONTAINER(#1)	PRESERVATIVE	MAXIMUM HOLDING TIME (#3)
Polynuclear Aromatic Hydrocarbons-Waters	Amber Glass (Teflon lined cap)	Cool, 4°C store in dark 0.008% $Na_2S_2O_3$ (#6) (#12)	5 days to extract, 40 days after extraction
Polynuclear Aromtics Hydrocarbons-Soils	Amber Glass (Teflon lined	Cool, 4°C (#12)	10 days to extract, 40 days after extraction
Haloethers-Waters	G (Teflon lined cap)	Cool; 4°C 0.008% $Na_2S_2O_3$ (#12)	5 days to extract, 40 days after extraction
Haloethers-Soils	G (Teflon	Cool, 4°C (#12)	10 days to extract 40 days after extraction
Chlorinated Hydrocarbons-Waters	G (Teflon lined cap)	Cool, 4°C (#12)	5 days to extract, 40 days after extraction
Chlorinated Hydrocarbons-Soils	G (Teflon	Cool, 4°C (#12)	10 days to extract, 40 days after extraction

TABLE 6.1. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES AND HOLDING TIMES (Continued)

PARAMETER	CONTAINER(#1)	PRESERVATIVE	MAXIMUM HOLDING TIME (#3)
Purgeables Halocarbons-Waters	40 ml vial teflon septa	Cool, 4°C (#12)	10 days
Purgeables Halocarbons-Soils	G (Teflon)	Cool, 4°C (#12)	10 days
Purgeables Aromatics-Waters	40 ml vial teflon septa	Cool, 4°C HCL to pH <2 (#12)	10 days
Volatile Organics - Soils,Waters	40 ml vial teflon septa or 4 oz wide-mouth with teflon/silicon septum caps	Cool, 4°C (#12)	10 days
Acrolein/ Acrylonitrile Waters	40 ml vial teflon septa	Cool, 4°C 0.008%, $Na_2S_2O_3$ adjust pH to 4-5 (#6) (#12)	10 days
Acrolein/ Acrylonitrile Soils	G (Teflon)	Cool, 4°C (#12)	10 days
Semivolatile Organics - Waters	Glass bottle,	Cool, 4°C (#12)	5 days to extract,40 days after extraction
Semivolatiles Organics - soils	8 oz widemouth with teflon lined caps	Cool, 4°C (#12)	10 days to extract, 40 days after extraction

TABLE 6.1. REQUIRED CONTAINERS, PRESERVATION TECHNIQUES AND HOLDING TIMES (Continued)

PARAMETER	CONTAINER(#1)	PRESERVATIVE	MAXIMUM HOLDING TIME (#3)
Phenols-Waters	Glass bottle, teflon lined cap	Cool, 4°C 0.008% 2S°2°3 (#6) (#12)	5 days to extract, 40 days after extraction
Phenols-Soils	G (Teflon)	Cool,4°C (#12)	10 days to extract, 40 days after extraction
Phthalate Esters-Waters	Glass bottle, teflon lined cap	Cool, 4°C (#12)	5 days to extract, 40 days after extraction
Phthalate Esters-Soils	G (Teflon)	Cool, 4°C (#12)	10 days to extract, 40 days after extraction
Benzidines-Waters	Glass bottle, teflon lined cap	Cool, 4°C 0.008% Na_2SO_3 (#6) (#12)	5 days to extract, 40 days after extraction
Benzidines-Soils	G (Teflon)	Cool, 4°C (#12)	10 days to extract, 40 days after extraction
TCDD-Waters	G (Teflon lined cap)	Cool, 4°C 0.008% Na2SO3 (#6) (#12)	5 days to extract, 40 days after extraction
TCDD-Soils	G (Teflon lined cap)	Cool, 4°C (#12)	10 days to extract, 40 days

TABLE 6-2. TABLE REFERENCES

1. Polyethylene (P) or Glass (G).
2. Sample preservation should be performed immediately upon sample collection. For composite samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
3. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory has data on file to show that the specific types of samples under study are stable for the longer time. Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory is obliged to hold the sample for a shorter time if knowledge exists to show this is necessary to maintain sample stability.
4. Samples should be filtered immediately on-site before adding preservative for dissolved metals.
5. Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.
6. Should only be used in the presence of residual chlorine.
7. 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. (Note 6.)
8. 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% $Na_2S_2O_3$. (Note 6.)
9. Maximum holding time is 24 hours when sulfide is present.
10. Sample receiving no pH adjustment must be analyzed within 7 days of sampling.
11. Samples for acrolein receiving no pH adjustment must be analyzed within 3 days of sampling.
12. Hold times are Verified Time of Receipt (VTSR).

If a more rigorous characterization of the waste is necessary, other procedures should be used to ensure a truly representative sample. Specifically for water samples, divide the surface area into an imaginary grid. Take three samples if possible: one sample near the surface, one sample at mid-depth, and one sample at the bottom. Repeat the sampling at each grid over the entire pond or site. For sediment/bottom sludge sampling, also divide the surface area into an imaginary grid. Take one sample from each grid over the entire lagoon or pit, using a split spoon sampler or an extension or a bottle (secured to an extension) with a mechanism for opening and closing the container.

6.6.2 Drainage Ditches, Creeks, Run-Off/Seepage Areas Sampling

SOPs consist of collecting water and sediment samples at the point of discharge into the surface water, downgradient (downstream) from the point of discharge, and upgradient (upstream) from the discharge point. Least contaminated areas should be sampled first. At each sampling point, the water should be collected prior to the sediment sample. Care should be taken not to disturb the sediment during collection of the water

samples. If wading is necessary, the sampling point should be approached from the downgradient side. The number and type (individual or areal composite) of samples should be based on the specific site sampling plan; however, the inspector should be allowed latitude to use his best judgment to add to the sampling program after a thorough site reconnaissance. Sampling equipment should be cleaned after each sampling point to avoid cross-contamination.

6.6.3 Groundwater Sampling

Law uses dedicated PVC bailers and Teflon bailers for groundwater sampling. The well will be purged using either a submersible pump or bailer constructed with non contaminating materials (i.e., stainless steel, teflon) before taking samples to clear the well of the standing water column. The purging volume is to be at least 3 to 5 well volumes. The depth of water should be determined before and after purging to assess well recovery. All equipment placed down the well must be cleaned. Appendix C presents Law's standard cleaning procedures for field equipment.

6.7 SOIL SAMPLING

Law soil sampling procedures are in accordance with Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, U.S. Environmental Protection Agency, Region IV, April 1986, and Test Methods for Evaluating Solid Waste, SW-846, U.S. Environmental Protection Agency, 3rd Edition, November 1986.

6.7.1 Site Selection

Areas selected for soil sampling should be strategically located in order to collect a representative fraction of the soils with the minimum number of samples and effort. A surface inspection of the subject area should be made to locate pertinent features and to evaluate the relationship between these features and potential sources of pollution. The locations of sediment depositional areas are good indications of surface run-off direction.

In most instances, the first investigation of a site will be reconnaissance or screening-type study. Sampling in these instances will generally be confined to surface soils or shallow

coring using hand equipment such as shovels, trowels, or hand augers. For screening purposes, surface soil/sediment sampling should be conducted in depositional areas primarily in the downstream or downgradient portion of the area of interest. An upgradient sample may be collected as a control site. (Note: Sampling at depositional areas tends to bias the sampling toward higher concentrations.)

For more sophisticated investigations, power equipment such as drilling rig may be used. The number of samples or test holes and the specific depth of sampling will vary according to site conditions and the scope of the investigation. In general, a minimum of three to four sampling sites or test holes should be installed in order to adequately determine subsurface conditions.

6.7.2 Sampling Techniques

Surface soil or sediment samples can be obtained by means of grab sampling. This method consists of collecting the soil or sediment in a sample container by scooping with a trowel, shovel, jar, or bottle.

Shallow subsurface samples can be collected by continuous coring with a hand auger. Shallow depth samples may also be collected by digging a hole with a shovel, then removing all the loose soil and collecting a sample at the desired depth using a trowel.

For deeper sampling using a drilling rig, a large diameter auger is used to advance the hole to the desired depth. A split spoon or Shelby tube is then added to the drill rod and forced into the undisturbed soil. The sample is extruded, the portions that are disturbed or contaminated with foreign material introduced through collection methodology are discarded, and the remainder is placed in the appropriate sample container(s).

6.8 LANDFILLS AND HAZARDOUS WASTE SITE SAMPLING

6.8.1 General

Sampling of sanitary landfills is considered a routine operation; however, sampling known or suspected hazardous waste sites could be dangerous to the personnel involved. Therefore, the Law safety SOP should be strictly observed during all sampling operations at known or suspected hazardous waste sites.

Sampling procedures for collecting waste, soil, sediment, water, and groundwater samples at hazardous waste sites and landfills are identical to those already discussed in this section.

All "hot" or concentrated samples should be clearly labeled as such when they are submitted for laboratory analyses. Any observations (odor, appearance, container labeling, etc.) made by the inspector that might alert the laboratory to potential dangers or provide laboratory personnel with information on possible constituents in the samples (high concentrations, etc.) should be explained on the field sheet.

6.8.2 Site Selection

In selecting sampling points in a landfill or hazardous waste site, the site should be checked for drainage areas, leachate flow, and surface spills. Springs, seeps, ponds, and wet areas should be examined for signs of leachate, such as discoloration. Areas of excessive dead vegetation and/or dead animals are good indicators of a potential hazard. Nearby water bodies and wells downgradient from the site should be located for sampling to check for off-site movement of leachate.

6.8.3 Sampling of Drums, Barrels, and Other Containers

Drum/barrel and container sampling should only be conducted when absolutely necessary. Whenever drum/barrel or container sampling is necessary, the first priority would be the collection of samples from open containers, because open containers generally present less hazard to the sampler than closed containers.

A problem which often arises in container sampling is stratification and/or phase separation. If only one layer or phase is sampled, this should be noted and taken into account when interpreting analytical results. Where possible, samples should be collected throughout the entire depth of the container or at several different points to provide a representative sample.

6.8.4 Sampling Techniques

Samples from drums/barrels can be collected using a 4-foot long, 1/2-inch internal diameter glass tube. The tube is inserted into the opening of the drum/container as far as possible. The open end is then sealed either with the thumb or a rubber stopper to

hold the sample in the tube while removing the tube from the drum/barrel. The sample is then placed in the appropriate container and the procedure repeated until an adequate amount of sample is collected. Sample volume should be held to the absolute minimum required for analysis.

6.9 SPECIFIC ANALYTICAL TECHNIQUES

The specific field analytical techniques used by Law are listed in Table 6-3. The procedures for each analytical technique and field test follow the table.

6.9.1 pH

Only electronic (portable) meters with provisions for temperature compensation should be used. Temperature resistant combination electrodes should be used in conjunction with the meters.

The meter should be checked before each field trip for any mechanical or electrical failures, weak batteries, and cracked or fouled electrodes. The meter also should be calibrated with standard buffer solutions of known pH values (e.g., 4, 7, and 10). While in the field, the meter should be calibrated with the

three buffers before using. Thereafter, the meter should be checked against two buffers before each reading. In case of an apparent pH violation, the electrode should be checked with a pH 7.0 buffer and recalibrated to the closest reference buffer. The sample then should be reanalyzed.

TABLE 6-3. SPECIFIC FIELD ANALYTICAL TECHNIQUES

Analytical Parameter	Method	Equipment
pH	Electrometrically using a glass electrode in combination with a reference potential or a combination electrode.	Portable pH meter
Dissolved Oxygen	Electrometrically using a calibrated DO meter	YSI dissolved meter
Specific Conductance	Wheatstone bridge type or equivalent meter at 25 degrees centigrade, or meter with temperature corrections applied	Self-contained conductivity meter, wheatstone bridge type, or equivalent

6.9.2 Dissolved Oxygen

Law uses only YSI dissolved oxygen (DO) meters for field measurements. The meter should be checked before each field trip for any mechanical or electrical failures and membrane continuity. All meters should be calibrated before each field trip.

6.9.3 Field Conductance

A portable specific conductance meter, wheatstone bridge type or equivalent, should be used. Each meter should be checked before each field trip. Batteries should be checked, and conductivity cells should be cleaned and checked against known standards. Before using in the field, check each day with known standards. Refer to the instrument instructions for temperature-conductance calculations. Duplicate field analyses should agree with +/- 10 percent.

6.10 GROUNDWATER LEVEL MEASUREMENT

6.10.1 General

The measurement of groundwater level in wells is frequently conducted in conjunction with groundwater sampling. The data

from such measurements is needed to determine the "free" water surface and can be used to establish groundwater gradients and, ultimately, the direction of groundwater flow.

All groundwater level measurements will be made in reference to an established reference point on the well casing. This reference point shall be well-documented in field records.

6.10.2 Specific Groundwater Level Measuring Techniques

Measuring the depth to the groundwater table can be accomplished by the following methods:

1. Popper or Bell Sounder. A bell or cup-shaped weight that is hollow on the bottom is attached to a measuring tape and lowered into the well. A "plopping" or "popping" sound is made when the weight strikes the surface of the water. An accurate reading can be determined by lifting and lowering the weight in short strokes and reading the tape when the weight barely strikes the water.

2. Weighted Tape. This method is the same as the "bell sounder", except any type of weight, such as a padlock or lead sinker, can be used to fasten to the tape measure.

3. Chalked Tape. Chalk the end of a weighted tape and lower it into the well, recording the amount of tape lowered. Retrieve the tape from the well and subtract the wet, chalked area from the total measurement. The tape should be withdrawn quickly from the well because

water has the tendency to rise up the chalk due to capillary action.

6.11 REQUIRED SAMPLE VOLUMES

The volume of sample obtained should be sufficient to perform all the required laboratory analyses with an additional amount collected to provide for any QC needs, split samples, or repeat examinations. Specific QC sampling sites may be identified prior to field collection to eliminate the need for excess sample collection at all sites.

EPA's Methods for Chemical Analysis of Water and Wastes and SW 846 may be consulted for suggestions on the volumes of sample required for specific analyses.

6.12 SELECTION AND PROPER PREPARATION OF SAMPLE CONTAINERS

The type of sample container used is dictated by the sample analysis required. The standard sample containers used by Law are given in Table 6-1. Law has adopted a policy of providing EPA approved cleaned sample containers and preservatives for

sample analysis by our laboratories. This insures that the integrity of the sample is maintained from the field to our lab.

6.13 SELECTION AND PROPER PREPARATION OF SAMPLING EQUIPMENT

The type of sampling equipment to be used is dictated by the investigation and is discussed for each matrix in Sections 6.5, 6.6 and 6.7. Sampling equipment must be selected with consideration for the analytes and matrices involved. PVC may be used for most general inorganics parameters while teflon and stainless steel are acceptable for both inorganic and organic analytes. All sampling equipment should be cleaned before use. The decontamination procedure is given in Appendix C.

6.14 SAMPLE PRESERVATION

Samples for some analyses must be preserved in order to maintain their integrity. Preservatives required for routine analyses of samples collected by Law personnel are given in Table 6-1. All samples should be preserved immediately upon collection in the field. Preservatives used should be noted on sample labels. The

following samples are the only ones that should not immediately be preserved in the field:

1. Barrel or other source samples from hazardous waste sites (these samples may be preserved only with ice, if necessary);

2. Samples that have extremely low or high pH or samples that would evolve potentially dangerous gases if they were preserved as specified in Table 6-1; and

3. Well or groundwater samples containing visible sediment that are not filtered in the field shall not be preserved with nitric acid in the field (these samples shall be preserved with ice and returned to the laboratory for additional sample preparation, and field records shall indicate why the sample was not preserved).

6.14.1 Special Sample Preservation Steps

Sample holding times, as presented in Table 6-1, are for preserved samples as indicated in the table. When preserving samples, the following steps should also be taken.

1. If samples are placed in an ice chest, personnel should ensure that the melted ice does not cause sample containers to be submerged; this may result in sample cross-contamination.

2. Plastic bags such as zip-lock bags should be used when small sample containers (e.g., volatiles or bacterial

samples) are placed in ice chests to prevent cross-contamination.

3. Lids on all containers should be securely tightened before placing in ice chests.

6.14.2 Special Precautions for Trace Contaminant Sampling

Since some compounds can be detected in the parts per billion or parts per trillion range, extreme care must be taken to prevent contamination between samples or of samples. The precautions listed below should be taken when trace contaminants are of concern.

1. A clean pair of new, disposable gloves should be worn each time a different site (sampling point) is sampled.

2. Sample containers for organics, pesticides, and metal analyses should be placed in separate plastic bags immediately after collection, tagging, preserving, etc.

   All ambient samples should be collected first and placed in separate bags and in separate ice chests or shipping containers. Each ice chest or shipping container should be lined with a new, clean, plastic bag.

3. One member of the field team should take all the notes, fill out tags, etc., while the other member does all of the sampling (if possible).

4. When sampling surface waters, the water sample should always be collected before the sediment sample is collected.

5. Sample collection activities should proceed progressively from the least contaminated area (if this fact is known).

6.15 SPECIFIC SAMPLE COLLECTION QC PROCEDURES

The specific field QC checks the sampling team must follow for blanks and duplicates are provided in Section 11. All new Law employees should have field experience through on-the-job training. New field employees should accompany an experienced employee on one or more field studies before they sample any sites on their own. During this training period, the new employee should be permitted to perform all facets of sampling under the supervision of an experienced employee.

The following specific sample collection QC procedures should always be followed.

1. Except when precleaned/preserved sample containers are employed, sample containers should be rinsed out before the sample is collected (Note: Exceptions to this procedure exist for certain analyses such as oil and grease where biases may be introduced by the rinsing).

A separate collection container can be used to collect the sample from which the sample can be redistributed to other containers. If this is done, however, the container used to collect the sample must be properly cleaned and must be of a material that meets requirements of the parameter(s) being investigated. Also, a separate container should be used at each sampling site. This will avoid cross-contamination between sampling sites.

2. Where prepreserved containers are employed, the pH and any other indicators should be determined to confirm their quantity of preservative was sufficient. If not, then add more preservative as needed. Record all observations in field notes/COC.

3. If samples are split with a facility, enough samples should be collected to allow for equal volume splitting. Also before splitting, the sample should be well mixed so that each split is a homogeneous composite of the sample material.

4. All sample collection activities are traceable, through sample request forms, to the person who collected the sample.

5. The Law laboratory is responsible for providing clean sampling containers, preservatives, and other sampling supplies.

6. All sampling equipment (trowels, shovels, bailers, etc.) should be cleaned before use (see Appendix C for details). Any cleaning procedures conducted in the field should be documented in field notes.

7. All ice chests should be washed with mild detergent (interior and exterior), rinsed with tap water, and air dried or wiped dry before storage.

8. All vehicles should be washed (if possible), including interior cleaning, at the conclusion of each sampling trip. This includes disposal of contaminated trash.

9. No sample container should be reused.

10. When sampling for organic compounds caution should be taken to keep all sample bottles and equipment away from fuels and solvents. The sample should be collected so that no air passes through the sample. The sample must be collected with no headspace in the container. The removal of air will prevent volatile compounds from being volatilized from the sample.

6.16 COLLECTION OF AUXILIARY DATA

All auxiliary data, such as photographs, meteorological conditions, and other observations, should be entered into field notes (in log book) or noted on the sample request form at the time samples are collected. These data also are recorded on the accompanying analytical sample manifest form (Figure 6-1).

6.16.1 Procedure for Identifying Potentially Hazardous Samples

Any sample either known or thought to be hazardous should be so identified on both the sample label and the sample request form. Information explaining the hazard, e.g., corrosive, flammable, poison, etc., should also be listed.

6.16.2 Time Records

The time when samples are collected should be noted in the log book or on the analytical sample manifest form, as well as on the sample label.

6.17 SAMPLE IDENTIFICATION

A standard analytical request form (see Figure 6-2) must be completed for all samples collected. All samples will be fully described.

All containers should be labeled prior to sampling. The sampling point for each sample should be identified on the container label (Figure 6-3). This can be done by assigning a unique number to each sampling point. A more exact description of the sampling point should be documented on the analytical sample manifest.

Sample request forms, container labels, shipping labels, manifest forms, notebooks, chain-of-custody forms, and all other field-related writing should be done in waterproof, nonerasable ink.

If a sample is split with a facility or other part, sample labels with identical information should be attached to each of the samples.

FIGURE 6-1. EXAMPLE OF ANALYTICAL SAMPLE MANIFEST FORM

LAW ENVIRONMENTAL, INC.
NATIONAL LABORATORIES
7215 PINE FOREST ROAD
PENSACOLA FL 32526
(904) 944-9772

Analytical Sample Manifest Form No. _____
(Including field chain of custody)

CLIENT _____ COLLECTION DATE: _____ SAMPLING SITE ID: _____

ALL SAMPLES TRANSFERRED TO, AND THIS FORM COMPLETED BY:A _____ (Signature)

DATE: _____ TIME: _____ TELEPHONE NUMBER: _____

Item No.	Sample Number	Date	Time	*Collected, Preserved & Prepared By	Shipping Case Number	**Analytical Request ID	Field Data on Collection, Presentation, And Preparation of Samples (also log book if available and reference it)	Checked In By: Initials	Date
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									

*Collector's Name/Log Book No: _____ / _____ = 1

_____ / _____ = 2

_____ / _____ = 3

** Analytical Request by contract, see file number _____ = A

or by accompanying analytical request form no. _____ = B

CERTIFICATION: Samples received, Labels and other items checked by _____ on _____ (Date) at _____ (Time) at LAW analytical division _____ (Loc) and found in good order as noted above.

6.17.1 Photograph Identification

All photographs taken by Law personnel should be identified with the following information:

1. An accurate description of what the photograph shows, including the name of the facility or site;
2. The location, date and time that the photograph was taken;
3. The orientation of the photograph (e.g., looking northeast, etc.), if pertinent; and
4. The signature(s) of the photographer(s).

FIGURE 6-2. EXAMPLE OF STANDARD ANALYTICAL REQUEST FORM

Law Environmental, Inc.
National Laboratories

Internal Branch
Analytical Request Form

To: _____ (Branch) _____ (Dept)

Attn: _____ (Dept Manager) _____ (CDC Number)

From: _____ (Branch) _____ (Dept or Name)

Collected: _____ Holding time expires: _____
Date)
Shipped: _____ Results Requested: _____

Project) Number: _____ Name: _____ Manager: _____

Sample ID	Analysis Requested	Detection Limits Req.	Exp. Concern.	Sample Type	Method

Comments:

FIGURE 6-3. ANALYTICAL SAMPLE CONTAINER LABEL

LAW ENVIRONMENTAL, INC.
904-844-6772

SITE NAME	DATE
ANALYSIS	TIME
	PRESERVATIVE

SPECIALTY CLEANED CONTAINER

6.17.2 Field Documentation

Field notes will be used for recording the data collection activities performed at the site. The notebooks will be bound, waterproof field notebooks. Each notebook will be identified by the project-specific document number. The cover of each notebook will contain:

- Book Number
- Project Name
- Start Date
- End Date

Entries will include sufficient detail to reconstruct site activities without reliance on memory. At the beginning of each entry, the date, start time, weather, field personnel present, level of personal protection, and the name of the person making the entry will be recorded. The names of visitors and the purpose of their visit also will be recorded in the site team leader's field notebook. In addition, the presence or occurrence of unusual objects or events related to the sampling activity will be entered into the field notebook.

All measurements and samples collected will be recorded. All entries will be in waterproof ink with no erasures. If an incorrect entry is made, the information will be crossed out with a single strike mark, initialed, and dated. Whenever a sample is collected or measurement made, a detailed description of the sample's location, identification, and type will be recorded.

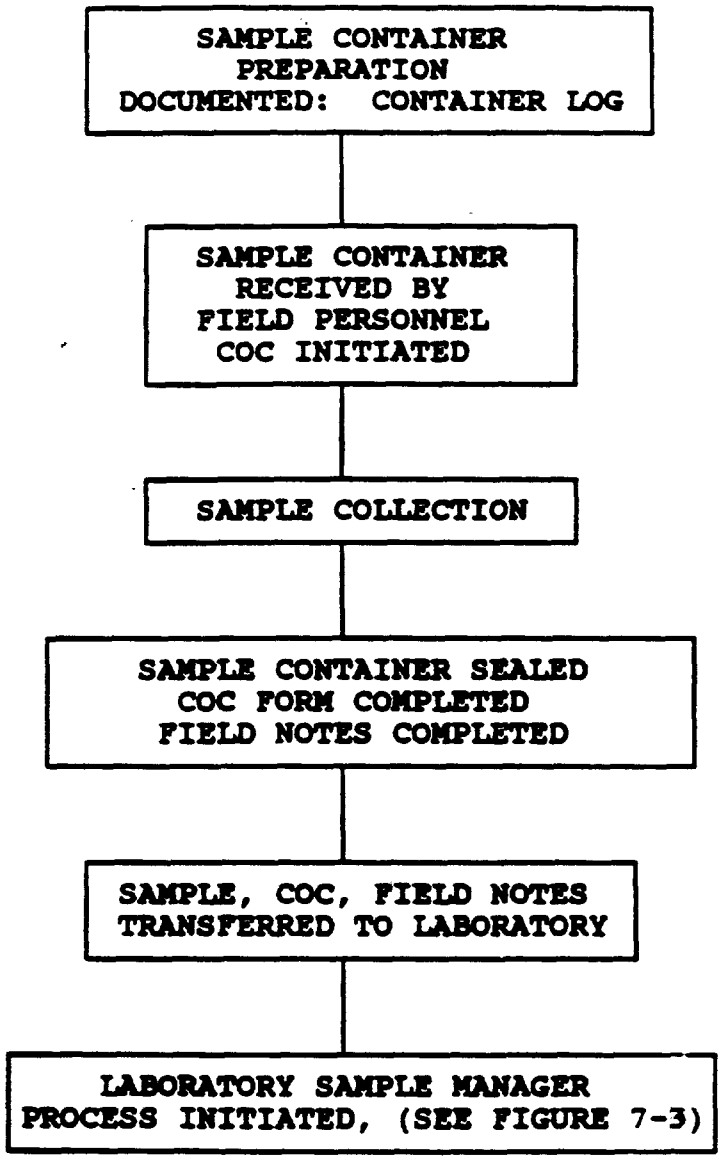
Samples will be collected following the procedures documented in this plan. The equipment used to collect samples will be noted along with the sampling time, sample description, sample depth and volume, and number of sample containers. In addition, the number of the cooler into which the sample is placed in the field will be recorded.

6.17.3 Sample Collection

A control system for sample collection is an important facet of the QA program. The custody of sample containers from preparation to delivery of collected samples to the laboratory is depicted by the flowchart shown in Figure 6-4. When chain of custody (COC) procedures are required, the COC Form is initiated

in the field and transferred to the laboratory along with samples.

FIGURE 6-4. SAMPLE COLLECTION FLOWCHART



7.0 SAMPLE CHAIN OF CUSTODY

The possession of samples should be traceable from the time the samples are taken until the analytical data is reviewed by the project management.

7.1 Sample custody is defined as any authorized person in actual possession of the sample.

7.2 SAMPLE CUSTODY

A sample or other physical evidence is under custody if:

1. It is in the person's actual possession; or
2. It is in the person's view, after being in his/her physical possession; or
3. It was in the person's physical possession, and he/she secured it to prevent tampering; or
4. It is placed in a designated secure area; or
5. It is transferred to another agency or laboratory with the chain of custody.

7.3 FIELD SAMPLING OPERATIONS

The minimum number of samples that provide a good representation of the media being sampled should be collected. The quality and types of samples and sample locations should be determined, to the extent possible, prior to the initiation of field operations.

The samples are labeled with an unique identifier either specified by the sampling plan or descriptive of the sampling

location. This identifier is recorded on the field notes and chain of custody forms for the project.

To simplify the chain of custody record, as few people as possible should handle the sample.

All observations pertaining to the sampling site (e.g., weather, surrounding environment) and sample (e.g., well purging, collection process, preservation verification(s) etc.) are recorded on the field sampling notes.

The field investigator is personally responsible for the care and custody of the samples collected until they are properly transferred to another person or facility.

7.4 TRANSPORTING OF SAMPLES

All samples will be packaged and sealed with a Law shipping case and seal number label (Figure 7-1) prior to transporting. Samples are hand delivered to the Law laboratory.

7.5 TRANSFER OF CUSTODY

All samples should be accompanied by an Analytical Request Form and an Analytical Sample Manifest Form. When transferring the possession of samples, the individuals receiving the samples should sign, date, and note the time they received the samples on the Chain of Custody Form (See Figure 7-2). This form is utilized in order to provide information needed by the laboratory and agencies responsible for interpretation of data.

FIGURE 7-1. SHIPPING CASE AND SEAL NUMBER LABEL

LAW ENVIRONMENTAL NATIONAL LABORATORIES OFFICIAL SAMPLE SEAL	SAMPLE NO.	DATE	SEAL BROKEN	DATE
	SIGNATURE			
	PRINT NAME AND TITLE			

When possession of sample is transferred, one copy of the analytical request form should be retained by the field inspector.

7.6 CUSTODY SUMMARY

Law has developed and maintained a system designed to meet EPA criteria associated with proper sample identification, preservation, and transportation while maintaining a formal chain of custody throughout the entire process. The standard analytical sample container label of Law is illustrated (See Figure 6-3). This label contains information on the site, the personnel involved in the collection, the time of the collection, the source of the sample, the matrix, the nature of the sample, how it was preserved, and the parameters to be tested. The sample label is cross-referenced to a manifest which is prepared for all samples collected from each site.

Figure 7-2 is an example of the chain-of-custody form of Law. The use of this form will produce a level of chain of custody acceptable to all federal and state agencies, including the EPA. This form is designed in such a way as to require certification

at each critical step in the transference of samples, as well as an inspection on a frequent basis of not only the sample's presence or absence, but also its condition.

7.7 LABORATORY SAMPLE RECEIPT AND RECORDS MANAGEMENT

The receipt of all samples entering the Law laboratory is the responsibility of the Sample Manager. The general SOP for maintenance of intra-laboratory sample custody is described in Appendix A.

7.8 SAMPLE VALIDATION

All samples received must be validated. That is, all samples must be accompanied by appropriate, complete documentation. This includes chain-of-custody forms, sample manifests, sample request forms, etc. It is the responsibility of the Sample Manager to ensure that such documentation is complete upon accepting samples.

7.9 SAMPLE LOG-IN

All documentation necessary for tracking and correlating analytical results with sample identification is recorded in a

Laboratory Information Management System (LIMS). Sample receipt and log-in flow chart is illustrated in Figure 7-3.

2214

LAW ENVIRONMENTAL, INC.
NATIONAL LABORATORIES
7215 PINE FOREST ROAD
PENSACOLA, FLORIDA 32526
(904) 944-9772

CHAIN OF CUSTODY RECORD

SAMPLING INFORMATION
NPDES NUMBER

NAME OF FACILITY: _____

STREET ADDRESS: _____

PROJECT NAME | JOB NO.

SAMPLERS (SIGNATURE)

SAMPLING DATE

TIME	GRAB	COMP.	*SOURCE CODE	SAMPLE STATION DESCRIPTION	TOTAL NO. OF CONTAINERS	CONTAINER TYPE: 40 ml G VOA HCl	1 L G - AMBER	8 oz. G, W/M	2 oz. G, W/M	1 L G (H_2SO_4)	500 ml - AMBER	1 L, PL (HNO_3)	1 L, PL (H_2SO_4)	1L, PL (NaOH+Ascorbic Acid)	1 L, PL (Zn Acetate + NaOH)	1 L, PL	4 oz. PL W/M	250 ml PL	1 L TEFLON						LENL LAB NO.

RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	DATE / TIME	RELINQUISHED BY: (SIGNATURE)	RECEIVED BY LABORATORY: (SIGNATURE)	DATE / TIME

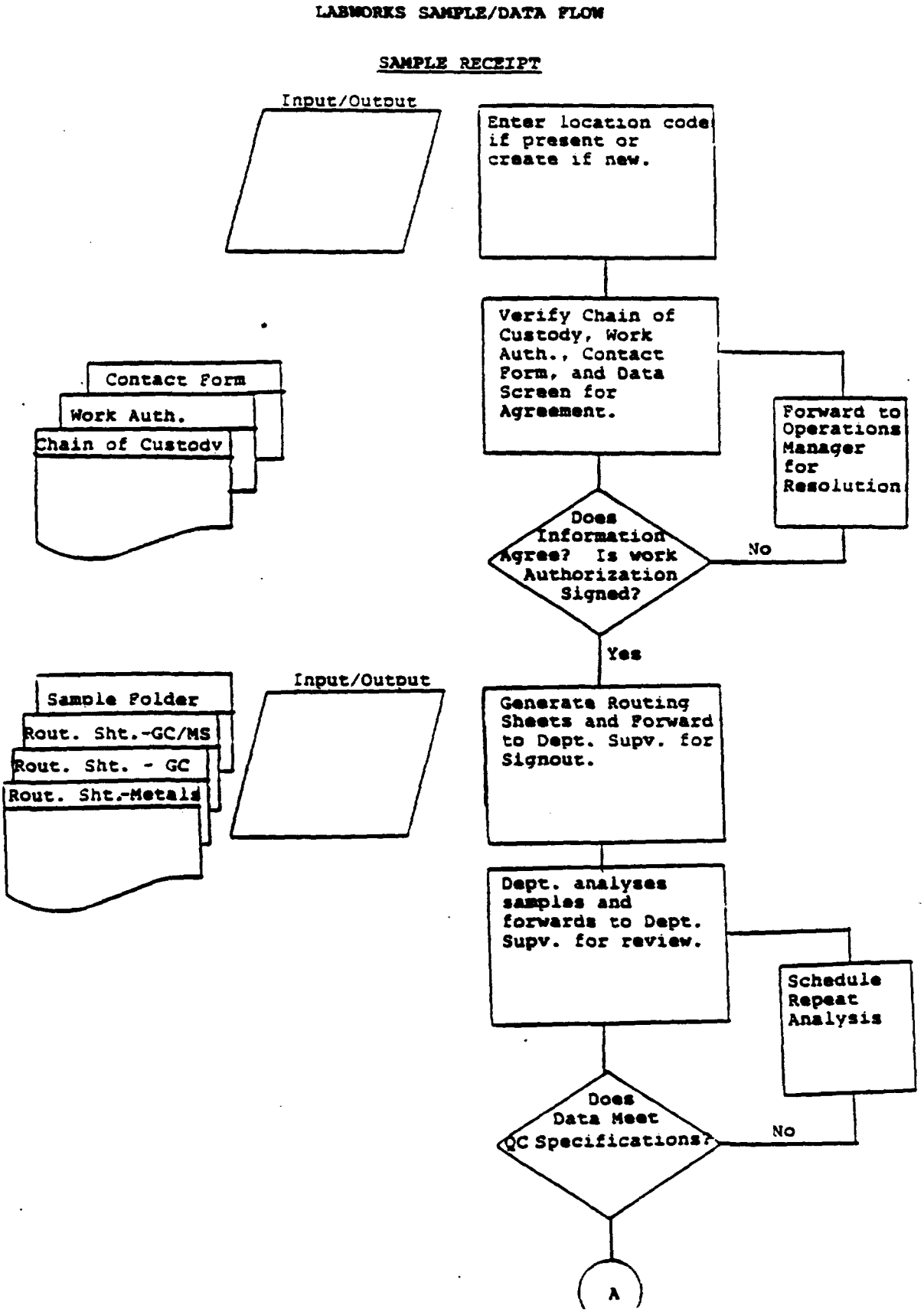
DISTRIBUTION: ORIGINAL AND YELLOW COPIES ACCOMPANY SAMPLE SHIPMENT TO LABORATORY.
PINK COPY RETAINED BY SAMPLERS. YELLOW COPY RETAINED BY LABORATORY.

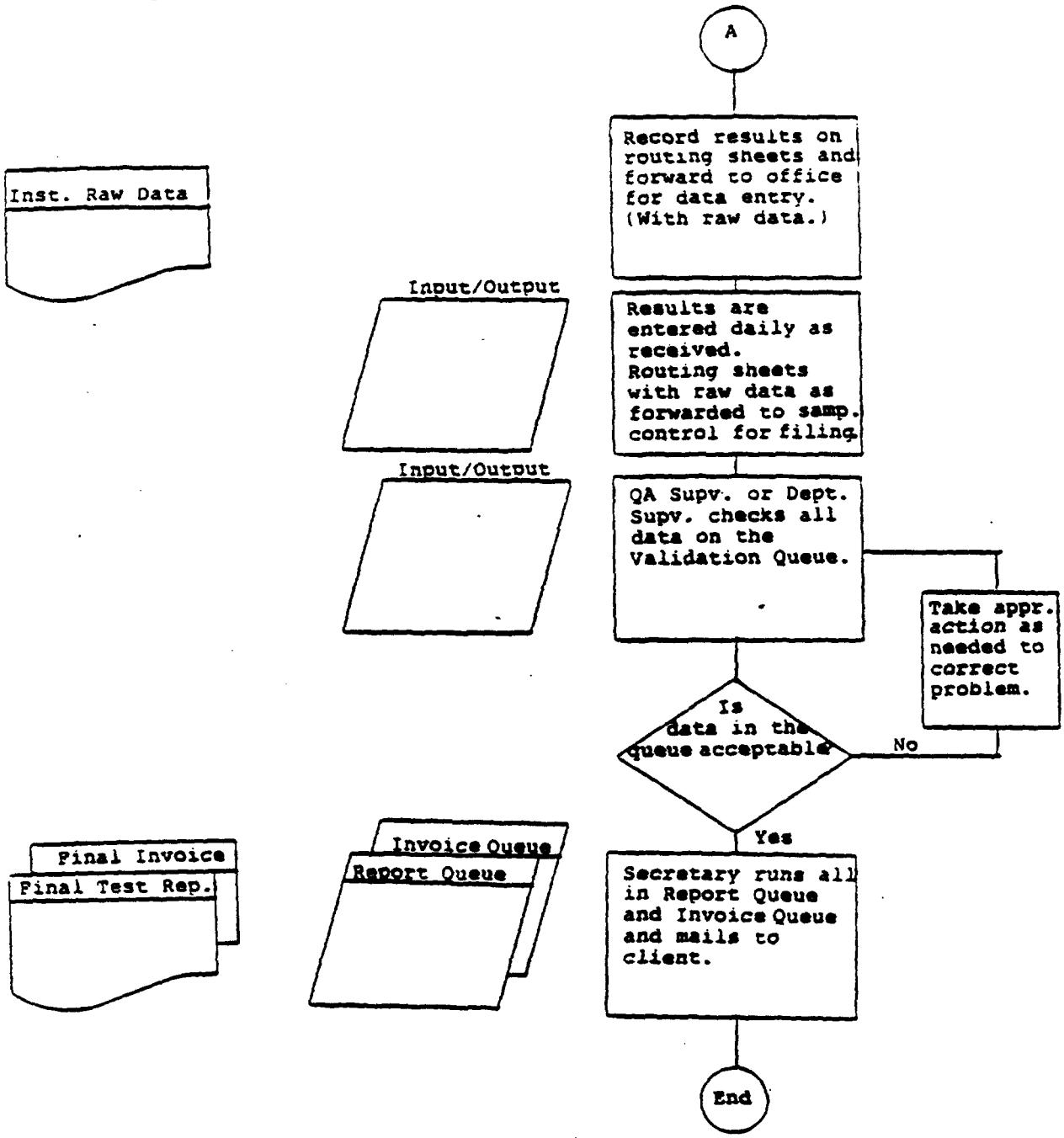
REMARKS _____

*SOURCE CODES

RECOVERY WELL - RW
RCRA MONITORING WELL - MW
SOIL / SEDIMENT - SO
SLUDGE - SL
NPDES DISCHARGE - ND
DRINKING WATER - DW
HAZARDOUS WASTE - HW
SURFACE WATER - SW
NON-AQUEOUS - NA

FIGURE 7-2. CHAIN OF CUSTODY FORM


LABWORKS SAMPLE/DATA FLOW
SAMPLE RECEIPT
Input/Output
Enter location code if present or create if new.
Verify Chain of Custody, Work Auth., Contact Form, and Data Screen for Agreement.
Contact Form
Work Auth.
Chain of Custody
Forward to Operations Manager for Resolution
Does Information Agree? Is work Authorization Signed?
No
Yes
Input/Output
Sample Folder
Rout. Sht.-GC/MS
Rout. Sht. - GC
Rout. Sht.-Metals
Generate Routing Sheets and Forward to Dept. Supv. for Signout.
Dept. analyses samples and forwards to Dept. Supv. for review.
Schedule Repeat Analysis
Does Data Meet QC Specifications?
No
A


A
Record results on routing sheets and forward to office for data entry. (With raw data.)
Inst. Raw Data
Input/Output
Results are entered daily as received. Routing sheets with raw data as forwarded to samp. control for filing.
Input/Output
QA Supv. or Dept. Supv. checks all data on the Validation Queue.
Take appr. action as needed to correct problem.
Is data in the queue acceptable
No
Yes
Final Invoice
Final Test Rep.
Invoice Queue
Report Queue
Secretary runs all in Report Queue and Invoice Queue and mails to client.
End

8.0 CALIBRATION PROCEDURES AND FREQUENCY

At a minimum all instruments and other equipment used by Law will be calibrated and maintained at the recommended intervals prescribed by the analytical method employed. In those cases where it has been demonstrated that more frequent calibration or maintenance is required, the base method will be enhanced as necessary. Calibration checks and preventive maintenance procedures are permanently recorded in a log book for future reference. Whenever possible, calibration checks on instruments and support equipment are performed using reference materials (e.g., weights) which are traceable to EPA EMSL or bear certificates of standardization from the National Bureau of Standards.

All chemical standards used by Law are certified of the highest reasonable purity with assays or certificates of analysis provided with the material. All materials are purchased from established and reputable chemical dealers. All standard materials are dated and stored under appropriate conditions in order to maintain chemical stability. Each time a specific standard is prepared, the material mass and dilution information

is recorded in the standards record book. All prepared standards (stock and working) are labeled in reference to the book number, page number, and entry number of the Analytical Standards Preparations Record Book. Additionally, the description, date, and analyst are given on the standard label. The Analytical Reagent Label is presented in Figure 8-1.

FIGURE 8-1. ANALYTICAL REAGENT LABEL

LAW ENVIRONMENTAL, INC.

STANDARD _____
CONCENTRATION _____
MATRIX _____
STANDARD REF. _____
BACKWARD REF. _____
EXPIRATION DATE ____/____/____
PREPARATION DATE ____/____/____ INITIALS _____

LAW ENVIRONMENTAL, INC.

STANDARD _____
CONCENTRATION _____
MATRIX _____
STANDARD REF. _____
BACKWARD REF. _____
EXPIRATION DATE ____/____/____
PREPARATION DATE ____/____/____ INITIALS _____

8.1 GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS) CALIBRATION

Analyses performed on the GC/MS will follow EPA Methods. This includes the following calibration procedure:

1. Instrument calibration will be performed every 12-hour time period. The GC/MS will be tuned to meet ion abundance criteria given in Table 8-1 and 8-2 for decafluorotriphenyl phosphine (DFTPP) and/or 4-Bromofluorobenzene (BFB).

2. Initial calibration will be performed on calibration standards at five concentration levels containing each compound of interest and each surrogate standard.

3. Every 12-hour time period a calibration check verification (CCV) standard will be analyzed. The calibration check compounds (CCC) must be less than 25 percent difference between the initial calibration and CCC's for semivolatiles and 25 percent difference for volatiles.The system performance check compounds (SPCC) response factors must be greater than 0.5 for semivolatiles and 0.3 for volatiles except for Bromoform which must be greater than 0.25.

8.2 GAS CHROMATOGRAPH (GC) CALIBRATION

Analyses performed on the GC will follow EPA Methods. This includes the following calibration procedure:

1. GC system is checked prior to analysis of samples to ensure reliability and reproducibility of analytical results.This is done on a daily basis.

2. GC is calibrated with five standards and a calibration blank using external standard technique.

3. A calibration curve for each compound is prepared. If ratio of response to amount injected is constant over the working range (< 10-20 percent relative standard

deviation [RSD] depending on the method used), the 5-point calibration curve is used.

4. Verify the calibration with an outside verification standard.

5. Verify the calibration blank.

TABLE 8-1. DFTPP KEY IONS AND ABUNDANCE CRITERIA[a]

Mass	Ion Abundance Criteria
51	30-60% of mass 198
68	<2% of mass 69
70	<2% of mass 69
127	40-60% of mass 198
197	<1% of mass 198
198	Base peak, 100% relative abundance
199	5-9% of mass 198
275	10-30% of mass 198
365	>1% of mass 198
441	Present but less than mass 443
442	>40% of mass 198
443	17-23% of mass 442

[a]J.W. Eichelberger, L.E. Harris, and W.L. Budde. "Reference Compound to Calibrate Ion Abundance Measurement in Gas Chromatography-Mass Spectrometry", Analytical Chemistry, 47, 995 (1975).

TABLE 8-2. BFB KEY IONS AND ABUNDANCE CRITERIA[a]

Mass	Ion Abundance Criteria
50	15-40% of mass 95
75	30-60% of mass 95
95	base peak, 100% relative abundance
96	5-9% of mass 95
173	less than 2% of mass 174
174	less than 50% of mass 95
175	5-9% of mass 174
176	greater than 95% but less than 101% of mass 174
177	5-9% of mass 176

[a]EPA Method 8240, SW-846, 3rd Edition, November 1986.

8.3 GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) CALIBRATION

Metal analyses performed on the GFAA will follow current EPA Methods. Instrument must be calibrated daily or once every 24 hours and each time instrument is set-up. This includes the following calibration procedure:

1. Verify instrument is operating satisfactorily by checking the energy output of the lamp and by checking the characteristic mass on the mid-point standard.
2. Set the instrument zero by running a calibration blank.
3. Calibrate instrument with four standards and a calibration blank.
4. Verify the calibration with a 2nd source outside verification standard.
5. Verify the calibration blank.
6. Verify low level standard calibration.

Every element which is to be analyzed by the GFAA must first go through the following calibration procedure:

1. The lamp must be peaked for position and for wavelength.
2. Temperature of the furnace must be calibrated at 2600 degrees centigrade.
3. After the proper conditions for each element are programmed for furnace operation, distilled water is

injected and run as a sample. This is done several times until the instrument response produces a steady base line absorbance.

8.4 INDUCTIVELY COUPLED PLASMA (ICP) CALIBRATION

Metal analyses on the ICP will follow current EPA CLP procedures. Instrument must be calibrated daily or once every 24 hours and each time instrument is set-up. This includes the following calibration procedure:

1. Verify instrument is operating satisfactorily by checking automatic gain setting and optical alignment.
2. Calibrate instrument with four standards and a calibration blank.
3. Calibrate with acid blank.
4. Verify the calibration with an outside verification standard.
5. Verify the calibration blank.
6. Check for interferences.
7. Verify low-level standard calibration.

8.5 COLD MERCURY VAPOR ANALYSIS CALIBRATION

Mercury analyses performed using the cold mercury vapor procedures will follow current EPA CLP procedures. This includes the following calibration procedure:

1. Optimize instrument setting and alignment by maximizing the energy setting.

2. Align cell minimizing absorbance readings.

3. Check absorbance of a 10 ppb standard.

4. Check correlation using five standards and calibration blank.

5. Verify analysis by running an initial calibration verification standard and a calibration blank.

8.6 UV-VIS SPECTROPHOTOMETER CALIBRATION

The UV-Vis spectrophotometer is calibrated daily. The procedure for calibration is as follows:

1. Select wavelength and proper filter.

2. Set readout control at A. Insert reference cuvette.

3. Set approximately 0.00 A with course control.

4. Set readout control at %T. Open sample compartment door and set -0.00% with 0%T control.

5. Close compartment door and set readout control at A. Set 0.00A with coarse and fine controls.

6. Remove reference cuvette. Insert standard solution. Four standards and a blank are used to create the calibration curve. Absorbance is reached for each standard. The calibration curve is generated by using a hand-held calculator and calculating a linear regression curve.

7. Insert samples, read absorbance, and determine sample concentration from the linear regressed curve.

8.7 DISSOLVED OXYGEN (DO) METER CALIBRATION

DO meter(s) are calibrated before each use following procedures specified by the manufacturers with calibration confirmation by comparison against a Winkler standardization. The following procedures are followed:

1. Turn the instrument on and let the probe stir in deionized water for 10 minutes.
2. Remove probe and carefully dry excess water from the membrane with a tissue.
3. Allow the probe to stand in an empty BOD bottle until a stable reading is obtained, usually about 3 minutes.
4. Calibrate using the knob on the instrument. Make appropriate adjustments according to temperature compensation table on reverse side of the instrument.
5. Confirm calibration acceptability by comparison to a Winkler standard.
6. Check the calibration at the end of the analyses or sooner if data warrants.

8.8 FIELD INSTRUMENT CALIBRATION

The pH and conductivity instrumentation will be calibrated and

operated in the field following standard EPA Methods 170.1 and 120.1. All calibration solutions employed in the field will be fresh and replaced on a weekly basis. The pH and conductivity meters will be factory serviced a minimum of once per year.

Certified GC and GC/MS calibration materials are obtained from Supelco, ULTRA Scientific, Chem. Service, and Restek. Metal calibration standards are obtained from Spex Industries and VHG Labs. Additionally, QA/QC material is obtained from EPA Quality Assurance Branch, Cincinnati, Ohio; and/or Environmental Resource Associates. These QA/QC samples are analyzed at least on a quarterly basis.

9.0 ANALYTICAL PROCEDURES

The Laboratory Manager ensures that these procedures are strictly adhered to by routinely inspecting the different instrumentation stations and checking that the appropriate calibrations and maintenance are being conducted. The QA/QC Coordinator will also independently inspect log-in documents and data to ensure acceptability of final results and adherence to SOPs. The analytical parameters and methods are given in Table 5-1. The organic parameters given in Table 5-1 are parameters selected for analyses and obtaining QC limits. Table 9-1 contains organic parameters with their respective methods. Table 9-2 contains inorganic parameters with methods. Table 9-3 contains extraction/digestion methods used for metals and organics.

TABLE 9-1. STANDARD ANALYTICAL PROCEDURES FOR ORGANIC PARAMETERS

PARAMETERS	EPA METHODS[1]
Purgeable Halocarbons	601, 8010
Purgeable Aromatics	602, 8020
Phenols	604, 8040
Organochlorine Pesticides and PCBs	608, 8080
Purgeables	624, 8240/8260
Base/Neutrals and Acids	625, 8270
Chlorphenoxyacid Herbicides	615, 8150

[1]EPA Methods
601, 602, 608, 624 and 625 = 40 CFR, Part 136, Appendix A, Federal Register, Revised as of July 1, 1986.

8000 Series = Test Methods for Evaluating Solid Waste, EPA SW-846, 3rd Edition, November 1986.

615 = Federal Register, Vol. 49, No. 209, October 26, 1984, revised Vol. 50, No. 3, January 4, 1985.

TABLE 9-2. STANDARD ANALYTICAL PROCEDURES FOR INORGANIC PARAMETERS

PARAMETERS	METHODS FURNACE	ICP	COLD VAPOR
Aluminum		200.7/6010	
Antimony		200.7/6010	
Arsenic	7060	200.7/6010	
Barium		200.7/6010	
Beryllium		200.7/6010	
Boron		200.7/6010	
Cadmium		200.7/6010	
Calcium		200.7/6010	
Chromium		200.7/6010	
Cobalt		200.7/6010	
Copper		200.7/6010	
Iron		200.7/6010	
Lead	7421	200.7/6010	
Magnesium		200.7/6010	

TABLE 9-2. STANDARD ANALYTICAL PROCEDURES FOR INORGANIC PARAMETERS (Continued)

PARAMETERS	METHODS FURNACE	ICP	COLD VAPOR
Mercury		200.7/6010	7470/7471
Molybdenum		200.7/6010	
Nickel		200.7/6010	
Potassium		200.7/6010	
Selenium	7740	200.7/6010	
Silver		200.7/6010	
Sodium		200.7/6010	
Thallium	7841	200.7/6010	
Tin		200.7/6010	
Vanadium		200.7/6010	
Zinc		200.7/6010	

TABLE 9-3. EXTRACTION/DIGESTION METHODS USED FOR METALS AND ORGANICS

METAL DIGESTIONS		
Digestion for dissolved metals of aqueous samples	EPA	3005
Digestion for aqueous samples	EPA	3010
Digestion for aqueous samples	EPA	3020
Digestion for oil samples	EPA	3040
Digestion for soil/sediment samples	EPA	3050
EPTox Extraction	EPA	1310
TCLP Extraction	EPA	1311

ORGANIC EXTRACTIONS		
Separatory funnel extractions	EPA	3510
Continuous L/L Extractions	EPA	3520
Soxhlet Extractions	EPA	3540
Sonication extraction	EPA	3550
Purge and Trap extractions	EPA	5030
Organic Dilution	EPA	3580

10.0 DATA REDUCTION, VALIDATION, AND REPORTING

10.1 DATA REDUCTION

The majority of data reduction at Law is performed by the data station associated with that particular piece of analytical equipment. Specifically, data stations are present with all instruments.

The analyst signs the sample out, performs the analysis, enters the data on the parameter forms(ie: sign out/sign in forms, bench sheets,analysis log forms, Lims reports,etc.), and corresponding data system(s), and signs the sample in. Paramater forms contain all necessary information to establish sample identity, integrity, calibration evaluation, and analytical observations/results to process/validate the sample test data. See Appendix E for laboratory parameter forms. A parameter form key is provided to the analyst which specifies the way in which paramter forms are to be filled out (i.e., notation, significant figures, etc.), the data reduction formulae and the QC samples required and their control criteria. QC samples include duplicates, matrix spikes, duplicates, or matrix spike duplicates, continuing calibration verification standards(CCVs),

etc. Calculations are performed by the data station at each instrument and/or specialized software utilized by MIS Department. The use of rounding rules and significant digits for numerical data are in accordance with EPA-600/4-79-019 publication, Handbook for Analytical Quality Control in Water and Wastewater Laboratories.

10.2 DATA VALIDATION

10.2.1 First Level Review, the Analyst

The analyst's primary responsibilities are the calibration of the instruments, incorporation of the required QC samples, and sample analysis.

The analyst has the important role of ensuring the instrument is calibrated prior to starting the analysis of any particular batch of samples. The analyst will ensure that the sensitivity responses of each instrument are performing satisfactorily. The analyst will ensure that the system is stable and that any interferences have been minimized or eliminated. Additionally, the analyst will check to ensure that there is no unacceptable high background response due to any reagents used in the analytical process. Once the analyst has ensured that the instrument has been calibrated and is responding in the

appropriate manner, the analyst will proceed to complete the analysis of samples.

The analyst's responsibilities will include the exercising of his own expertise and the Supervisor's if necessary, in evaluating the data generated with each batch of samples, as well as the QA parameters using the project QA limits (Table 5-1). The analyst will submit the data to his Supervisor.

10.2.2 Second Level Review, the Supervisor

The Supervisor of each section will be responsible for reviewing on a daily basis all data generated by analysts within his/her section. The review of the quality associated with each set of data will be of a more rigorous nature. The Supervisor and/or Laboratory Manager will review the QA data to verify that the results are within the prescribed limits.

Only under extraordinary circumstances will the Laboratory Manager allow the acceptance of a set of data from duplicates or spike determination beyond the project QA limits. All data associated with out-of-control QA/QC samples will be flagged, and a corrective action report will be generated for review by the QA/QC Coordinator and Laboratory Manager. The QA/QC Coordinator and Laboratory Manager may require that the analysis be repeated.

10.2.3 Third Level Review, the QA/QC Coordinator

The QA/QC Coordinator will review a portion of all preliminary sample and QC data. The review will consist of the following:

1. Verifying analysis system performance and calibration acceptability.

2. Verifying sample results by tracing the final number back to the raw data;

3. Verifying the QC data has met project QC frequency and control limits or, if the requirements were not met, verifying that documentation is present explaining why the data were accepted and verify that the data were flagged to signify an out-of-control situation;

4. Verify that sample holding times meet Table 6-1 requirements;

5. Verify that samples were analyzed using methods specified in the QAP; and

6. Verify that the proper chain-of-custody procedures were documented.

Preliminary data may be presented to the client by the Laboratory Manager, before the final data report is sent to the client.

10.3 REPORTING OF DATA

All final reduced data for samples analyzed will be reported to the client in the units appropriate for that type of analysis. The units are given in Table 5-1. All soil and sediment data will be reported on a dry-weight basis. All sludge data will be reported on a wet-weight basis unless specified by EPA protocol for dry weight basis. Client confidentiality will be strictly observed and maintained at all times. The data flow scheme from the collection of raw data through reporting of data to the client is shown (See Figure 7-3).

10.4 GENERAL DATA REQUIREMENTS

The largest problems facing data management for QA/QC deal with reduction and control for data. For the purposes of this document, data will be defined as any hard copy, file (i.e., client file), or computer file. Reduction of data prevents multiple copies of data from being erroneously used. Assume that a report is generated on a hard disk, then copied onto a floppy disk. At a later date, the hard disk version is updated. Unless the floppy disk copy is also updated, all use of the information contained on the disk may be inaccurate and cause poor data to be

reported. Reducing data will prevent this from occurring. Control must be exercised to maintain an organized flow of data. Duplicate effort and inefficiencies may result from poor control. A well defined, well organized system will permit all data users to understand how to obtain that day's work, how to report the work when finished, and aid in problem resolution. (Information flow will be covered in detail in a later section.)

10.5 FILE BACKUP/DATA ARCHIVE

Backups for client information for the LIMS will be performed as deemed necessary.

10.6 DATA MANAGEMENT CHAIN-OF-CUSTODY

All information pertaining to clients must be treated with the highest degree of confidentiality. The data must be protected in the following manner:

- Client hard copies must be in a locked file cabinet.
- Computer data systems must have sufficient data security features to prevent unauthorized access.
- Telephone conversations about data must be restricted to persons authorized to do so.
- Data in archived form must also receive the same consideration.

- Proper legal concerns will follow when dealing with data. (i.e., white out or other masking products will not be used. Errors should be marked through once, corrected, and initialed and dated.)

10.7 PERSONNEL TRAINING

An aggressive training program for employees entering the data has been initiated. This program will provide the employees with apprpriate information to establish a working knowledge of what is being entered rather than "just numbers on a page". Chemists that are tasked with dealing with the LIMS will receive training regarding the operation of computers as well as the software packages involved.

10.8 ERROR DETECTION

The LIMS has built in features for error trapping. Cyclic Redundacy Checks (CRCs) and Check Sums are used to monitor transmission quality. If a bad packet is obtained the system automatically retransmitts the necessary data. The integrity of the data base is maintained through a routine regime of backing up on tape. In addition, specification checking for upper and lower control/warning limits can be input per sample. Since systems cannot be designed to be error proof, the main focus continues to be attention to detail and an adequate layout of

double check systems. All data being processed through the LIMS is double checked by at least two of the following: analyst, department supervisor, Progect Manager/Coordinator, QA/QC Coordinator, Laboratory Manager. These checks include evaluation of data/reports for typographical errors, historical data trends, etc.

10.9 INFORMATION FLOW

DOCUMENTS	DATA QUEUE	PROCESS
Contact Form	Library	Create Location and Analysis codes and record on Contact Form Copies of Contact Form to Sample Control
Chain-of-Custody Work Authorization Purchase Order	Data Log-In	Samples received Documentation checked against samples and system entries **Does the information agree?** **<u>No</u>: Contact Laboratory Mgr.** **<u>Yes</u>: Continue** **Is a PO# or Job# Present?** **<u>No</u>: Contact Laboratory Mgr.** **<u>Yes</u>: Continue** **Are any samples damaged?** **<u>No</u>: Continue** **<u>Yes</u>: Record information on applicable form and contact Laboratory Mgr.**
Routing Sheets Inorganic/Organic Check out form	Data Pending	Generate routing sheets, sample receipts, etc. Place samples in walk-in cooler and follow sample custody SOP Initiate inorganic/organic check out form

DOCUMENTS	DATA QUEUE	PROCESS
		Analyst collects routing sheets, signs out samples, and removed samples from cooler.
		Analyses completed on samples Results recorded on routing sheets Department Supervisor reviews completed sheets against raw data
		Is data acceptable? **<u>No</u>: Correct problem and order re-run or contact Laboratory Manager for resolution** **<u>Yes</u>: Continue**
	Data Directory	Return routing sheets for data entry or automated data transfer
	Validation	After all data entry for each sample has been completed, the results are validated by the QA/QC Coordinator
		Is data acceptable? **<u>No</u>: Order re-run and contact Laboratory Manager for resolution** **<u>Yes</u>: Continue**
Final Report	Report	Generate final report to client

DOCUMENTS	DATA QUEUE	PROCESS
Final Invoice	Invoice	Generate final invoice to client
	Inactive	Archive data

NOTE: QC checks are presented in bold.

11.0 FIELD AND LABORATORY QUALITY CONTROL CHECKS

11.1 ANALYTICAL DATA RECORDING, STANDARDS, AND REAGENTS

After the samples have been properly collected, preserved, and documentation inspected and entered into LIMS system, they are held in sample receiving until the appropriate analyst signs out the sample via intra-lab chain-of-custody form (See Figures 11-1 and 11-2). Upon signing out of the sample and selection of the appropriate SOP, the analyst is ready to prepare for the actual analysis.

11.1.1 Analytical Standards and Reagents

The quality of all analytical results is dependent on many factors. One such area deals with the preparation of analytical standards and reagents. All materials used by Law for standards are certified chemicals of the highest reasonable purity. All materials are purchased from established and reputable chemical dealers. All standard materials are dated and stored under appropriate conditions in order to maintain chemical stability. Most standards (97%) are EPA reference traceable.

FIGURE 11-1. CHECK OUT/CHECK IN CUSTODY FORM FOR INORGANICS

DV092691

INORGANIC CHECKOUT FORM
LENL-Pensacola, FL

Client: _____ Case: _____ SDG: _____

Location: _____ Calib. Ref. _____ Form Iniated ___/___/___

S=Sample		CHECKED OUT		D=Digestate		Y=Yes		CHECKED IN		N=No
Type S/D	Date	Time	Removal Purpose*	Taken By	Cust. App.	Date	Time	Return By	Cust. App.	Complete Y/N-S/D

* REMOVAL PURPOSE

PREPARATION
- A - pH / % Moisture
- B - ICP Digestion
- C - GFAA Digestion
- D - Hg Digestion
- E - Solids

ANALYSES
- G - ICP
- H - GFAA
- I - Hg-CV
- J - CN
- K - Solids
- L - R/C/I

DISPOSITION
- V - Storage
- W - Return
- X - Consumed/ Disposal

Y - TCLP Extract - SV/Metals

Z - OTHER (List on Back)

SAMPLES CONSTITUTING THIS BATCH

Matrix: Level: # Sample Containers:

Sample ID	Analyses Req'd	Sample ID	Analyses Req'd
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	

FIGURE 11-2. CHECK OUT/CHECK IN CUSTODY FORM FOR ORGANICS

DV092691

ORGANIC CHECKOUT FORM
LENL-Pensacola, FL

Client: _____ Case: _____

ation: _____ Calib. Ref. _____ Form Iniated ___/___/___

S=Sample			CHECKED OUT		X=Extract	Y=Yes		CHECKED IN		N=No
Type S/X	Date	Time	Removal Purpose*	Taken By	Cust. App.	Date	Time	Return By	Cust. App.	Complete Y/N-S/X

*** REMOVAL PURPOSE**

PREPARATION
- A - pH / % Moisture
- B - Extract SV - TPH
- C - Extract SV - Acids
- D - Extract SV - B/N's
- E - Extract SV - B/N/A's
- F - Extract TRPH
- G - Extract Pest/PCBs
- H - Clean-up SV
- I - Clean-up Pest/PCBs
- J - Extract - HPLC
- Y - TCLP Extract - VOA's

ANALYSES
- K - Screening
- L - VOA - GC
- M - VOA - GC/MS
- N - VOA - TPH
- O - SV - GC/MS
- P - SV - TPH
- Q - Pest/PCB - GC
- R - GC/MS Confirmation
- T - HPLC
- U - TRPH

DISPOSITION
- V - Storage
- W - Return
- X - Consumed/ Disposal

Z - OTHER (List on Back)

SAMPLES CONSTITUTING THIS BATCH

Matrix: Level: # Sample Containers:

Sample ID	Analyses Req'd	Sample ID	Analyses Req'd
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	

The preparation of specific standards is outlined in the appropriate SOP. Each time a standard is prepared, the material mass and dilution information is recorded in the standards record book.

All prepared standards (stock and working) are labeled in reference to the book number, page number, and entry number of the Analytical Standards Preparations Record Book. Additionally, the description, date, and analyst are presented on the standard label. The analytical label is presented (See Figure 8-1).

11.2 FIELD MINIMUM QC CHECKS

11.2.1 Field Duplicates

At least one duplicate sample must be collected per parameter for each group of samples of similar matrix type or for every 20 samples collected, whichever is more frequent.

11.2.2 Split Samples

Split samples will be collected upon DER request.

11.2.3 Blank Samples from the Field

Blank samples are required to control and evaluate contamination within the sampling procedure. There are three types of blank samples; trip blanks, equipment blanks and field blanks.

11.2.3.1 Trip Blanks

For volatile organic parameters the sampling team will transport a trip blank into the field for each day of sampling at a minimum rate of 5 percent per parameter group per site. The trip blank will not be opened in the field. A trip blank is laboratory blank water and is a check on sample contamination originating from sample transport, shipping, and site conditions. Trip blanks are analyzed for all parameters and are transported into the field in the proper container with preservatives or additives, if required for that parameter group. The containers for each parameter group and preservatives are specified in Table 6-1.

11.2.3.2 Equipment Blanks

An equipment blank will be collected at a frequency of 5 percent per parameter per site per day. The equipment blanks are composed of a blank water rinse from the equipment used at that

site (e.g. bailers, pump tubing, spoons, augers, etc.). The rinse water is poured over or through the decontaminated equipment, collected in the sample container, properly preserved, and returned to the laboratory as a sample. Equipment blanks are a check on sampling device cleanliness.

11.2.3.3 Field Blanks

A field blank will be collected at a frequency of 5 percent per parameter per site per day. The field blanks are composed of fresh source blank water that has been poured in the field into the sample container, properly preserved, and returned to the laboratory as a sample. Field blanks are required to be able to evaluate the sample container filling procedure, site contamination, and preservation contamination.

11.3 LABORATORY MINIMUM QC CHECKS

For the parameters in Table 5-1, a minimum of one sample or 1 in 20 samples of a similar matrix and level of concentration will be spiked and duplicated. Specific minimum QC requirements are given in the following subsections for GC, GC/MS and metals.

11.3.1 Gas Chromatography Minimum QC Checks

For GC analysis by EPA Methods, the minimum QC requirements are as follows:

1. Surrogate compounds will be spiked for EPA Methods 601, 8010, 602, 608, 8080, 8020, 615 and 8150 into each sample, standard, and reagent water blank. Table 11-1 lists the surrogate compounds for each analysis. The target spike concentration should be 30 ug/L. The QC limits have not been established as of this QAP; however, the procedure and precision limits are described in EPA Method 8000 and are as follows:

   a. For each sample analyzed, calculate the percent recovery of each surrogate in the sample.

   b. Once a minimum of 30 samples of the same matrix have been analyzed, calculate the average percent recovery (p) and standard deviation of the percent recovery (s) for each of the surrogates.

   c. For a given matrix, calculate the upper and lower control limit for method performance for each surrogate standard. This should be done as follows:

      - Upper Control Limit (UCL) = $p + 3s$
      - Lower Control Limit (LCL) = $p - 3s$

   d. If recovery is not within limits, the following is required:

      - Check to be sure there are no errors in calculations, surrogate solutions, or internal standards. Also, check instrument performance.

- o Recalculate the data and/or reanalyze the extract if any of the above checks reveal a problem.

- o Reextract and reanalyze the sample if none of the above are a problem or flag the data as "estimated concentration."

2. At least one sample or 1 in 20 samples (whichever is more frequent) will be spiked to assess accuracy of the data.

   Parameters and QC Limits are given Table 5-1.

3. At least one sample or 1 in 20 samples (whichever is more frequent) will be spike duplicated to assess precision of the data. The duplicate spike will be a replicate of Item 2 above. The QC limits are given in Table 5-1.

4. Samples will be within the concentration range of the standards (refer to Section 8.2 for GC calibration).

5. A mid-point calibration verification standard should be analyzed at the beginning of a run to confirm calibration is o.k.; also at end.

6. At least one reagent water blank must be analyzed each day to demonstrate that interferences and/or contamination are not present. If a problem exists, corrective action will be taken before samples are analyzed.

7. A QC check sample prepared independently from the calibration standards will be analyzed at least every 40 samples.

TABLE 11-1. SURROGATE SPIKING COMPOUNDS FOR GC ANALYSES

Surrogate Compound	EPA Method	Spike Amount
Bromochloromethane	601/8010	40 ppb
2-Bromo-1-chloropropane	601/8010	40 ppb
1,4-Dichlorobutane	601/8010	40 ppb
a,a,a-Trifluorotoluene	602/8020	40 ppb
Fluorobenzene (Ft. Knox only)	602/8020	40 ppb
Dibutylchlorendate	608/8080	200 ppb
2,4,5,6-Tetrachloro-m-xylene (Optional)	608/8080	200 ppb
2,4-DB	615/8150	20 ppb

NOTE: Spiking Amounts for Methods 608/8080 and 615/8150 are altered under the following conditions:

1. Spike amount is doubled if GPC cleanup is used.
2. Spike amount is doubled if medium level preparation is used.

11.3.2 GC/MS Minimum QC Checks

For GC/MS analysis by EPA Methods 625 and 8270, the minimum QC requirements are as follows:

1. Surrogate compounds will be spiked into each sample, standard and reagent water blank. Table 11-2 lists the surrogate compounds and spike recovery limits. The target spike concentration should be 50 ug/L for base/neutrals and 100 ug/L for acids.

2. Internal standards will be added to each sample, standard, and reagent blank. The final concentration of each internal standard will be 40 nanograms per microliter (ng/uL). The internal standards are as follows:

   - 1,4-Dichlorobenzene-d_4
   - Naphthalene-d_8
   - Acenaphthene-d_{10}
   - Phenanthrene-d_{10}
   - Chrysene-d_{12}
   - Perylene-d_{12}

3. At lease one sample or 1 in 20 samples (whichever is more frequent) will be spiked prior to sample extraction to assess accuracy of the data. The parameters and QC limits are given in Table 11-2.

4. At least one sample or 1 in 20 samples (whichever is more frequent) will be spike duplicated prior to sample extraction to assess precision of the data. The duplicate spike will be a replicate of Item 3 above. QC limits are given in Table 11-2.

TABLE 11-2. PERCENT RECOVERY LIMITS FOR SEMI-VOLATILES

SURROGATE SPIKE

Surrogate Compound	Water	Soil/Sediment
Nitrobenzene-d_5	35-114	23-120
2-Fluorobiphenyl	43-116	30-115
Terphenyl-d_{14}	33-141	18-137
Phenol-d_6	10-94	24-113
2-Fluorophenol	21-100	25-121
2,4,6-Tribromophenol	10-123	19-122

TABLE 11-2. PERCENT RECOVERY LIMITS FOR SEMI-VOLATILES (Continued)

MATRIX SPIKES

Matrix Compound	Water	Soil/Sediment
1,2,4-Trichlorobenzene	39-98 (28)	38-107 (23)
Acenaphthene	46-118 (31)	31-137 (19)
2,4-Dinitrotoluene	24-96 (38)	28-89 (47)
Pyrene	26-127 (31)	35-142 (36)
N-Nitrosodi-n-propylamine	41-116 (38)	41-126 (38)
1,4-Dichlorobenzene	36-97 (28)	28-104 (27)
Pentachlorophenol	9-103 (50)	17-109 (47)
Phenol	12-89 (42)	26-90 (35)
2-Chlorophenol	27-123 (40)	25-102 (50)
4-Chloro-3-methylphenol	23-97 (42)	26-103 (33)
4-Nitrophenol	10-80 (50)	11-114 (50)

Maximum relative percent difference between matrix spikes is listed in parentheses.

TABLE 11-3. PERCENT SPIKE RECOVERY LIMITS FOR VOLATILES

SURROGATE SPIKE

Surrogate Compound	Water	Soil/Sediment
4-Bromofluorobenzene	86-115	74-121
1,2-Dichloroethane-d_4	76-114	70-121
Toluene	88-110	81-117

MATRIX SPIKES

Matrix Compound	Water	Soil/Sediment
1,1-Dichloroethene	61-145 (14)	59-172 (22)
Trichloroethene	71-120 (14)	62-137 (24)
Benzene	76-127 (11)	66-142 (21)
Toluene	76-125 (13)	59-139 (21)
Chlorobenzene	75-130 (13)	60-133 (21)

11.3.3 Metals Minimum QC Checks

11.3.3.1 GFAA Minimum QC Checks

1. At least one matrix spike or 1 in 20 samples (whichever is more frequent) will be spiked prior to digestion. The spike recovery must be within +/- 25% of the spiking value. If the recovery is out of range, the data will be flagged.

2. A post-digestion spike (analytical spike) must be performed on every sample with a recovery of +/- 15% of the original sample concentration. In the event of a spike failure, the flow scheme in Figure 11-3 must be followed. Analytical spikes are considered as a sample.

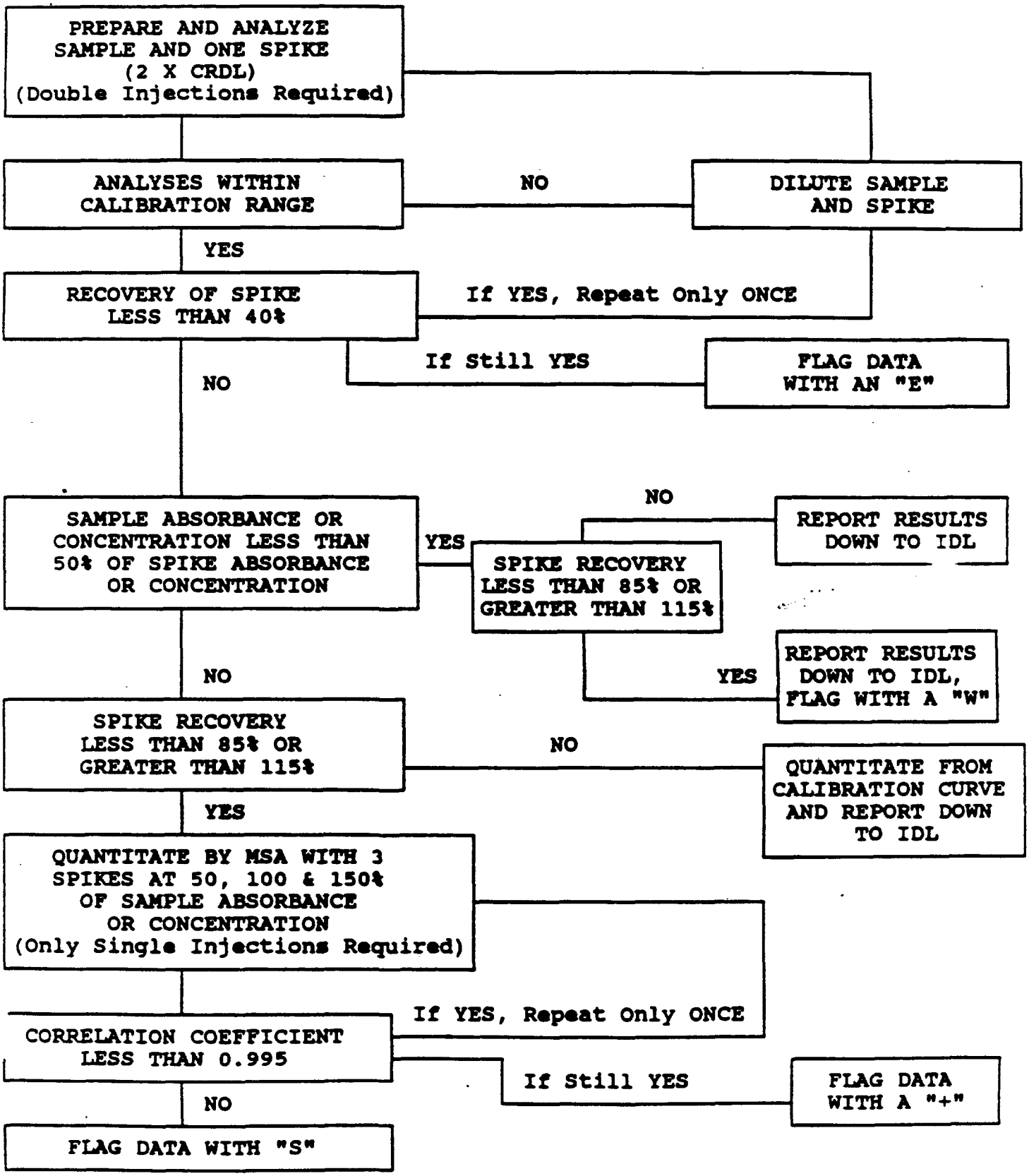
3. At least one sample or 1 in 20 samples (whichever is more frequent) will be duplicated prior to digestion to assess precision of the data. The QC limits are given in Table 5-1.

4. A calibration verification (ICV) will be analyzed immediately after calibration, after every 10 samples (CCV) and at the end of the run. The response must be within +/- 10% of the true value; if not, recalibration is required and any samples run prior to the out-of-control CCV must be reanalyzed. ICV/CCV standard solutions must be supplied by an EPA approved second source.

5. A continuing calibration blank (CCB) will be analyzed at the beginning, every 10 samples, and at the end of the run. The response must be less than the CRDL; if not, recalibration is required and those samples prior to the out-of-control CCB must be reanalyzed.

6. At least one reagent blank must be prepared and analyzed with each digestion lot or every 20 samples received, whichever is more frequent.

FIGURE 11-3. FURNACE ATOMIC ABSORPTION ANALYSIS SCHEME



11.3.3.2 ICP Minimum QC Checks

For ICP analysis by EPA Methods 200.7 and 6010, the minimum QC requirements are as follows:

1. At least one matrix spike or 1 in 20 samples (whichever is more frequent) will be spiked prior to digestion. The spike recovery must be within the limits in Table 5-1. If not, the data must be flagged with a corrective action report.

2. A post-digestion spike must be performed for those elements with spike recoveries falling outside the control limits. Spike the unspiked aliquot of the sample at 2x indigenous level or 2x CRDL.

3. At least one sample or 1 in 20 samples (whichever is more frequent) will be duplicated prior to digestion to assess precision of the data. The QC limits are presented in Table 5-1.

4. A CCV will be analyzed at the beginning, every 10 samples, and at the end of the run. The response must be within 10 percent of the initial response; if not, recalibration of the instrument is required and those samples prior to the out-of-control CCV must be reanalyzed.

5. A CCB will be analyzed at the beginning, every 10 samples, and at the end of the run. The response must be +/- CRDL; if not, recalibration is required and those samples prior to the out-of-control CCB must be reanalyzed.

6. An interference check solution must be analyzed at the beginning and at the end of the run (or at least every 8 hours); refer to EPA Methods for acceptable limits which are +/- 20%.

11.3.3.3 Mercury Cold Vapor Minimum QC Checks

For mercury analysis by EPA Methods 245.1, 7470 and 7471, the minimum QC requirements are as follows:

1. At least one matrix spike or 1 in 20 samples (whichever is more frequent) will be spiked prior to digestion to assess the accuracy of the data. The QC limits in Table 5-1 should be met; if not, the data must be flagged with a corrective action report.

2. At least one sample or 1 in 20 samples (whichever is more frequent) will be duplicated prior to digestion to assess precision of the data. The QC limits are given in Table 5-1.

3. A CCV will be analyzed at the beginning, every 10 samples, and at the end of the run. The response must be within 20 percent of the initial response; if not, recalibration of the instrument is required and those samples prior to the out-of-control CCV must be reanalyzed.

4. A CCB will be analyzed at the beginning, every 10 samples, and at the end of the run. The response must be less than the instrument detection limit; if not, recalibration is required and those samples prior to the out-of-control CCB must be reanalyzed.

12.0 PERFORMANCE AND SYSTEMS AUDITS

Law views quality assurance as the means by which the effectiveness and quality of its various participating departments are gauged as they carry on day-to-day operations under the QA/QC program. The major goals associated with the QA/QC program are listed below:

1. QA reviews should help ensure compliance with mandated QC procedures;
2. QA reviews provide a structured means of communicating problems between the technical and administrative portions of the company;
3. QA procedures are designed to ensure operating regularity between the various branches of Law; and
4. QA audits provide a mechanism by which our QC procedures are constantly being reviewed and updated in an orderly fashion.

12.1 SYSTEMS AUDITS

Systems audits are qualitative evaluations of all components of field and laboratory QC measurement systems. A systems audit will be performed periodically and will consist of inspecting the following procedures:

1. Sampling;
2. Sample custody;
3. Sample storage and preservation;

4. Sample preparation;
5. Analytical methodology;
6. Data management;
7. Preventative maintenance; and
8. Personnel qualifications.

In the past, Law has participated in systems audits from federal and state agencies, including on-site inspection by : Florida HRS, COE, AFCEE, NEESA, and Louisiana. Law will submit to on-site external systems audits by any prime contractor or their authorized representative.

12.2 PERFORMANCE AUDITS

A performance audit is a quantitative evaluation of a measurement system. Law participates in the following performance evaluation programs:

1. EPA, Environmental Monitoring Support Laboratory -- Cincinnati;

2. U.S. Army Corps of Engineers, Missouri River Division; and

3. Florida Department of Health and Rehabilitative Services (FDHRS).

Periodically blind QC samples are entered into the samples flow scheme. Since blind QC samples are difficult to enter into the laboratory without the knowledge of the analysts, the QA Manager relies heavily on the performance evaluation programs by outside sources and QC samples such as matrix spikes, duplicates and surrogates.

13.0 PREVENTATIVE MAINTENANCE

The first facet of the analytical process (after sample collection and preservation) is the manipulation of the sample by laboratory instrumentation and equipment. The quality of the final analytical product depends on the condition and dependability of the laboratory instrumentation and equipment.

It is the policy of Law to maintain all instruments, equipment, and supplies in the cleanest and highest state of readiness. In order to minimize downtime and out-of-control situations, Law scientists conduct a preventative maintenance program consisting of scheduled routine maintenance of all laboratory instruments and equipment. Law has secured manufacturers' service contracts on all major instruments. The routine maintenance schedule for laboratory instruments and equipment is presented below in the following subsections.

13.1 AA SPECTROPHOTOMETER PREVENTIVE MAINTENANCE

Law has the following AA spectrophotometers: Two Perkin-Elmer Model 5100Z; HGA furnace with Zeeman system equipped with AS-60 Autosamplers. One Perkin-Elmer 1100B flame AA unit retrofitted

for cold vapor mercury analysis. A manufacturer service contract is maintained on these instruments. The routine maintenance schedule for this equipment is found in Table 13-1.

13.2 ICP MAINTENANCE

Law has an ARL Model 3560 Simultaneous ICP with an Ultrasonic Nebulizer and autosampler and an ARL Model 3410 Sequential ICP with autosampler and ultrasonic nebulizer. In Table 13-2 is a short list of operator performed maintenance procedures. This list is provided to help the operator detect potential problems so corrective action may be taken. For problems not covered here, please refer to the Instrument Manual for specific directions. When in doubt, call the manufacturer.

TABLE 13-1. ROUTINE MAINTENANCE SCHEDULE FOR AA SPECTROPHOTOMETER

Maintenance
1. Contact cylinders, tube, and platform should be cleaned and checked each day before running samples. Use cotton swab and methanol for cleaning.
2. Contact cylinders should be checked for cracks and pitting. Tubes should be checked for pitting, peeling pryolitic coating and burn marks around sample port hole. Any of the above indicate a worn tube or cylinder.
3. Furnace/spectrometer windows should be checked and cleaned daily.
4. Check coolant level in recirculator and temperature setting daily.
5. Spectroscopy lab should be wet mopped, counters dusted, and exterior of instruments cleaned on a weekly basis to ensure a dust free environment.
6. Consult instrument operations manual for further maintenance instructions.
7. All maintenance is to be recorded in the Maintenance Log Book.
8. Argon gas pressure to furnace should be 60 psi. Check regulator to ensure proper pressure.

TABLE 13-2. ROUTINE MAINTENANCE SCHEDULE FOR ICP

Maintenance
1. Check reflected and incident watts on control panel.
2. Check gas flow rates.
3. Check nebulizer up-take rate periodically.
4. Nebulizer should be flushed with deionized water after each use.
5. Clean spray chamber when droplets form on the inside.
6. Clean torch if system starts to show memory effect (carryover) for a particular element.

13.3 GC PREVENTIVE MAINTENANCE

Law has the follow GCs/LCs:

3 Hewlett-Packard 5890, Dual ECD
5 Hewlett-Packard 5890, Dual FID
3 Hewlett-Packard 5890, PID, ELCD
1 Hewlett-Packard 1090, DAD, FLD

A manufacturer service contract is maintained on these instruments. An inventory of chromatographic accessories is maintained in the laboratory to minimize downtime. The maintenance schedule of this equipment is given in Table 13-3.

TABLE 13-3. ROUTINE MAINTENANCE SCHEDULE FOR GC

	Maintenance	Frequency
1.	Check carrier gas supply	Daily
2.	Check head pressure	Daily
3.	Change septums	As needed
4.	Change carrier gas filters	As needed
5.	Check baseline and detector response	Daily
6.	Air dust electronics and main frame	Annually

13.4 GC/MS PREVENTIVE MAINTENANCE

Law has the following GC/MS equipment: four Hewlett-Packard Model 5970 MSDs and a Model 5971 MSD. A manufacturer service contract is maintained on these instruments. Table 13-4 gives the maintenance schedule for these instruments.

13.5 UV-VIS SPECTROPHOTOMETER PREVENTIVE MAINTENANCE

The following practices from a daily care routine which will maintain the instrument in good condition.

1. Immediately clean all spilled materials from the instrument and wipe the instrument dry with lintless paper or cloth. Always place samples, etc., on a mixing tray.

2. Do not leave cuvettes in the sample compartment. Close the sample compartment door.

3. Whenever the instrument is not in relatively continuous use, turn it OFF, disconnect the line cord, and cover with the plastic cover.

The air filter should be checked frequently from the time the instrument was first installed to determine the length of time it takes to load the filter with dirt. This will vary with the amount of usage the instrument gets, but a suitable schedule can be determined for checking and cleaning the filter. The filter element is easily removed by pinching the foam plastic material

TABLE 13-4. ROUTINE MAINTENANCE SCHEDULE FOR GC/MS

	Maintenance	Frequency
1.	System Diagnostics	
	a. Scan box I/O test	Daily
	b. Scan box DMA test	Daily
	c. MS I/O test	Daily
	d. Filament test	Daily
	e. RF Power Test	Daily
	f. Electromultiplier test	Daily
	g. Background signal noise test	Daily
2.	Vacuum/Carrier Flow Check	
	a. Column headpressure check	Daily
	b. Vacuum check	Daily
	c. Replace septum	When needed
	d. Leak check and tighten fittings	When needed
3.	Instrument Tune Check	
	a. BFB/DFTPP tune check	Daily
	b. PFTBA tuning	When needed
4.	Calibration check	
	a. VOA standards check	Daily
	b. BNA standards check	Daily
	Replace inlet liner	When needed
5.	Clean source	When needed
6.	Replace column (or remove front end)	When needed

and pulling it loose from its mounting. After the filter element has been cleaned, push it back into place by tucking the edges into the slots which form a part of the frame.

The sample compartment should be cleaned every time anything is spilled into it to preserve the black matte finish on the compartment walls and to prevent corrosion or contamination. The bottom of the compartment is equipped with a drain which will run liquids off to the bench top underneath the instrument.

1. Remove the standard cell holder from the sample compartment by loosening the two knurled posts and lifting the holder out. If another holder is installed, see the applicable instructions for removal information.

2. Using a soft rag and soapy solution, lightly scrub away all foreign material. Using a clean soft rag dampened with water, rinse the cleaned surfaces thoroughly. Dry with a lintless tissue.

3. Clean the cell holder and the bottom plate, as necessary, using the same cleaning method.

13.6 ANALYTICAL BALANCE

Analytical Balances are serviced regularly by Weight Check. A log of all routine/non-routine maintenance is maintained by the QA/QC Coordinator.

All top loading scales are also maintained and serviced by G.T. Michelli Co.

13.7 OTHER MISCELLANEOUS EQUIPMENT

All balances, meters, spectrophotometers, ovens, and other laboratory equipment are monitored on a routine basis to ensure cleanliness, operational status, and accuracy. The monitoring of these items is recorded in the proper maintenance record book.

13.8 FIELD EQUIPMENT

Field Equipment is cleaned after each use and repaired if any malfunction is determined. The cleaning/maintenance/repair operations are recorded in the respective maintenance log.

All field equipment scheduled for use will be checked 48 hours prior to use. The following items must also be cleaned or checked:

1. Batteries - fully charged
2. pH - fresh solutions and responses
3. Temperature/conductivity meters
4. pH meters and probes
5. Interface probes

To ensure the proper performance of equipment in the field, the following spare parts and materials should be taken on all field work:

1. Sampling SOP manuals
2. Extra filling solution for pH electrodes
3. Alconox soap to clean interface probes
4. Extra pH reference solution
5. Extra distilled water
6. Extra batteries
7. Probe cleaner
8. Pertinent Equipment Operations SOP's

14.0 SPECIFIC PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

14.1 PRECISION

Precision is a measure of mutual agreement among individual measurements using the same test procedure. Precision will be assessed for all parameters listed in Table 5-1 calculating the relative percent difference (RPD) of two duplicate spike samples (for organic analysis) and two duplicate samples (for inorganic analysis) as follows:

$$RPD = \frac{|D_1 - D_2|}{(D_1 + D_2)/2} \times 100$$

Where D_1 and D_2 = concentration of duplicate spikes or samples 1 and 2, respectively, and RPD = Relative Percent Difference.

Precision data given in Table 5-1 are from Law historical data. The maximum RPD limit is recalculated after at least 20 values are reported. The upper limit is based on the mean RPD +3 standard deviations of the mean. The lower limit is always zero.

Standard deviation (SD) is calculated as follows:

14.2 ACCURACY

Accuracy is the degree of agreement between a sample's spike value (minus the sample's value) and a sample's spike target value. Accuracy is measured in terms of matrix spike percent recovery and is calculated as follows:

$$\text{Matrix Spike Percent Recovery} = \frac{SSR - SR}{SA} \times 100$$

Where,

SSR = Spike Sample Result
SR = Sample Result
SA = Spike added from Spiking Mix

The percent accuracy limits given in Table 5-1 are from Law historical data, EPA CLP, and EPA Methods. The percent accuracy limits are recalculated after 20 values are reported. New limits are based on the mean percent recovery +/- 3 standard deviations of the mean.

14.3 COMPLETENESS

Completeness is expressed as the percentage of valid data

obtained from a measurement system. For data to be considered valid, it must meet all the acceptance criteria including accuracy, precision, and any other criteria specified for the analytical method used. Completeness is computed by dividing the number of valid measurements by the total number of measurements. The result is expressed as a percentage.

$$\text{Percent Completeness} = \frac{\text{Number of valid measurements X 100}}{\text{Total Number of Measurements}}$$

The minimum percent completeness for a project is 90% .
If the percent completeness criteria is not met (Table 5-1), then the QA Manager must be notified immediately and corrective action taken. The corrective action may be reevaluating the QC limits, reanalysis, and/or resampling.

If precision and accuracy data do not meet acceptance criteria as specified in Table 5-1, results reported must be flagged as suspect and a corrective action report explaining the problem and a possible solution must be provided to the QA Manager. At the request of the QA Manager or Project Manager, the samples may need to be repeated.

15.0 CORRECTIVE ACTIONS

15.1 RATIONALE

An effective QC program requires rapid and thorough correction of QC problems. Rapid corrective action (CA) minimizes the possibility of questionable data on any project. The need for corrective action originates when an inadequacy is found in the method of analysis (e.g., inappropriate calibration) or a determinate error occurs (e.g., calibration error due to standards failure). Failures of the first kink are precluded by LENL and Regulator/Contractee audits which evaluate analytical SOPs. The analytical SOPs incorporate mechanisms to detect the existence of determinate errors and specify the procedures to correct them. Depending on the nature of the CA, it is classified as one of two types, immediate and long-term. Immediate corrective actions are the correction of procedures or repair of instrumentation that is working improperly. Long-term corrective actions eliminate the source of sampling, matrix or analytical problems by correcting systemic errors.

To provide a complete record of QC activities all QC problems and corrective actions applied must be documented. Historical

records assist laboratory management in identifying long-term corrective actions, such as personnel training, replacement of instrumentation, improvement of sampling procedures, etc.

A corrective action requires defined responsibilities for scheduling, performing, documenting, and assuring the effectiveness of the action.

15.2 STANDARD OPERATING PROCEDURES

Many times the source of a nonsystematic problem is obvious to the analyst and can be corrected immediately. Immediate corrective action routinely made by field technicians or laboratory analysts should be documented as normal operating procedures in instrument log books or personal notebooks. The Supervisor and analyst should compile a list of commonly encountered problems and the appropriate routine corrective actions (in addition to manufacturer's troubleshooting guides).

A quality assurance corrective action request and routing form, the Deficient Incident Report (DIR) (Figure 15-1), is used to document all corrective actions taken. The form may be initiated by any individual who observes a major problem. If more than one problem is involved, each problem should be documented on a

separate deficient incident report form.

Copies of the form are given to the Supervisor responsible for the analysis, the Laboratory Manager, and the QA/QC Coordinator. During the weekly staff meeting, a standing item for discussion is QA problems encountered that week. Once a problem has been technically defined, the Laboratory Manager and the QA/QC Coordinator discuss the problem and jointly take the following steps:

1. Determine that specific corrective action is needed to eliminate the problem and assign responsibility for investigating, implementing, and documenting the situation;

2. Set a time schedule for determining the required action;

3. Assign responsibility and time schedule to implement the desired action;

4. Establish desired effectiveness of the corrective action and implement the correction; and

5. Verify that the corrective action has eliminated the problem and document.

Deficient Incident Report Revision 051090

LENL-Pensacola, FL **Section:** _____

Analyst: _____ **Date:** __/__/__ **Supervisor:** _____ **Date:** __/__/__

Description

SDG/Samples Affected

Resolution

The Laboratory Manager and QA/QC Coordinator are responsible for approving all corrective actions.

Corrective action is not complete until the problem has been effectively and permanently solved. Follow-up action to ensure that the problem remains corrected is a vitally important step in the corrective action procedure.

Law will implement any corrective action deemed necessary by the Prime Contractor.

16.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The management is informed of QA activities in three ways: (1) by immediate verbal notification of QA problems, (2) by interim QA reports, and (3) a written final QA report.

A final report will be prepared and submitted to the Prime Contractor at the end of a project by the QA/QC Coordinator. Interim QA reports are prepared for projects lasting more than 6 months. These reports will include the following QA items:

- An assessment of QC (accuracy, precision, and completeness);
- Performance and system audit results;
- Significant QA problems encountered and results of corrective actions taken; and
- Position of the individual preparing the QA reports.

17.0 RESUMES OF KEY PERSONNEL

PROFESSIONAL RESUME

NAME: James M.G. Tucci

TITLE: Laboratory Manager

EDUCATION: B.S. Zoology - University of Maryland
Graduate Studies - University of Maryland

QUALIFICATIONS NARRATIVE:

As Laboratory Manager of Law Environmental's Pensacola facility, Mr. Tucci has overall responsibility for ensuring the quality and timeliness of analytical efforts, as well as maintaining and enhancing the cost effective performance of the staff of over 50 people. His duties include providing technical assistance to clients regarding field sampling activities, analytical requirements and assisting them in interpretation of the results.

Mr. Tucci ensures that laboratory performance conforms to the requirements of the various approved methods such as those specified by the USEPA in 40CFR 136, SW 846 and the Contract Laboratory Programs (CLP) Statements of Work. He is responsible for the effective flow of samples through the laboratory, while managing all overtime, purchasing and the financial planning necessary for laboratory growth. Mr. Tucci also oversees the activities of the in-house safety committee and manages the laboratory's hazardous waste program.

SPECIAL TRAINING:

Mr. Tucci has vast experience with the U.S. Army and Environmental Restoration Program as an analytical chemist. Other areas of expertise include personnel management; laboratory analysis in the areas of bacteriology and microbiology; environmental field studies and animal research.

SELECTED EXPERIENCE:

- <u>Quality Assurance Manager, Environmental Protection Systems, Inc.</u> Maintained procedures that ensured that all analyses conducted under the CLP program followed the quality control (QC) guidelines of the EPA. Also performed quarterly, in-depth audits of the entire field and analytical process and the program data management process; served as a

PROFESSIONAL RESUME: James M.G. Tucci (Continued)

clearing-house for all substantive changes and quality assurance methodologies; and monitoring QC aspects of each project.

- Research Section Supervisor, Center for Disease Control (C.D.C.)., Atlanta, Georgia. Responsible for Maintenance and computerization of the Quality Assurance/Quality Control Program for the Animal Research Division for C.D.C. Supervised 45 people in the day-to-day activities associated with disease prevention and analysis. Performed chemical analysis on biological samples to assess the extent of chemical interaction on organ systems.

- Sample Manager, Environmental Protection Systems, Inc. Responsible for logging in all samples received by the laboratory and maintaining accurate records and chain of movement of samples from the time they arrived at the laboratory until they were disposed of in an appropriate manner. Supervised all field collection.

- Supervisor in Charge, Walter Reed Army Institute of Research, Animal Quarantine/Issue Section. Responsibilities included supervision of medical care, organizing and maintaining the health record system for more than 1,000 animals, operation of technical equipment and maintenance of lab notes.

- Research Colony Manager, U.S. Army. Established an automated data base computer system to track breeding demographics, medical records updating, supply purchasing and animal availability.

PROFESSIONAL RESUME

NAME: Burnie D. Fuson

TITLE: QA/QC Coordinator

EDUCATION: B.S. Chemistry - University of West Florida, Pensacola, Florida

QUALIFICATIONS NARRATIVE:

As QA/QC Coordinator, Mr. Fuson is responsible for all QA/QC aspects for the laboratory. Duties include technical support, quality assistance, laboratory management, consulting, training, and safety. Mr. Fuson has experience in instrumental techniques (GC, GC/MS, HPLC, AAS).

As QA/QC Coordinator for Law Environmental's Pensacola laboratory, Mr. Fuson is responsible for insuring that laboratory operations are consistent with good laboratory practices and in compliance with regulatory requirements. He also serves as a technical and QA/QC liaison to clients and governmental agencies.

SELECTED EXPERIENCE:

- Law Environmental, Inc.
  As a GC/MS Senior Chemist for Law Environmental's Pensacola Laboratory, Mr. Fuson is responsible for maintaining and operating volatile and semivolatile GC/MS systems, utilizing a data system to identify and quantitate EPA Target Compounds, following EPA and CLP protocols. All results and quality assurance are produced for CLP acceptance. Mr. Fuson also assists the GC/MS Supervisor with analytical operations.

- Environmental Control Technology Corp. Gas Chromatopraph/ Mass Spectrometer Senior Project Chemist. Responsibilities included Night Supervisor for GC/MS Department and Night Senior Chemist for entire laboratory. The maintenance and operation of six Finnigan GC/MS systems for volatile and and semivolatile compounds including CLP protocol. Research and development of special projects including hazardous waste screening for incineration and air sample analysis. Included producing SOP's for R&D projects. Analysis of volatiles and semivolatile included low level drinking waters, HSL, Appendix IX, and California compounds lists. Also CLP certified.

- Pioneer Laboratory, Inc., Chemist II
  Operated two Hewlett-Packard GC/MS systems for volatiles and semivolatiles. Also operated two Tracor GC's with hall and PID Detectors for 601 and 602 pesticides, extraction of BNA's and pesticides, HPLC, TOX, TOC, AA and all aspects of wet chemistry analysis.

PROFESSIONAL RESUME

NAME: J. Damon Abbott

TITLE: Computer Systems Manager

EDUCATION: Credits toward B.S. in Computer Science

QUALIFICATIONS NARRATIVE:

Mr. Abbott has seven years in the computer field with duties varying from personal computer Lans to mainframes. He has researched, developed and implemented PC networks to serve the needs of two laboratories larger than 10,000 square feet. Data systems were designed from streamlined processing and reporting for either manual or automated data acquisition. Mr. Abbott has also served as the EPA CLP Program Manager. Duties included data validation and operational systems to ensure contract compliance.

SELECTED EXPERIENCE:

- IBM Token Ring Network of 12 and 20 Nodes: Smartware II, Lotus, DBase III and Word Perfect; PS/2 Model 80 Network Server, PS/2 Model 30 Data Stations, HP LaserJet II, Data Products (Color Printer), Hayes Smartcom. Analyze company needs and provide complete network system and custom programming (Pascal) for EPA requirements. Responsible for providing all computing needs. Monitor all departments and troubleshoot in-house manual systems for computerized upgrades.

- IBM Sys/38: RPGIII. In conjunction with Data Processing staff, design, develop, and implement environmental air particulate/microbial tracking program. System needed to constantly monitor biological quality of production areas during pharmaceutical operations. Programming to provide scheduling, data forms, trending analysis, monthly/quarterly reports to Division, Corporate HQ, and the FDA. Design and implement spreadsheet to track specific product information containing biological data, trending analysis and monthly reports.

- IBM CICS: Advanced Text Management. Using CICS host system at Corporate HQ, maintain strict control on all documents relating to product manufacturing and testing as required per FDA regulations.

PROFESSIONAL RESUME: J. Damon Abbott (Continued)

- Zenith Z-100: Condor rDBMS. Design, develop, and implement data base system for immunizations and hearing conservation testing for a crew of approximately 5000.

- Xerox 860 Word Processor. Use and govern word processing/ ETHERNET (electronic mail) needs for the Medical Department.

- Program Manager for EPA CLP CERCLA. Manages all CERCLA - Superfund projects to include contacts, program assessments, problem solving, preparing extensive data deliverable packages, and validation of the data from the laboratory.

- Program Manager for U.S. Army Corp of Engineers. Manages the environmental remediation projects from the Corps of Engineers. Provides guidance, point of contact, problem solving, data preparation and delivery, and validation of analytical data.

- EPA Data Validation. Setup and manages a group of experts in contract compliance and data validation based on the EPA CLP protocols and Statements of Work.

PROFESSIONAL RESUME

NAME: Bruce D. Hunt

TITLE: GC/MS Supervisor

EDUCATION: B.S. Biology - Drury College, Springfield, MO

QUALIFICATIONS NARRATIVE:

As a GC/MS Chemist for Law Environmental's Pensacola laboratory, Mr. Hunt is responsible for maintaining and operating volatile and semivolatile GC/MS systems, utilizing a data system to identify and quantitate EPA target compounds and performing CLP protocol for organics by GC/MS to produce acceptable results and quality assurance. Mr. Hunt also performs GC/MS data system managerial duties.

SELECTED EXPERIENCE:

- Environmental Protection Systems, Inc., Gas Chromatograph/Mass Spectrometer Operator. Responsible for alleviating overload of organic supervisor by maintaining and operating volatile organics Gas Chromatograph/Mass Spectrometer. Solved previous problems/liabilities, reorganized, upgraded and streamlined entire GC/MS section to return it to a profitable mode. Participated in New York State Drinking & Water Certification program, Water Pollution Laboratory Performance Evaluations, quarterly EPA Water Supply Certification; Corps of Engineers, Florida HRS and NIOSH Certification obtained, among others. Operated under CLP protocol although not CLP certified for volatile organics.

- Pioneer Laboratory, Inc., Gas Chromatograph/Mass Spectrometer Operator. Trained to operate Hewlett-Packard GC/MS and Finnigan Incos 50 system. Responsible for the complete analyses of a wide variety of sample matrices. Participated in and achieved CLP certification, along with periodic EPA Performance Evaluations, client evaluations, state certifications, and in-house QC checks. Seven to nine months experience operating three (3) Tracor GC's with Hall's and PID detectors. Worked with asbestos group

PROFESSIONAL RESUME - Bruce D. Hunt (Continued)

identifying asbestos in bulk samples and slides generated from on-site air monitoring wells. Was able to become familiar with Total Organic Halide and Total Organic Carbon instrumentation and standard operating procedures (SOP's).

PROFESSIONAL RESUME

NAME: Carl B. Causey

TITLE: Gas Chromatography Supervisor

EDUCATION: B.S. Chemistry
Millsaps College

AFFILIATIONS: American Chemical Society
Pensacola Section

QUALIFICATIONS NARRATIVE:

Manage all activities associated with gas chromatography. Maintain a working knowledge of organic methodologies applicable to chromatography and implement these to meet EPA-CLP protocol and client contract requirements.

SELECTED EXPERIENCE:

- Chromatography Group Leader, Environmental Protection Systems, Inc. In the Inorganic Laboratory section, initial responsibilities included expanding inorganic sample prep and cyanide analyses, to accommodate entry into EPA Inorganic CLP. Responsibilities broadened to include all wet chemical analyses using methods referenced in Standard Methods, SW 846, etc. Active participant in EPA laboratory performance evaluations for inorganic parameters, water pollution and water supply certifications.

  In the Organic Laboratory section, directed all analytical effort in gas chromatography (GC), liquid chromatography and ion chromatography. GC area expanded from one instrument to four to implement more effectively EPA methods for pesticides/PCBs, VOC's, phenols, phthalates, etc. HPLC techniques successfully used in analyzing water and soil samples for explosives and in obtaining certification from American Cyanamid for analysis of SCEPTER in agricultural soils/products. Active participant in EPA laboratory performance evaluations for organic parameters in water pollution and water supply samples. Also, obtained certification in NIOSH PAT samples for organics.

PROFESSIONAL RESUME: Carl B. Causey (Continued)

- Chemist to Research Specialist, Monsanto Company. Assignments included methods development and day-to-day troubleshooting in support of plant technology and research activities. Experience includes classical wet chemistry, visible, UV and IR spectroscopy and GC/HPLC instrumental techniques. Provided analytical support to Maleic Anhydride facility at pilot plant and full-scale plant operations by developing GC and HPLC techniques for characterization of various organic, gas and aqueous process streams. Supervised Quality Control laboratory at Monsanto's Spandex Plant.

- Environmental Control Chemist, Texas Gulf Sulphur. Responsible for monitoring air and water quality within plant boundaries and out from plant site for phosphates, sulfates, fluorides, etc., typical of a mining/fertilizer operation. Conducted employee monitoring for fluoride exposure via urine and x-ray techniques.

- Senior Analytical Chemist, Beaunit Fibers. Provided analytical support to fibers research in polymer molecular weight characterization using viscosity, light scattering, membrane osmometry and gel permeation chromatography. Developed separation methods for characterization of competitive spin finishes.

PROFESSIONAL RESUME

NAME: Gary St Pere

TITLE: Inorganic Supervisor

EDUCATION: Working towards B.S. in Environmental Sciences

QUALIFICATIONS NARRATIVE:

As Supervisor of the Inorganic department of Law Environmental's Pensacola laboratory, Mr. St. Pere is responsible for the productivity and timeliness of both the traditional wet chemistry and the metals analysis areas. Other duties include the hiring and training of the technical staff for the inorganic preparation area, as well as the chemists involved with advanced analytical instrumentation. He coordinates sample flow through the inorganic area, ensuring that protocol required by the EPA's Contract Laboratory Program (CLP) are followed. All analytical data is reviewed by Mr. St. Pere to ensure its completeness and compliance with required quality control prior to submitting such data to the project management area.

Mr. St. Pere is also accountable for overseeing the department's budget, including salary and overtime management, as well as ordering and maintaining the required reagents, glassware and supplies inventory. He ensures that routine documentation activities and instrument maintenance are performed by the staff, in addition to handling troubleshooting of all analytical instrumentation. Responsible for designing and overseeing the construction of the inorganic laboratory faculties required due to growth at this facility. Mr. St. Pere has extensive experience using sequential and simultaneous Inductively Coupled Argon Plasma Emission Spectroscopy (ICAP/ICP) as well as both Graphite Furnace and Cold Vapor Atomic Absorption (GFAA/CVAA) instrumentation.

SELECTED EXPERIENCE:

- <u>Inorganic Analyst; Environmental Protection Systems, Inc.</u> Initially responsible for metals analysis by Graphite Furnace Atomic Absorption (GFAA); progressed to mercury analysis using Cold Vapor Atomic Absorption (CVAA) and; then to metals analysis by Inductively Coupled Argon Plasma Emission Spectroscopy (ICP). Responsible for data review and quality control review of analytical results.

Functioned as night shift supervisor for inorganic metals analysis.

- Statistical Process Control Coordinator: Sterling Engineered Products. Responsible for establishing Statistical Process Control Program and monitoring quality control_of production line for facility using injection and extrusion molds to produce plastic and rubber components.

- Senior Metallurgical Technician; Cooper Industries. Initially employed as a Finish Inspector in Material Handling area; transferred to Metallurgical/Quality Control Laboratory. Coordinated activities of three quality control technicians. Responsible for all microscopic and macroscopic evaluations of heat treatment processes at this facility.

PROFESSIONAL RESUME

NAME: Cheryl D. Oliver

TITLE: Organic Prep Supervisor

EDUCATION: B.S. Biological Sciences with a minor in Chemistry
Florida State University

SELECTED EXPERIENCE:

- Organic Prep Supervisor. Direct supervision of Organic sample preparation, clean-up, and GC/MS Semi-Volatile sample screening technicians. Responsible for assuring prep, clean-up and screening methods are being properly employed, training of employees, and maintaining an orderly flow of samples through prep area by evaluating and scheduling the workload.

- GC-Organic Supervisor. Direct supervision of fuels area consisting of PAH by HPLC, modified 8015 (TPH, Diesel and gasoline) by GC-FID, Ethylene Dibromide by GC-ECD, TRPH and oil and grease by FTIR. Responsible for training employees, troubleshooting instrumentation problems, reviewing data and quality control produced in the department and maintaining shift scheduling to ensure smooth and timely flow of workload through the department.

- Organic Prep Supervisor. Responsible for the development and refinement of extraction area as an independent department. Researched methods, wrote SOP's, trained personnel, organized and designed new system for tracking and scheduling the workload.

- GC-Technician. Responsible for pesticide, PCB and Herbicide analyses. Duties also included the extraction of Herbicides. Also included instrument maintenance and troubleshooting, training other department members on Maxima data system, and data and quality control evaluation and computation.

- GC-Technician. Responsible for the analyses of Pesticides, PCB's, Herbicides, Polynuclear Aromatic Hydrocarbons, Ethylene Dibromide, Trihalomethanes, and Aldicarb. Utilized both GC and HPLC systems to include maintenance and troubleshooting. Duties also included evaluation and computation of data.

PROFESSIONAL RESUME

NAME: Sharon Lynn Taber

TITLE: Sample Manager

QUALIFICATIONS NARRATIVE:

As Sample Manager for Law Environmental's Pensacola laboratory, Ms. Taber is responsible for receiving samples and maintaining an accurate record system and documented chain of custody upon their arrival. She maintains EPA samples by CLP protocol, evaluates the condition of samples, contacts the Operations Manager about any discrepancies found upon arrival due to sample collection, shipping, or preservation procedures, maintains accurate written documents of all contacts with SMO and distributes documents to sample data manager. Ms. Taber also assists the QA/QC Supervisor with in-house QA/QC program to include sample duplicating, splitting and spiking. She is also responsible for proper storage and disposal of laboratory generated hazardous waste according to EPA guidelines.

Previously, Ms. Taber was Sample Manager for Environmental Protection Systems, Inc., (EPS) where her job duties were the same. Prior to working for EPS, Inc. she was employed as QA/QC Production Inspector at Pacer Industries, Inc. where she was responsible for QA/QC of production auto parts.

PROFESSIONAL RESUME

NAME: Earl Austin

TITLE: GC Chemist I

EDUCATION: B.S. Chemistry, Mississippi College, May 1988

QUALIFICATIONS NARRATIVE:

Responsible for the analysis of samples by gas chromatography. This entails the analysis of soils and water by either EPA 601/602 or by SW846 8010/8020 methods. This analysis is performed with HP 5890 II GC and OI purge and trap autosampler.

SELECTED EXPERIENCE:

- Law Environmental, Inc. Screening all VOA and Semi-VOA samples in-house. Analysis of water and soils for 601/602 and 8010/8020.

- Environmental Testing and Certification. Analysis of all water and soils by 601/602 and 8010/8020 methods. Extraction and analysis of herbicides, Pesticides, PCBs, and TPHCs by INFRA-RED techniques.

- Enviropact, Inc. Analysis of all water and soils by 601/602 and 8010/8020 methods. Extraction and analysis of herbicides, Pesticides, PCBs, EDBs, and Alcohols using Diazomethane derivitizations. EPA proficiency for herbicides, EDBs, and chlordane (alpha and gamma).

PROFESSIONAL RESUME

NAME: Bryan Blanchard

TITLE: Laboratory Technician

EDUCATION: B.S. Chemistry, pending, University of West Florida

QUALIFICATIONS NARRATIVE:

As a chemical laboratory technician for the Pensacola branch of Law Environmnental, Inc., Mr. Blanchard is responsible for providing technical support in the operation of the laboratory. As a member of the organic prep section, he is both knowledgable and skilled in prep methods utilized for extracting samples for G.C./MS semi-volatiles, G.C. ECD/FID semi-volatiles, and HPLC departments.

Extraction methods utilized in organic prep section are as follow: SW-846 3510 (seperatory funnel), 3520 (continuous liquid-liquid extraction), 3540 (soxhlet), 3550 (sonication), 3580 (organic dilution).

Bryan is also a skilled technician in the clean-up section, where he most utilizes Sw-846 methods 3620 (florisil column clean-up) and 3640 (gel-permeation chromatography).

He also preps samples for the Toxicity Characteristic Leachate Procedure; SW-846 method 1311. She is responsible for prepping both semi-volatiles and volatile (ZHE) samples.

PROFESSIONAL RESUME

NAME: Steven D. Braatz

TITLE: Laboratory Technician

EDUCATION: B.S. Chemistry - University of West Florida
A.A. Meteorology - Community College of The Air Force

AFFILIATIONS: American Chemical Society

QUALIFICATIONS NARRATIVE:

As a chemical laboratory technician for the Pensacola branch of Law Environmnental, Inc., Mr. Braatz is responsible for providing technical support in the operation of the laboratory. As a member of the organic prep section, he is both knowledgable and skilled in prep methods utilized for extracting samples for G.C./MS semi-volatiles, G.C. ECD/FID semi-volatiles, and HPLC departments.

Extraction methods utilized in organic prep section are as follow: SW-846 3510 (seperatory funnel), 3520 (continuous liquid-liquid extraction), 3540 (soxhlet), 3550 (sonication), 3580 (organic dilution).

Steve is also responsible for our TRPH and Oil & Grease extraction and analyses. This duty not only includes knowledge of prep methods 418.1, 9073, 413.2 and 9071, but also the analyticla requirements involved such as instrument calibration and maintenance; and data reduction and Q.C. interpretation.

Previously, Mr. Braatz was a Teachers Assistant in Freshman General Chemistry Labs.

PROFESSIONAL RESUME

NAME: Maria Laarni G. Cortez

TITLE: Inorganic Prep

EDUCATION: B.S. Chemistry - Adamson University, Manila, Philippines

QUALIFICATIONS NARRATIVE:

As an Analyst for Law Environmental, Inc., Pensacola laboratory, Ms. Cortez is responsible for providing technical support in the operation of the laboratory in connection with the analysis of inorganic samples. Her responsibilities include maintenance of laboratory equipment, preparation and digestion of samples for ICP and Furnace/Flame analysis including determination of ph, total solids, filterable residue and percent solids. Documentation and preparation of ICP and Furnace LCS and spike. Do specific conductivity, Hexavalent-chrome and cyanide analysis.

SPECIAL TRAINING:

- Bureau of Research, Food & Drug Laboratory Div., Department of Health, Manila Philippines. Training on quantitative analysis of protein, fat, carbohydrates, calories, cholesterol, sodium and potassium on food samples.

- Red Cross, Hospital Laboratory Technician. Training on how to separate plasma and hemoglobin on blood samples, preparing disk for bacterial counts, counting parasites through microscope and checking urine samples for specific gravity and pregnancy test.

SELECTED EXPERIENCE:

- Analyst, Environmental Protection Systems, Inc. Responsible for all routine or weekly analytical analysis by standard methods for waste water, sludge, and soil samples. Such analysis are following; ph, hardness, alkalinity, conductivity, colorimetric analysis for Hexavalent-chrome, aquaquant test kit for Cyanide, Ammonia- Nitrogen, Residual-Chlorine, Phenol, Oil and Grease, Chemical Oxygen Demand, Biochemical Oxygen Demand, Total Solids, Filterable Residue, Non-filterable Residue and percent solids.

PROFESSIONAL RESUME - Maria Laarni G. Cortez

She performed all States Certification Studies and EPA Certification for the following analysis; B.O.D., C.O.D., pH, F.O.G., Phenol, Ammonia-Nitrogen, T.D.S., T.S.S. and T.S. Ms. Cortez has experience with the following instruments: Perkin-Elmer Spectrophotometer, YSI Model 32 Conductance Meter, YSI Model 57 Oxygen Meter, Expandable Ion Analyzer, ph- meter, electronic balance and microscope.

PROFESSIONAL RESUME

NAME: Frank Deang

TITLE: Laboratory Technician I

EDUCATION: Graduate Dau Academy, Philippines

QUALIFICATIONS NARRATIVE:

As a Chemical Laboratory Technician of Law Environmental, Inc. Mr. Deang is responsible for providing technical support in the Operation of the laboratory. His responsibilities include documentation, standards preparation and analysis of samples by GFAA technique. Prior to Mr. Deangs GFAA training he was responsible for the preparation and analysis of samples by the cold-vapor technique. Mr. Deang also has experience in all aspects of metals preparation of ICP and GFAA analysis as well as glassware cleaning.

Mr. Deang previously held positions with local businesses and has had training in chemical handling precautions.

PROFESSIONAL RESUME

NAME: Walter Patrick Drew

TITLE: GC/MS Analyst

EDUCATION: B.S. Biology - University of West Florida

QUALIFICATIONS NARRATIVE:

As a GC/MS Chemist for Law Environmental's Pensacola laboratory, Mr. Drew is responsible for maintaining and operating volatile and semivolatile GC/MS systems, utilizing a data system to identify and quantitate EPA target compounds and performing CLP protocol for organics by GC/MS to produce acceptable results and quality assurance, troubleshooting, standards preparation, QA/QC review, instrument maintenance, and preparation of final volatile data packages.

Methodologies iclude 524, 624,8240, and 8260. Mr. Drew also performs GC/MS data system managerial duties on a Hewlett-Packard REV.E data software system.

SELECTED EXPERIENCE:

o Analytical Technologies Inc. Chromatography Analysis, method development, QC review, instrument repair, standard preparation, sample extractions and screening. Familiar with methods: 8010, 8020, 601, 602, BETX, TPH, 8021A. Utilized the following instruments: Tracor, Tekmar, and O.I. Purge and Trap Units, Tracor 540, HP 5890 Series I and II, Perkin-Elmer, and Carle Gas Chromatographs.

PROFESSIONAL RESUME

NAME: Karen Emmons

TITLE: Branch Administrator

EDUCATION: Credits toward B.S. in Business Management
Continuing Education Credits in Business

QUALIFICATIONS NARRATIVE:

As Branch Administrator for Law Environmental's Pensacola laboratory, Mrs. Emmons is responsible for all personnel records, setting up physicals for new employees as well as annual exams for current employees. Keeping employees updated on any changes within the Company and orientating new employees. Other responsibilities include managing imprest funds and petty cash, accounts payable, manage ordering of lab and office supplies, maintain applications and resumes, set up travel arrangements for Pensacola staff and manage mail room. Mrs. Emmons also assist the Laboratory Manager and is responsible for one other employee in her department.

Prior to joining Law Environmental, Inc., Mrs. Emmons was employed with Amsouth Bank for 6 years with experience in mortgage loans, student loans, checking accounts, savings accounts, CD's and Commercial Accounts. Management experience includes 2 years as Store Manager for Colortyme and 2 years as Manager for Merle Norman Cosmetics.

PROFESSIONAL RESUME

NAME: Marshalla W. Fant

TITLE: Chemistry Laboratory Technician

EDUCATION: Graduate J.M. Tate High

QUALIFICATIONS NARRATIVE:

As a chemical laboratory technician for the Pensacola branch of Law Environmnental, Inc., Ms. Fant is responsible for providing technical support in the operation of the laboratory. As a member of the organic prep section, she is both knowledgable and skilled in prep methods utilized for extracting samples for G.C./MS semi-volatiles, G.C. ECD/FID semi-volatiles, and HPLC departments.

Extraction methods utilized in organic prep section are as follow: SW-846 3510 (seperatory funnel), 3520 (continuous liquid-liquid extraction), 3540 (soxhlet), 3550 (sonication), 3580 (organic dilution).

Marshalla's responsibilities also include G.C./FID screening for G.C./MS screening semi-volatiles. Duties include data reduction and interpretation, as well as G.C. calibration, troubleshooting and maintenance.

Ms. Fant was previously a Lab Technician at Analytical Technologies, Inc. Her duties were the extraction of environmental samples for organic targets including BNA's, pesticides, total petroleum hydrocarbons and herbicides by U.S. EPA methodologies. She was familiar will all types of matrix extractions.

PROFESSIONAL RESUME

NAME: Rodney Forbes

TITLE: Laboratory Technician I

EDUCATION: Graduate J.M. Tate High School

QUALIFICATIONS NARRATIVE:

As a chemical laboratory technician for the Pensacola Laboratory of Law Environmental, Inc., Mr. Forbes is responsible for providing technical support in the operation of the laboratory. His responsibilities include preparation and analysis of aqueous and solid samples to determine mercury content. Mr. Forbes is also responsible for the accurate documentation of the work that he performs. Other duties include maintenance of equipment used in mercury determinations and assisting in sample preparation for ICP and GFAA.

Mr. Forbes previously held positions with local businesses and has had training in chemical handling and safety precautions.

Mr. Forbes is responsible for documentation and preparation of samples for mercury analysis. He is also responsible for analysing samples for mercury and performing the proper documentation for these analysis.

PROFESSIONAL RESUME

NAME: Marc C. Gillette

TITLE: Chemistry Laboratory Technician

EDUCATION: Working towards B.S. Biology

QUALIFICATIONS NARRATIVE:

As a chemical laboratory technician for the Pensacola branch of Law Environmnental, Inc., Mr. Gillette is responsible for providing technical support in the operation of the laboratory. As a member of the organic prep section, he is both knowledgable and skilled in prep methods utilized for extracting samples for G.C./MS semi-volatiles, G.C. ECD/FID semi-volatiles, and HPLC departments.

Extraction methods utilized in organic prep section are as follow: SW-846 3510 (seperatory funnel), 3520 (continuous liquid-liquid extraction), 3540 (soxhlet), 3550 (sonication), 3580 (organic dilution).

Marc's responsibilities also include G.C./FID screening for G.C./MS screening semi-volatiles. Duties include data reduction and interpretation, as well as G.C. calibration, troubleshooting and maintenance.

PROFESSIONAL RESUME

NAME: Nida Ginkel

TITLE: Sample Control Technician

QUALIFICATIONS NARRATIVE:

As Sample Control Technician for Law Environmental's Pensacola laboratory, Ms. Ginkel is responsible for receiving samples and maintaining an accurate record system and documented chain of custody upon their arrival. She maintains EPA samples by CLP protocol, evaluates the condition of samples, contacts the Laboratory Manager about any discrepancies found upon arrival due to sample collection, shipping, or preservation procedures, and maintains accurate written documents of all contacts with MIS distributes documents to sample data manager. Ms. Ginkel also assists the QA/QC Coordinator with in-house QA/QC program to include sample duplicating, splitting, and spiking. She is also responsible for proper storage and disposal of laboratory generated hazardous waste according to EPA guidelines.

Ms. Ginkel is also responsible for proper cleaning of laboratory glassware, segregation of inorganic/organic glassware, and distribution of clean glassware to the proper departments.

Previously, Ms. Ginkel was working for Quincy's Restaurant. Her job duties included taking care of the food bar and customer service.

PROFESSIONAL RESUME

NAME: Randy Gonzalez

TITLE: Laboratory Technician I

EDUCATION: Graduate J.M. Tate High School
Currently enrolled at Pensacola Junior College

QUALIFICATIONS NARRATIVE:

As a chemical laboratory technician for the Pensacola Laboratory of Law Environmental, Inc., Mr. Gonzalez is responsible for providing technical support in the operation of the laboratory. His responsibilities include documentation and preparation of samples for metals analysis for both GFAA and ICP Instruments, LDRL and TCLP extractions, percent solids and the upkeep and preperation of all instruments and solutions needed to carry out all aspects of the position.

Mr. Gonzalez has been properly trained in chemical handling and safety precautions.

PROFESSIONAL RESUME

NAME: Keith R. Greene

TITLE: GC/MS Analyst

EDUCATION: B.S. Biological Science - Kent State University Kent, Ohio

QUALIFICATIONS NARRATIVE:

As a GC/MS Chemist for Law Environmental's Pensacola laboratory, Mr. Greene is responsible for maintaining and operating volatile and semivolatile GC/MS systems, utilizing a data system to identify and quantitate EPA target compounds and performing CLP protocol for organics by GC/MS to produce acceptable results and quality assurance. Mr. Greene also performs GC/MS data system managerial duties.

SELECTED EXPERIENCE:

o American Analytical Labs Inc. GC/MS Operator responsible for operating and maintaining volatile and semivolatile organics by GC/MS. Participated and passed Ohio Drinking Water Certification program. Participated in water Pollution Performance Evaluations. Quarterly water supply Certification as well as internal ERA performance evaluations. Maintained and trouble-shoot HP 5890 GC 5970 MS as well as HP RTE-1000 Data system managerial duties. Maintained computerized QA/QC with Radian Lims System including Benchsheet, Test Programs, and Report generation.

GC/HPLC Operator responsible for IH and Environmental samples including GC - Pest, Herb, PCBS, IH work HPLC - Isocyonates, Explosives, PAH's Performed also in PAT Round Certification as well as mentioned above Trouble-shooting Lims system.

Purge/Trap Operator responsible for 601/602 - 8010/8020 including BTEX California modified TPH method. Trouble-shooting ELCD, PID, FID as well as same QA/AC Proceedings on LIMS System. Set up entire sonication IR protocol for running TPH method EPA 8015.

Atomic Absorbtion /Graphite Furnace: maintained, operated, trouble-shoot Thermal Jerrel Ash Videoll/IL 755 AA. Furnace as well as Varian 200 Series. Set up complete computerized QA/QC procedure for tracking/graphing QC for Environmental/IH matrices. Complete EPA Water Pollution/Water Supply/ERA studies as well as PAT Rounds.

Conventional Parameters - Ran, maintained various NPDES parameters, UV-VIS Spectroscopy.

PROFESSIONAL RESUME

NAME: Janet Gregory

TITLE: Data Coordinator

QUALIFICATIONS NARRATIVE:

As data coordinator for the Management Information Systems Department, Ms. Gregory is responsible for coordinating, collecting, and compiling all data necessary to complete a case for the Inorganic Contract Laboratory Program. She also maintains a status report system on all current in-house samples for use by the Quality Assurance Manager and the Manager of the Analytical Services Department. Additional responsibilities include computerization of analytical data, report production, and quality control checks on all laboratory paperwork.

Ms. Gregory was data coordinator for a previous CLP Contract and has experience on a variety of computers and software packages, including IBM Personal Computer (Lotus 1-2-3, Word Perfect, Smart System, Smartlog, Symphony, Multimate, Formtool, and many in-house software programs.

PROFESSIONAL RESUME

NAME: Ann Harber

TITLE: Data Coordinator

QUALIFICATIONS NARRATIVE:

As data coordinator for the Management Information Systems Department, Ms. Harber is responsible for coordinating, collecting, and compiling all data necessary to complete a case for the Organic Contract Laboratory Program. She also maintains a status report system on all current in-house samples for use by the Quality Assurance Manager and the Manager of the Analytical Services Department. Additional responsibilities include computerization of analytical data, report production, and quality control checks on all laboratory paperwork.

Ms. Harber was data coordinator/supervisor for two previous Inorganic CLP Contracts and has experience on a variety of computers and software packages, including IBM Personal Computer (Lotus 1-2-3, Word Perfect, Smart, Smartlog, Formtool, and many in-house software programs.

PROFESSIONAL RESUME

NAME: David A. Harman II

TITLE: GC/MS Analyst

EDUCATION: B.S. Biology and Chemical Environmental Studies - University of Kentucky, Lexington, Kentucky

QUALIFICATIONS NARRATIVE:

As a GC/MS Chemist for Law Environmental's Pensacola laboratory, Mr. Harman is responsible for maintaining and operating volatile and semi-volatile GC/MS systems, utilizing a data system to identify and quantitate EPA target compounds and performing CLP protocol for organics by GC/MS to produce acceptable results and quality assurance.

SELECTED EXPERIENCE:

- Ati/Pioneer Lab - GC/VOA operator responsible for screening all volatile and semi-volatile samples in-house utilizing Maxima software. Duties also included environmental research.
- Lab Assistant - Responsible for DNA recovery and genetics research.
- Smith-Kline Bio-Science Lexington - Responsible for specimen processing.

PROFESSIONAL RESUME

NAME: Paulette Harmon

TITLE: Data Coordinator

QUALIFICATIONS NARRATIVE:

As data coordinator for the Management Information Systems Department, Ms. Harmon is responsible for coordinating, collecting, and compiling all data necessary to complete a case for the Inorganic Contract Laboratory Program. She also maintains a status report system on all current in-house samples for use by the Quality Assurance Manager and the Manager of the Analytical Services Department. Additional responsibilities include computerization of analytical data, report production, and quality control checks on all laboratory paperwork.

Ms. Harmon was data coordinator for a previous CLP Contract and has experience on a variety of computers and software packages, including IBM Personal Computer (Lotus 1-2-3, Word Perfect, Smart System, Formtool, and many in-house software programs.

PROFESSIONAL RESUME

NAME: Carol Hatcher

TITLE: Data Coordinator

EDUCATION: A.A. Science - Pensacola Junior College
B.S. Biology - University of West Florida
B.S. Systems Science, Business Option - University of West Florida

QUALIFICATIONS NARRATIVE:

As data coordinator for the Management Information Systems Department, Ms. Hatcher is responsible for coordinating, collecting, and compiling all data necessary to complete a case for the Inorganic Contract Laboratory Program. She also maintains a status report system on all current in-house samples for use by the Quality Assurance Manager and the Manager of the Analytical Services Department. Additional responsibilities include computerization of analytical data, report production, and quality control checks on all laboratory paperwork.

Ms. Hatcher was data coordinator on a previous CLP Contract and has experience with a variety of computers and software including IBM Personal Computer, Word Perfect, Displaywrite, Smart Systems, Smartlog, Lotus 1-2-3, DBase III, and Formtool.

PROFESSIONAL RESUME

NAME: Jan Hendrix

TITLE: Word/Data Processor

QUALIFICATIONS NARRATIVE:

As word/data processor the Project Management Department, Mrs. Hendrix is responsible for compiling the data necessary to complete a case for the Inorganic contract Laboratory Program and the volatiles for the Organic Contract Laboratory Program.

Mrs. Hendrix has experience on a variety of computers and software packages, including the IBM Personal Computer (Lotus 1-2-3, Quattro Pro, Word Perfect, Word Star, Formtool and many in-house software programs).

PROFESSIONAL RESUME

NAME: Christopher L. High

TITLE: Chemistry Laboratory Technician

EDUCATION: Graduate Escambia High, Attending PJC

QUALIFICATIONS NARRATIVE:

As a laboratory technician I, Mr. High is responsible for analyzing and reporting data ran by the Icp. His responsibilities includes preparing all his working and stock solutions, any maintenance of laboratory equipment (comp & ICP), and washing of sample tubes.

Previously Mr. High was responsible for GFAA analysis. His responsibilities include preparing all his working and stock solutions, any maintenance of laboratory equipment. (Balance, GFAA, comp., recirculator)

Mr. High was previously a Lab Technician at Roche Biomedical Laboratory where his duties were the collection of serum, preparation of serum for testing, and editing of results. He was also responsible for running and diluting of veterinary samples and keeping stock of reagents.

PROFESSIONAL RESUME

NAME: Michelle Hinton

TITLE: Client Services Representative

EDUCATION: Continuing Education
Pensacola Junior College

QUALIFICATIONS NARRATIVE:

As Sample Control Technician for Law Environmental's Pensacola laboratory, Mrs. Hinton is responsible for receiving samples and maintaining an accurate record system and documented chain of custody upon their arrival. She maintains EPA samples by CLP protocol, evaluates condition of samples, contacts the Laboratory Manager about any descrepencies found upon arrival due to sample collection, shipping, or preservation procedures, maintains accurate written documents of all contacts with MIS, and distributes documents to sample data manager. Mrs. Hinton also assists the QA/QC Coordinator with in-house QA/QC program to include samlpe duplicating, splitting, and spiking. She is also responsible for proper storage and disposal of laboratory generated hazardous waste according to EPA guidelines.

Responsible for entering all analytical data as well as generating client analytical reports. Enters analytical data into branch data base using LIMS system and Labworks software. Generates analytical reports for clients. Modifies analytical reports to meet client requests. Accounts for all branch invoicing. Issues client invoices/credit memos. Reviews data entered into LIMS system for transcription/transposition errors. Generates work backlog reports for analytical department.

SELECTED EXPERIENCE:

- <u>Word Processor II.</u> Responsible for reporting client data and issuing final reports and invoices. Helped implement specifications, proposals and quotes. Also composed weekly and monthly invoice summaries.

PROFESSIONAL RESUME

NAME: Carolyn Hooper

TITLE: Client Services Representative

EDUCATION: Legal Secretary/Word Processing
20th Century College

Continuing Education
Pensacola Junior College

QUALIFICATIONS NARRATIVE:

Responsible for entering all analytical data as well as generating client analytical reports. Enters analytical data into branch data base using LIMS system and Labworks software. Generates analytical reports for clients. Modifies analytical reports to meet client requests. Accounts for all branch invoicing. Issues client invoices/credit memos. Reviews data entered into LIMS system for transcription/transposition errors. Generates work backlog reports for analytical department.

SELECTED EXPERIENCE:

- Analytical Department Administrator. Developed and implemented laboratory tracking system on PC based computer system to more expediently track and invoice in-house analytical samples. Acted as local client coordinator responsible for reporting client data and issuing final reports. Assisted QA/QC supervisor with data basing of all statistical quality control data to include generation of x-bar/r-charts, student t-tests and client statistical packages.

PROFESSIONAL RESUME

NAME: Jason T. Jernigan

TITLE: Chemistry Laboratory Technician

EDUCATION: Graduate Pensacola High, Attending PJC

QUALIFICATIONS NARRATIVE:

Mr. Jernigan is responsible for screening of all GC and GC/MS volatile blanks, samples, and spikes prior to actual analysis. He prepares, screens, and evaluates all screening analyses to determine dilutions and then forwards the results to the appropriate departments. He also is responsible for the sceening GC instrument maintenance.

Mr. Jernigan has limited GC/MS experience which allows him to analyze GC/MS volatile samples, determine if the QA/QC criteria is met, and to review completed sample packages with the help of his supervisor. He is also responsible for chain-of-custody of samples to and from the Westgate facility.

SELECTED EXPERIENCE

Mr. Jernigan was a chemical laboratory technician for the Pensacola Laboratory of Law Environmental, Inc. His responsibilities were to provide technical support in the operation of the laboratory and included extraction of samples for analysis, maintenance of laboratory equipment, and preparation of stock solutions used in analysis.

Mr. Jernigan was previously a Lab Technician at Roche Biomedical Laboratory where his duties were the collection of serum, preparation of serum for testing, and editing of results.

PROFESSIONAL RESUME

NAME: Sharon Elizabeth (Beth) Jordan

TITLE: Chemistry Laboratory Technician

EDUCATION: B.S. in Biology - University of Tennessee

QUALIFICATIONS NARRATIVE:

As a chemical laboratory technician for the Pensacola branch of Law Environmnental, Inc., Mrs. Jordan is responsible for providing technical support in the operation of the laboratory. As a member of the organic prep section, she is both knowledgable and skilled in prep methods utilized for extracting samples for G.C./MS semi-volatiles, G.C. ECD/FID semi-volatiles, and HPLC departments.

Extraction methods utilized in organic prep section are as follow: SW-846 3510 (seperatory funnel), 3520 (continuous liquid-liquid extraction), 3540 (soxhlet), 3550 (sonication), 3580 (organic dilution).

She also preps samples for the Toxicity Characteristic Leachate Procedure; SW-846 method 1311. She is responsible for prepping both semi-volatiles and volatile (ZHE) samples.

Beth's other duties include maintaining an inventory supply list and ordering supplies for the section.

PROFESSIONAL RESUME

NAME: Chad Lightner

TITLE: Word/Data Processor

EDUCATION: Pace High School Graduate, Pensacola Junior College

QUALIFICATIONS NARRATIVE:

As a word/data processor for the Project Management Department, Mr. Lightner is responsible for collecting and compiling all data necessary to complete a case for the Inorganic Contract Laboratory Program. He also maintains a status report system on all current in-house samples for use by the Quality Assurance Manager and the Manager of the Analytical Services Department. Additional responsibilities include computerization of analytical data, report, production, and quality control checks on all laboratory paperwork.

Mr. Lightner has experience on a variety of computers and software packages, including IBM Personal Computers (Word Perfect, Smart System, Lotus 1-2-3, and many in-house software programs).

PROFESSIONAL RESUME

NAME: Janet A. Macauley

TITLE: Environmental Analyst/Chemist I

EDUCATION: B.S. Biology - Florida State University

QUALIFICATIONS NARRATIVE:

As an Environmental Analyst for the Pensacola Laboratory of Law Environmental, Inc., Ms. Macauley is responsible for providing analytical support in the operation of the laboratory. Her responsibilities include analysis of digestates by graphite furnace atomic absorbtion spectroscopy, maintenance of log books and laboratory equipment including the graphite furnace, reduction of data from analyses for reporting purposes, execution of QA/QC protocols and preparation of standard stock and working solutions for analytical use.

Ms. Macauley was previously a Medical Technician with Roche Biomedical Laboratories, Inc. of Pensacola were her duties included following laboratory SOP's for reagent preparation, sample collection, machine maintenance, and start up procedures for the Technician Sequential Multiple Analyzer Computer, a machine which analyzes blood serum samples.

Ms. Macauley's other technical background includes work for the University of West Florida at the EPA laboratory in Gulf Breeze, FL. Her duties there included organizing, training, and supervising college students hired to process marine sediment samples, as well as construction and maintenance of experimental laboratory microcosms. She also took part in sample collection and processing, and was responsible for sample management.

Prior to Ms. Macauley's employment at EPA, she processed marine sediment samples to remove organisms for sorting and identification, and prepared fish stomachs for content analysis. This work was performed for Dr. Robert J. Livingston, Department of Biology, Florida State University.

PROFESSIONAL RESUME

NAME: Liyonabah Oetinger

TITLE: Scientist I

EDUCATION: B.S. General Science - Mississippi State University

QUALIFICATIONS NARRATIVE:

Responsible for the analysis of total petroleum hydrocardons in soil and water by Cal-DHS methods. These analyses are performed with HP5890, Series II GC's.

SELECTED EXPERIENCE:

Law Environmental, Inc.: Organic prep responsibilities for extraction of samples of GC/MS analysis, maintenance of laboratory equipment, and preparation of stock solutions used in analysis.

MSCL: Lab technician level 6 with Mississippi State Chemical Lab where her duties included extract preparation for pesticide residue procedures:

- sample receipt/preparation
- florisil column
- silica gel column
- KD's
- liquid-liquid partitioning
- weighing out samples
- calc. moistures, paperwork

Before becoming a full time employee, Lee was a part time student worker for MSCL. Her duties included sample preparation (homogenization) and sample receipt.

Other technical background included work as a summer student assistant for Dr. Miranda with the Mississippi State Fish and Wildlife Co-op which included aging fish scales, assisted in paperwork and occasional collection of traps.

PROFESSIONAL RESUME

NAME: James Terrell Parker

TITLE: Gas Chromatograph Operator

EDUCATION: Currently a third year Engineering student at Pensacola Junior College

QUALIFICATIONS NARRATIVE:

As a Gas Chromatograph Operator for Law Environmental's Pensacola laboratory, Mr. Parker is primarily responsible for the operation of the HP 5890 Gas Chromatographs (GC), following EPA guidelines for the analysis of volatile and semivolatile organics (TPH, 601, 602). He will also be involved in the analysis of pesticides/PCB's using the same protocol (method 608). Secondary duties may require assisting in organic prep.

Mr. Parker has experience with TPH volatiles (GC Automated Headspace Analysis), TPH semivolatiles (GC), and organic sample extraction (semivolatiles, pesticides/PCB's, sediment and water).

SELECTED EXPERIENCE:

- Graphite Furnace/ICP Operator, Environmental Protection Systems. Performed all functions involved in operating a Perkin-Elmer Z5100 Graphite Furnace using EPA Contract Laboratory Program (CLP) protocol. Responsible for analysis of major contract clients such as USEPA CLP and TAC. Also responsible for analysis of Laboratory Certification/Proficiency samples for New York, Florida, New Jersey and Army Corps of Engineers. Diversified duties include two months operational experience with an ARL 3510 sequential Spectrometer as well as sample digestion procedures for both instruments.

PROFESSIONAL RESUME

NAME: April Phelps

TITLE: Environmental Analyst/Chemist I GC

EDUCATION: A.A. Chemistry, Pensacola Junior College

QUALIFICATIONS NARRATIVE:

Responsible for the analysis of pesticides and PCBs in soil and water samples by EPA methods 608 and 8080 and CLP. These analyses are performed with HP5890 Series II GC. Experience also includes TPH analysis using Cal-DHS methodologies and PAH via GC/FID method 610/8100.

SELECTED EXPERIENCE:

- Law Environmental, Inc. - Analysis of soil and water samples for pesticides and PCBs by 608, 8080 and CLP methods.

- Analytical Technologies, Inc. - Analysis of soil and water samples for Pesticides, and PCBs and herbicides by EPA methods 608, 8080 and 615. Also responsible for the extraction of herbicides.

PROFESSIONAL RESUME

NAME: Terry Sartain

TITLE: Data Coordinator

QUALIFICATIONS NARRATIVE:

As data coordinator for the Management Information Systems Department, Ms. Sartin is responsible for coordinating, collecting, and compiling all data necessary to complete a case for the Inorganic Contract Laboratory Program. She also maintains a status report system on all current in-house samples for use by the Quality Assurance Manager and the Manager of the Analytical Services Department. Additional responsibilities include computerization of analytical data, report production, and quality control checks on all laboratory paperwork.

Ms. Sartin has experience on a variety of computers and software packages, including IBM Personal Computer (Lotus 1-2-3, Word Perfect, Smart System, Formtool, and many in-house software programs.

PROFESSIONAL RESUME

NAME: Bill Schwerdtfeger

TITLE: Facilities Engineer

QUALIFICATIONS NARRATIVE:

Responsibilities encompass all aspects of maintenance related to the laboratory building. Mr. Schwerdtfeger's abilities include carpentry, installation of electric equipment, and any other repair as needed.

Previously Mr. Schwerdtfeger held a position in yacht finishing. Duties included pipe fitting, welding, fiberglass, painting, and construction supervision.

PROFESSIONAL RESUME

NAME: Kelli Silvia

TITLE: Client Services Representative

EDUCATION: Currently junior, Business Major at University of West Florida
A.A. Business, Pensacola Junior College

QUALIFICATIONS NARRATIVE:

Responsible for entering and reviewing all analytical data generated by the laboratory as well as issuing client reports. Coordinate all major analytical projects for various clients. Manage case tracking on laboratory workload/management system software. Validation and quality assurance/quality control procedures to ensure laboratory use. Implement and maintain client filing system. Issue client invoices.

SELECTED EXPERIENCE:

- Data Coordinator, Environmental Protection Systems.
  As data coordinator for the Management Information Systems Department, Ms. Silvia is responsible for coordinating, collecting, and compiling all data necessary to complete a case for the Inorganic Contract Laboratory Program. She also maintains a status report system on all current in-house samples for use by the Quality Assurance Manager and the Manager of the Analytical Services Department. Additional responsibilities include computerization of analytical data, report production, and quality control checks on all laboratory paperwork.

  Ms. Silvia was data coordinator on a previous CLP Contract and has experience with a variety of computers and software including IBM Personal Computer, Smart Systems, Smart Log, Lotus 1-2-3, Word Perfect, and many in-house software programs.

PROFESSIONAL RESUME

NAME: Georgette E. Tacheny

TITLE: Environmental Analyst/Chemist I GC

EDUCATION: B.S. Biology, University of South Alabama, May 1989

QUALIFICATIONS NARRATIVE:

Responsible for the analysis of pesticides and PCBs in soil and water samples by EPA methods 608 and 8080 and CLP. Also, methods 8150 for clorinated herbicides. These analyses are performed with HP5890 Series II GC.

SELECTED EXPERIENCE:

- Law Environmental, Inc. - Analysis of soil and water samples for pesticides and PCBs by 608, 8080 and CLP methods.
- Analytical Technologies, Inc. - Analysis of soil and water samples for Pesticides, PCBs and herbicides by EPA methods 608, 8080 and 615. Also responsible for the extraction of herbicides.

PROFESSIONAL RESUME

NAME: Nan Upton

TITLE: General Office Assistant

QUALIFICATIONS NARRATIVE:

As a Sample Control Technician for Law Environmental's Pensacola laboratory, Mrs. Upton is responsible for receiving samples and maintaining an accurate record system and documented chain of custody upon their arrival. She maintains EPA samples by CLP protocol, evaluates the condition of the samples, contacts the Laboratory Manager about any discrepancies found upon arrival due to sample collection, shipping or preservation procedures, maintains accurate written documents of all contacts with MIS, and distributes documents to sample data manager. Mrs. Upton also assists the QA/QC Coordinator with in-house QA/QC program to include sample duplicating, splitting, and spiking. She is also responsible for proper storage and disposal of laboratory generated hazardous waste according to EPA guidelines.

As General Office Assistant for Law Environmental's Pensacola laboratory, Ms. Upton is responsible for taking and directing incoming telephone calls. Responsibilities also include ordering and tracking all office and lab supplies, logging in all job applications and resumes. Ms. Upton also assists the Branch Administrator with maintaining time sheets and imprest funds.

Previously, Ms. Upton was Office Manager for Rod's Auto Recovery. Her duties included accounts payable and receivable, filing and maintaining all records for the office as well as collections.

PROFESSIONAL RESUME

NAME: Travis Lee Willard

TITLE: Chemistry Laboratory Technician

EDUCATION: B.S. Chemistry - University of West Florida
A.A. General - Pensacola Junior College

QUALIFICATIONS NARRATIVE:

As a chemical laboratory technician for the Pensacola branch of Law Environmnental, Inc., Mr. Willard is responsible for providing technical support in the operation of the laboratory. As a member of the organic prep section, he is both knowledgable and skilled in prep methods utilized for extracting samples for G.C./MS semi-volatiles, G.C. ECD/FID semi-volatiles, and HPLC departments.

Extraction methods utilized in organic prep section are as follow: SW-846 3510 (seperatory funnel), 3520 (continuous liquid-liquid extraction), 3540 (soxhlet), 3550 (sonication), 3580 (organic dilution).

Travis is also instrumental in our clean-up section, where he employs clean-up methods 3620 (florisil column) and 3640 (gel-permeation chromatogrphy). He is responsible for troubleshooting and maintaining the GPC unit.

Mr. Willard was previously a Cooperative Eduction Environmental Specialist I with the Florida Department of Environmental Regulation, Pensacola Office, where his duties included following department SOP's for inspection of wastewater treatment facilities and laboratories, sample collection, machine maintenance, and analyzing bacteriological samples.

18.0 INSTRUMENT LIST

GC/MS

(1) Hewlett-Packard GC/MS - Volatiles
Accessories: 5970B Quadrupole MSD
5890II Series II GC
O.I. 4460A Purge and Trap
O.I. MPM-16 autosampler with MHC-16 Heater Controller and Jackets
Date of Purchase: 06/26/89 and 01/17/90

Model #1:	5970B Quadrupole MSD	Serial #1:	3004A12518
Model #2:	5890 Series II GC	Serial #2:	2950A27390
Model #3:	O.I. MPM-16 autosampler	Serial #3:	91-381
Model #4:	O.I. 4460A Purge and Trap	Serial #4:	89-453F
Model #5	O.I. MHC-16 HeaterController	Serial #5:	91-146

(1) Hewlett-Packard GC/MS - Volatiles
Accessories: 5970B Quadrupole MSD
5890 Series II GC
O.I. 4460A Purge and Trap
O.I. MPM-16 autosampler with MHC-16 heater controller and jackets
Date of Purchase: 01/17/90 and 06/26/89

Model #1:	5970B Quadrupole MSD	Serial #1:	3004A12517
Model #2:	5890 Series II GC	Serial #2:	2921A23425
Model #3:	O.I. MPM-16 autosampler	Serial #3:	90-105B
Model #4:	O.I. 4460A Purge and Trap	Serial #4:	12210-1-999
Model #5:	O.I. MHC-16 HeaterController	Serial #5:	89-027

(1) Hewlett-Packard GC/MS - Semi-Volatiles
Accessories: 5970B Quadrupole MSD
5890II Series II GC
7673A Auto-injector/auto-sampler
Date of Purchase: 06/26/89

Model #1:	5970B Quadrupole MSD	Serial #1:	2923A12181
Model #2:	5890 Series II GC	Serial #2:	2921A23426

Model #3:	18596A Auto-sampler	Serial #3:	2920A11184
Model #4:	18593 Auto-injector	Serial #4:	2932A14190
Model #5:	18594A Inj./Samp. Controller	Serial #5:	2929A15381

(1) Hewlett-Packard GC/MS - Volatiles
Accessories: 5971A Quadrupole MSD
5890 Series II GC
7673 Auto-injector/auto-sampler
Date of Purchase: 11/01/91

Model #1:	5971A Quadrupole MSD	Serial #1:	3188A02984
Model #2:	5890 Sreies II GC	Serial #2:	3140A38543
Model #3:	MPM-16 Auto-sampler	Serial #3:	4344-9-018
Model #4:	4460A Purge and Trap	Serial #4:	90-571F
Model #5:	MHC-16 HeaterController	Serial #5:	91-147

1) Hewlett-Packard GC/MS - Semi-Volatiles
Accessories: 5970B Quadrupole MSD
5890II Series II GC
7673 Auto-injector/auto-sampler
Date of Purchase: 01/17/90 and 06/26/89

Model #1:	5970B Quadrupole MSD	Serial #1:	2923A12182
Model #2:	5890 Series II GC	Serial #2:	2950A27391
Model #3:	18596B Auto-sampler	Serial #3:	3013A21137
Model #4:	18594B Controller (Inj/Samp)	Serial #4:	3013A21276
Model #5:	18593B Auto-injector	Serial #5:	3013A21393

(1) HP Micro 24 CPU RTE-A File Server, Data Archives
Accessories: 16-track Streaming Tape Back-up
Date of Purchase: 08/31/89

Model #1:	Micro 24 CPU GC/MS	Serial #1:	2907A06709
Model #2:	Tape Back-up	Serial #2:	2908E52695

(1) HP Micro 24 CPU RTE-A File Server, Data Archives
Accessories: 9-track Tape Back-up
Date of Purchase: 01/17/90

Model #1:	HP Micro 24 CPU	Serial #1:	2922A10769

Model #2: 9-track Tape Back-up Serial #2: 2807A03457

(2) Vectra ES/12 Model 26 PC, 20 Mbyte hard disk
Date of Purchase: 08/31/89
Model #1: Vectra ES/12 Model 26 PC Serial #1: 2931A69843
Model #2: Vectra ES/12 Model 26 PC Serial #2: 3004A81221
Model #3: Vectra 386/25 Model 170 PC Serial #3: 3139A12944

(2) Best Power 15 KVA Uninterruptable Power Supply
Date of Purchase: 01/10/89
Model #1: 15 KVA UPS Serial #1: C15K01837
Model #2: 15 KVA UPS Serial #2: FD18K005037

(1) HP MICRO 14 CPU RTE-A File Server, Data Archives
Accessories: 16-Track Streaming Tape Back-up
Date of Purchase: 11/01/91
Model #1 MICRO 14 CPU Serial #1: 9100A00856
Model #2 Tape Back-up Serial #2: 9100A00858

GC

(1) Hewlett-Packard Model 5890, Series II, GC
Accessories: Dual Flame Ionization Detectors
HP 7673 Auto-injector/Auto-sampler
HP 3392A Integrator
Date of Purhcase: 06/26/89
Model #1: Model 5890 Series II GC Serial #1: 2950A27109
Model #2: FID Detectors (Qty 2) Serial #2: N/A
Model #3: 18593B Auto-injector Serial #3: 3009A20938
Model #4: 18593B Auto-injector Serial #4: 3009A20932
Model #5: 18594B Controller Serial #5: 3007A20871
Model #6: HP 3392A Integrator Serial #6: 2736A12722
Model #7: HP 3392A Integrator Serial #7: 2736A13020

Model #8: 18596B Auto-sampler Serial #8: 2942A20665

(1) Hewlett-Packard Model 5890, Series II, GC
Accessories: Dual Flame Ionization Detector
Heated Head Space Auto Sampler
HP 7673A Auto-injector/auto-sampler
Nelson Box and Cables
Date of Purchase: 06/26/89

Model #1:	Model 5890 Seies II GC	Serial #1:	2950A26219
Model #2:	FID Detectors (Qty 2)	Serial #2:	N/A
Model #3:	HHS Auto Sampler 19395A	Serial #3:	2741I02305
Model #4:	HP 19395A Controller	Serial #4:	2741I02305
Model #5:	Nelson Box and Cables	Serial #5:	9249571384
Model #6:	HP 3396A Integrator	Serial #6:	2841A05972
Model #7:	18593A Auto-injector	Serial #7:	2932A14191
Model #8:	18594A Controller	Serial #8:	2919A14824
Model #9:	18596A Auto-sampler	Serial #9:	2920A11146

(1) Hewlett-Packard Model 5890, Series II, GC
Accessories: Dual Flame Ionization Detector
Heated Head Space Auto Sampler
HP 7673B Auto-injector/auto-sampler
Nelson Box and Cables
Date of Purchase: 10/10/91

Model #1:	Model 5890 Series II GC	Serial #1:	3133A37901
Model #2:	FID Detectors (Qty 2)	Serial #2:	NA
Model #3:	HHS Auto-Sampler 19395A	Serial #3:	2741I02538
Model #4:	HP 7673A Controller	Serial #4:	2941A20355
Model #5:	Nelson Box and Cables	Serial #5:	1227573973
Model #6:	7673A Auto-injector	Serial #6:	3114A25869
Model #7:	7673A Controller	Serial #7:	2941A20355
Model #8:	7673A Auto-sampler	Serial #8:	2942A20796

(1) Hewlett-Packard Model 1090M, Series II HPLC
Accessories: 1046 Fluorescence Detector

Diode Array Detector
Chemstation Processing System

Date of Purchase: 09/15/91

Model #1:	Model 1090M HPLC	Serial #1:	3125A03259
Model #2:	1046 Fluorescence Detector	Serial #2:	3016G01692
Model #3:	Diode Array Detector	Serial #3:	3102A00474
Model #4:	Chemstation System	Serial #4:	3135A10890
Model #5:	79994A Chemstation	Serial #5:	2925A2064
Model #6:	9144A Tape Drive	Serial #6:	3107E97106
Model #7:	35741B Monitor	Serial #7:	9109J41647
Model #8:	7957B Fixed Disc	Serial #8:	3001A16724
Model #9:	Inkjet Printer	Serial #9:	3103S57778

(1) Hewlett-Packard Model 5890, Series II, GC
Accessories: Dual Electron Capture Detectors
HP 7673 Auto-injector and sampler
Nelson Box and Cables

Date of Purchase: 05/30/89

Model #1:	Model 5890 Series II GC	Serial #1:	2921A23427
Model #2:	Dual ECD's	Serial #2:	F3110, F3111
Model #3:	18593B Auto-injector	Serial #3:	3009A20965
Model #4:	18593B Auto-injector	Serial #4:	3009A20897
Model #5:	Nelson Box and Cables	Serial #5:	9249571382
Model #6:	HP 3396A Integrator	Serial #6:	2841A11408
Model #7:	18594B Controller (inj/sam)	Serial #7:	2941A20436
Model #8:	18596B Auto-sampler	Serial #8:	2942A20797

(1) Hewlett-Packard Model 5890, Series II, GC
Accessories: Dual Electron Capture Detectors
HP 7673 Auto-injector and sampler
Nelson Box and Cables

Date of Purchase: 12/14/89

Model #1:	Model 5890 Series II GC	Serial #1:	2950A26263
Model #2:	Dual ECD's	Serial #2:	L6918, L6919
Model #3:	18593B Auto-injector	Serial #3:	3004A20711
Model #4:	18593B Auto-injector	Serial #4:	3004A20439
Model #5:	Nelson Box and Cables	Serial #5:	9339571659

Model #6:	HP 3396A Integrator	Serial #6:	2841A11516
Model #7:	18594B Controller	Serial #7:	2941A20513
Model #8:	18596B Auto-sampler	Serial #8:	2942A20568

(1) Hewlett-Packard Model 5890, Series II GC
Accessories: Dual Electron Capture Detectors
HP7673 Auto-injector and sampler
Nelson Box and Cables
Date of Purchase: 01/15/92

Model #1:	Model 5890 Series II GC	Serial #1:	3203A41786
Model #2:	Dual ECD's	Serial #2:	F3323/F3325
Model #3:	18593B Auto-injector	Serial #3:	3218A30614
Model #4:	18593B Auto-injector	Serial #4:	3218A30617
Model #5:	Nelson Box and Cables	Serial #5:	2135574867
Model #6:	HHP 3396B Integrator	Serial #6:	3131P31859
Model #7:	18594B Controller	Serial #7:	3218A28486
Model #8:	18596B Auto-sampler	Serial #8:	3218A39466

(1) Hewlett-Packard Model 5890, Series II GC
Accessories: O.I. Model 4430 Photoionization Detector
O.I. Model 4420 Electrolytic Conductivity Detector
O.I. Model MPM-16 Auto-sampler with heater controller and jackets
Nelson Box and Cables
O.I. Model 4460A Purge and Trap Concetrator
Date of Purchase: 09/15/91

Model #1:	Model 5890 Series II GC	Serial #1:	3126A36958
Model #2:	Model 4430 PID	Serial #2:	91-1064
Model #3:	Model 4420 ELCD	Serial #3:	91-472
Model #4:	Model 4460A Purge and Trap	Serial #4:	13089-1055
Model #5:	Model MPM-16 Auto-samlper	Serial #5:	91-350
Model #6:	Nelson Box and Cables	Serial #6:	1227573974
Model #7:	Model MHC-16 Heater Contrl.	Serial #7:	91-137

(1) Hewlett-Packard Model 5890, Series II, GC
Accessories: O.I. Model 4430 Photoionization Detector
O.I. Model 4420 Electrolytic Conductivity Det.
O.I. Model MPM-16 Autosampler with heater controller and jackets
Nelson Box and Cables
O.I. Model 4460A Purge and Trap Concentrator
Date of Purchase: 05/26/89

Model #1:	Model 5890 Series II GC	Serial #1:	2921A24115
Model #2:	Model 4430 PID	Serial #2:	89-327
Model #3:	Model 4420 ELCD	Serial #3:	89-966
Model #4:	Model MPM-16 Autosampler	Serial #4:	89-084B
Model #5:	Model 4460A Purge and Trap	Serial #5:	89-457F
Model #6:	Nelson Box and Cables	Serial #6:	9249571381
Model #7:	Model MHC-16 Heater Contrl.	Serial #7:	89-029

(1) Hewlett-Packard Model 5890, Series II, GC
Accessories: O.I. Model 4430 Photoionization Detector
O.I. Model 4420 Electrolytic Conductivity Det.
O.I. Model 4460A Purge and Trap Concentrator
O.I. Model MPM-16 Autosampler
Nelson Box and Cables
Date of Purchase: 06/26/89

Model #1:	Model 5890, Series II GC	Serial #1:	2921A24117
Model #2:	Model 4430 PID	Serial #2:	89-326
Model #3:	Model 4420 ELCD	Serial #3:	89-967
Model #4:	Model 4460A Purge and Trap	Serial #4:	89-452F
Model #5:	Model MPM-16 Autosampler	Serial #5:	89-082B
Model #6:	Nelson Box and Cables	Serial #6:	9249571383
Model #7:	Model MHC-16 Heater Contrl.	Serial #7:	90-064

(1) Hewlett-Packard Model 5890, Series II GC
Accessories: Dual Flame Ionization Detectors
HP 7673 Auto-injector/Auto-sampler (Dual)
HP 3396A Integrator
Date of Purchase: 11/01/91

Model #1:	Model 5890 Series II GC	Serial #1:	3140A37963
Model #2:	FID Detectors (QTY 2)	Serial #2:	NA
Model #3:	18593B Auto-injector	Serial #3:	3120A27971
Model #4:	18593B Auto-injector	Serial #4:	3120a27968
Model #5:	18594B Controller	Serial #5:	3138a26785
Model #6:	3396A Integrator	Serial #6:	2841A05972
Model #7:	3392 Series II Integrator	Serial #7:	3112P28048
Model #8:	18596B Auto-sampler	Serial #8:	3137A26291

(1) Hewlett-Packard Model 5890, Series II GC
Accessories: Dual Flame Ionization Detectors
HP 7673 Auto-injector/Auto-sampler (Dual)
HP 3396B Series II Integrator
Date of Purchase: 01/05/92

Model #1:	Model 5890 Series II GC	Serial #1:	3203A41787
Model #2:	FID Detectors (QTY 2)	Serial #2:	NA
Model #3:	18593B Auto-injector	Serial #3:	3218A30595
Model #4:	18593B Auto-injector	Serial #4:	3218A30592
Model #5:	18594B Controller	Serial #5:	3216A28401
Modle #6:	3396B Series II Integrator	Serial #6:	3131P31800
Model #7:	18596B Auto-sampler	Serial #7:	3218A28460

(2) IBM PS/2 Model 70 CLP Data Stations, Instrument Controllers
Accessories: Printers
Date of Purchase: 08/31/89

Model #1:	Model 70 Data Station	Serial #1:	237154577
Model #2:	Model 70 Data Station	Serial #2:	237153982
Model #3:	Model 70 DAta Station	Serial #3:	72-07039076
Model #4:	Model FX-1050 Epson Printer	Serial #4:	0E11039135
Model #5:	Model FX-1050 Epson Printer	Serial #5:	0E10037550
Model #6:	Model FX-1050 Epson Printer	Serial #6:	0E10027343
Model #7:	Model 70 Data Station	Serial #7:	237144355
Model #8:	Model FX-1050 Epson PRinter	Serial #8:	0E11191519

<u>Spectroscopy</u>

(1) ARL Model 3560 Simultaneous Inductively Coupled Plasma (ICP-001)

Accessories: AIM 101 Autosampler
ARL Ultrasonic Nebulizer
Deltac Line Conditioner
Date of Purchase: 09/01/89

Model #1:	ARL 3560 ICP	Serial #1:	5392
Model #2:	AIM 101 Autosampler	Serial #2:	165
Model #3:	ARL Ultrasonic Nebulizer	Serial #3:	138
Model #4:	Deltac Line Conditioner	Serial #4:	054805

(1) ARL Model 3410 Sequential Inductively Coupled Plasma (ICP-002)
Accessories: AIM 101 Auto-sampler
USN Ultrasonic Nebulizer
Deltac Line Conditioner
Model 30-286 IBM P/S2 Data Station
with Monitor and Printer
Date of Purchase: 08/20/92

Model #1:	ARL Model 3410 Seq. ICP	Serial #1:	1198
Model #2:	AIM 101 Auto-sampler	Serial #2:	367
Model #3:	USN Ultra. Nebulizer	Serial #3:	138
Model #4:	Deltac Line Conditioner	Serial #4:	055524
Model #5:	Model 30-286 IBM P/S2 D.S.	Serial #5:	23-7738839
Model #6:	IBM Monitor	Serial #6:	72-0708526
Model #7:	IBM Pro-Printer	Serial #7:	11-3523181

(1) Perkin Elmer 5100Z Graphite Furnace Atomic Absorption Spectrophotometer (GFAA-001)
Accessories: AS-60 Autosampler
EDL Power Supply
Lauda Recirculator
Date of Purchase: 05/01/89

Model #1:	5100 PC Spectrophotometer	Serial #1:	133081
Model #2:	Zeeman 5100	Serial #2:	6583
Model #3:	HGA 600	Serial #3:	5003
Model #4:	AS-60 Autosampler	Serial #4:	7591
Model #5:	EDL Power Supply	Serial #5:	134356
Model #6:	Lauda Recirculator	Serial #6:	L04006

(1) Perkin Elmer 5100Z Graphite Furnace Atomic Absorption Spectrophotometer (GFAA-002)
Accessories: AS-60 Autosampler
EDL Power Supply
Lauda Recirculator
Date of Purchase: 05/01/89

Model #1:	5100 PC Spectrophotometer	Serial #1:	135745
Model #2:	Zeeman 5100	Serial #2:	6664
Model #3:	HGA 600	Serial #3:	5076
Model #4:	AS-60 Autosampler	Serial #4:	7385
Model #5:	EDL Power Supply	Serial #5:	134165
Model #6:	Lauda Recirculator	Serial #6:	K21008

(1) Perkin Elmer Model 1100B Atomic Absorption Spectrophotometer (AAS-001)
Date of Purchase: 05/01/89
Model #1: PE Model 1100B AA Serial #1: 136268

(1) Buck Hg Analyzer
Accessories: Plotter
Date of Purchase: 02/09/90
Model #1: Hg Analyzer Serial #1: 081
Model #2: Plotter Serial #2: 34404

(1) Buck IR Analyzer(in Organic Prep)
Date of Purchase: 02/09/90
Model #1: Buck IR Analyzer Serial #1: 031

(1) ST 690 Visible Photometer
Date of Purchase: 08/01/89
Model #1: ST 690 Visible Photometer Serial #1: 011290

(1) Erdco Rapid Tester
Date of Purchase: 09/29/90

Model #1: Model RT-01 Flashpoint Tester
Serial #1: 1357

(4) Thermolyne Hot Plates with Remote
Date of Purchase: 11/10/89
Model #2200 Hot Plate

(1) CMS Digital Conductivity Meter
Date of Purchase: 11/10/89
Model # Serial #1: 023228

(1) Lauda RMT Recirculator
Date of Purchase: 09/12/89
Model # RMP 6 Serial #: L07033

(1) Equatherm Hot Water Bath
Date of Purchase: 01/15/91
Model #273-807 Serial #: 0391-0781

(1) Precision Shaking Water Bath
Date of Purchase: 11/10/89
Model #50 Serial #: 31AX-10

(1) Scientific Products Tempcon Oven
Date of Purchase: 01/5/92
Model #N8620-13A Serial #: 0292-1092

(1) Haake 1000 KRYO-Thermal
Date of Purchase: 05/05/91
Model #KRYO-1000 Serial #: 895193

(1) IBM PS/2 Model 50Z Instrument Controller (GFAA-001)
Date of Purchase: 08/31/89

Model #1:	Model 50Z	Serial #1:	72-7627409
Model #2:	IBM Monitor	Serial #2:	72-0714399
Model #3:	Epson EX800 Printer	Serial #3:	00N0003961
Model #4:	Tripp-Lite Power Conditioner	Serial #4:	LC1200A

(1) IBM PS/2 Model 50Z Instrument Controller (GFAA-002)
Date of Purchase: 08/31/89

Model #1:	Model 50Z	Serial #1:	23-7695514
Model #2:	IBM Monitor	Serial #2:	23-TG274
Model #3:	Epson EX800 Printer	Serial #3:	00N0009877
Model #4:	Tripp Lite Power Conditioner	Serial #4:	LC1200A

(1) IBM PS/2 Model 30-286 Instrument Controller (ICP-001)
Date of Purchase:

Model #1:	Model 30-286	Serial #1:	23-7738300
Model #2:	IBM Monitor	Serial #2:	23-GN589
Model #3:	IBM Proprinter II	Serial #3:	113490851

ORGANIC-PREP

(1) ABC Gel Permeation Cleanup
Accessories: UV Detector
Date of Purchase: 01/18/90 - 01/05/92

Model #1:	GPC-1002B	Serial #1:	796B-199
Model #2:	UV Detector - 0106-0000	Serial #2:	00456
Model #3:	Chart Recorder	Serial #3:	232133
Model #4:	GPC System 1000	Serial #4:	9124-SI
Model #5:	UVD Detector/UVD 1000	Serial #5:	5039
Model #6:	Chart Recorder	Serial #6:	1136

(1) Organomation Nitrogen Evaporator
Date of Purchase: 10/24/89

Model #1:	Nitrogen Evaporator 111	Serial #1:	8827

(3) Zymark - Turbo-Vap automated evaporators
Date of Purchase: 10/24/89

Model #1:	Turbo-Vap ZW640-3	Serial #1:	04222
Model #2:	Turbo-Vap ZW640-3	Serial #2:	04402
Model #3:	Turbo-Vap ZW640R-s	Serial #3:	04558

(24) Continuous Liquid-Liquid Extractors
Date of Purchase: 10/27/89

Model #1:	N/A	Serial #1:	N/A

(2) Heat Systems Ultrasonics Sonicators
Accessories: Soundproof enclosures
Date of Purchase: 10/24/89

Model #1:	Sonicator W-385	Serial #1:	G9548
Model #2:	Sonicator X02020	Serial #2:	G1079
Model #3:	Sonicator 475	Serial #3:	V4037
Model #4:	Son-a-box Sound Muffler	Serial #4:	N/A
Model #5:	Son-a-box Sound Muffler	Serial #5:	N/A
Model #6:	Son-a-box Sound Muffler	Serial #6:	N/A

(1) Lars Lande 10-place Rotary Extractor
Date of Purchase: 10/24/89

Model #1:	10-Place Rotary Extractor	Serial #1:	1109
Model #2:	10-Place Rotary Extractor	Serial #2:	9390

(1) Thermolyne Hot Plate 2200
Date of Purchase: 10/15/91
Model #HPA2235M Serial #: 237910793914

(1) Corning Hotplate
Date of Purchase: 10/15/90
Model # PC-500 Serial #: LR33491

(1) Millipore Pressure Filtration Unit

Date of Purchase: 01/15/91
Model # NA Serial #: NA

(10) Lars Lande Zero Headspace Extractors
Date of Purchase: 05/02/90
Model #1: N/A Serial #1: N/A

(1) Millipore Ultra-Pure Water System
Accessories: Continental Deonized Water System
Date of Purchase: 10/24/89
Model #1: Milli-Q-System Serial #1: 10837-C

(1) Equatherm Oven - 900 watts
Date of Purchase: 10/27/89
Model #1: Equatherm Oven - 900 watts Serial #1: 0989-0679

(3) Equatherm Ovens - 600 watts
Date of Purchase: 10/27/89
Model #1: Equatherm Oven - 600 watts Serial #1: 0489-1328
Model #2: Equatherm Oven - 600 watts Serial #2: 0489-1333
Model #3: Equatherm Oven - 600 watts Serial #3: 0489-0486

(2) Tabletop Centrifuge
Date of Purchase: 05/02/90
Model #1: IEC HN-S2 Serial #1: 235519029
Model #2: IEC HN-S2 Serial #2: 235520449

(1) Microwave Oven
Date of Purchase: 11/08/89
Model #1: Microwave Oven Serial #1: N/A

(1) Recirculator
Date of Purchase: 06/01/90
Model #1: Lauda 001-6166 Serial #1: 895193

(1) Orion SA720 pH/ISE Analyzer
Date of Purchase: 10/24/89
Model #1: SA720 pH/ISE Analyzer Serial #1: TT121A

(1) Walk-in Cooler, locking, 14′ x 8′ x 7′
Date of Purchase: 09/19/89
Model #1: Walk-in Cooler, locking Serial #1: N/A

(1) Ohaus E4000D Top-loading Balance
Date of Purchase: 10/24/89
Model #1: Ohaus E4000D Balance Serial #1: 1851

(1) Ohaus GA200 Analytical Balance
Date of Purchase: 10/24/89
Model #1: GA200 Analytical Balance Serial #1: 1238

(1) Ohaus GT210 Top-Loading Balance
Date of Purchase: 10/24/89
Model #1: GT210 Serial #1: 1415

(1) Ohaus GT4800 Top-Loading Balance
Date of Purchase: 10/24/89
Model #1: GT4800 Serial #1: 1549

(2) Ohaus E120 Top-Loading Balance
Date of Purchase: 10/24/89
Model #1: E-120 Top Loading Balance Serial #1: 1664
Model #2: E-120 Top Loading Balance Serial #2: 1853
(4) Captair Ductless Fume Hoods - 4′
Date of Purchase: 08/23/89
Model #1: Ductless Fume Hood - 4′ Serial #1: 19901
Model #2: Ductless Fume Hood - 4′ Serial #2: 18391
Model #3: Ductless Fume Hood - 4′ Serial #3: 19849

Model #4: Ductless Fume Hood - 4' Serial #4: 23197

(7) Labconco 8' Fume Hoods with Make-up Air
Date of Purchase: 08/29/89

Model #1:	Labconco 8' Fume Hood	Serial #1: 203528
Model #2:	Labconco 8' Fume Hood	Serial #2: 203527
Model #3:	Labconco 8' Fume Hood	Serial #3: 203526
Model #4:	Labconco 8' Fume Hood	Serial #4: 203524
Model #5:	Labconco 8' Fume Hood	Serial #5: 203525
Model #6:	Labconco 8' Fume Hood	Serial #6: 203523
Model #7:	Labconco 8' Fume Hood	Serial #7: 203521

(1) Thermolyne Furnace 6000
Date of Purchase: 10/27/89
Model #6000 Furnace Serial #: 53900579

(1) Labline Furnace 15000
Date of Purchase: 10/15/90
Model #15000 Serial #: 490103

(2) Scientifc Products Tempcon Ovens
900 Watts
Date of Purchase: 09/15/91
Model #1: NA Serial #1: 0891-0110
Model #2: NA Serial #2: 0891-0115

(1) Sartorius H160 Top-Loading Balance
Date of Purchase: 05/15/91
Model # H160 Serial # 39120117

(2) Sartorius LC42005 Top-Loading Balance
Date of Purchase: 02/02/91
Model #1: LC42005 Serial #1: 40070075
Model #2: LC42005 Serial #2: 40070055

(1) Neslab Coolflow
Date of Purchase: 01/05/92
Model # HX-300 Serial #: 92BML09160-1

(1) Corning Stirrer/Hotplate
Date of Purchase: 01/15/90
Model # PC-320 Serial #: LR-33491

(1) Lab-Line Multi-Magnestir
Date of Purchase: 11/20/90
Model # 1278 Serial #: 0991

Computers

(1) IBM Model 80 File Server, Data Archives
Accessories: Irwin 80 Mbyte Tape Backup System
Date of Purchase: 10/19/89
Model #1: Model 80 File Server Serial #1: 726068696
Model #2: Irwin Tape Backup System Serial #2: N/A

(1) IBM Token Ring Network, 32 Network Nodes
Accessories:
Date of Purchase: 08/31/89
Model #1: N/A Serial #1: N/A

(14) IBM PS/2 Model 70 CLP Data Stations
Accessories:
Date of Purchase: 10/19/89
Model #1: Model 70 CLP Data St. Serial #1: 23-7153977
Model #2: Model 70 CLP Data St. Serial #2: 23-7153666
Model #3: Model 70 CLP Data St. Serial #3: 23-7144355
Model #4: Model 70 Data Mgmt. Serial #4: 23-KAXPV
Model #5: Model 70 Data Mgmt. Serial #5: 23-KAXMC
Model #6: Model 70 Data Mgmt. Serial #6: 23-KAXMD

Model #7:	Model 70 CLP Data St.	Serial #7:	23-KAXML
Model #8:	Model 70 CLP Data St.	Serial #8:	23-KAXMP
Model #9:	Model 70 -386 TPH	Serial #9:	23-AVZZ3
Model #10:	Model 70-386 Pest.	Serial #10:	23-XFL21
Model #11:	Model 70-CLP Data St.	Serial #11:	23-KAXYH
Model #12:	Model 70-MIS	Serial #12:	23-8094394
Model #13:	Model 70-Inorganics	Serial #13:	23-KDZWD
Model #14:	Model 70-386 Pest.	Serial #14:	23-7154577

(2) IBM P/S2 Model 50 Inorganics
Accessories:
Date of Purchase: 10/19/89

Model #1:	Model 50Z Inorganics	Serial #1:	72-7627409
Model #2:	Model 50 Inorganics	Serial #2:	23-7695514

(5) IBM PS/2 Model 30-286 Data Stations
Accessories:
Date of Purchase: 10/19/89

Model #1:	Model 30-286	Serial #1:	23-7507547
Model #2:	Model 30-286	Serial #2:	23-7504724
Model #3:	Model 30-286	Serial #3:	23-7504180
Model #4:	Model 30-286	Serial #4:	23-7507186
Model #5:	Model 30-286	Serial #5:	23-7504096
Model #6:	Model 30 Receptionist	Serial #6:	23-7738300

(3) ALR 386/33
Accessories:
Date of Purchase: 04/16/91

Model #1:	386/33-101	Serial #1:	0231385
Model #2:	386/33-101	Serial #2:	0244109
Model #3:	ECM-14396	Serial #3:	98470195

(7) Epson FX1050
Accessories:
Date of Purchase: 10/19/89

Model #1:	FX1050	Serial #1:	OE10054458

Model #2:	FX1050	Serial #2:	OE10025824
Model #3:	FX1050	Serial #3:	OE10037550
Model #4:	FX1050	Serial #4:	OOOOO32873
Model #5:	FX1050	Serial #5:	OE11300909
Model #6:	FX1050	Serial #6:	OE11371613
Model #7:	FX1050	Serial #7:	OE10027343

(3) Hewlett-Packard Laserjet
Accessories: #1 512K RAM Expansion
Date of Purchase: 10/19/89

Model #1:	HP Laserjet IID	Serial #1:	2914A04926
Model #2:	HP Laserjet II	Serial #2:	2914A88408
Model #3:	HP Laserjet IID	Serial #3:	2830J19387

(3) IBM Laserprinter
Accessories:
Date of Purchase: 04/25/91

Model #1:	Laser Printer E(4019)	Serial #1:	11-YN801
Model #2:	Laser Printer E(4019)	Serial #2:	11-YP261
Model #3:	Laser Printer E(4019)	Serial #3:	11-ZR115

(1) Labworks Data Tracking System (LIMS) from Analytical Automation Specialists
Accessories: QA Analyst from Northwest Analytical
Date of Purchase: 08/31/89

Model #1:	Labworks Ver. 2.95 (LIMS)	Serial #1:	89285156
Model #2:	QA Analyst Ver. 3.12	Serial #2:	QH874736

(1) Smartware II from Informix
Accessories: PC-LAN 12 Node LAN-PAK
Date of Purchase: 08/31/89

Model #1:	Smartware II Version 1.02	Serial #1:	LX0306168
Model #2:	PC-LAN LAN-PAK	Serial #2:	N/A

(1) Ward Scientific CLP Software Ver. 2.36
Accessories:

Date of Purchase: 12/30/89
Model #1: CLP Software Ver. 2.36 Serial #1: 8305

(1) EPA EMSL-CINN Organic CLP Software Ver. 10.5
Accessories:
Date of Purchase: Public Domain
Model # EMSL-CINN Ver. 10.5 Serial #: NA

APPENDIX A

MAINTENANCE OF INTRA-LABORATORY CUSTODY

MAINTENANCE OF INTRA-LABORATORY SAMPLE CUSTODY

1.0 GENERAL

1.1 INTRODUCTION

This section dictates all procedures to maintain and document sample and subsample custody and security at the Law Environmental - National Laboratories Pensacola Branch.

INTRA-LABORATORY SAMPLE CUSTODY PROCEDURES

1. All samples are received, checked, and logged into the laboratory system by the Sample Custodian in accordance with SOP: "General Laboratory Operations," section "Sample Receipt and Log-In". The SOP manual is located in the QA/QC office.

2. When samples are not undergoing manipulation (preparation, subsampling, analysis, etc.), they must be maintained exclusively under lock in the storage areas identified below.

Sample Type	Sample Location
Metals in Water pH < 2	Walk-in Refrigerator
Metals in Sediment	Walk-in Refrigerator
Cyanide in Water pH > 12	Walk-in Refrigerator
Cyanide in Sediment	Walk-in Refrigerator
Subsamples Digested for Metals	Sample Storage Area

3. Samples must be checked out of storage areas from SM/C or sample custodians <u>only</u>. All check-outs will be documented by the SM/C or sample custodians on the Inog/Org. Check Out Forms (Exhibits A1 and A2). Each set of samples checked out for a manipulation constitute a pre-established analytical batch. All duplicates and spikes produced by the analyst will become part of the batch and will be appended to the

checked out batch list on the back of the Inorg/Org. Check Out Form. Once an analytical batch is established, it shall be processed as a unit for all subsequent preparations, testing, and analyses.

a. The samples are contained on the sample case.

b. The samples are of the same matrix.

c. The samples have the same analytical requirements.

d. The samples are all received within a five day period.

e. The number of samples does not exceed twenty.

5. Initially, the non-manipulated samples will be checked out by the preparatory personnel. Subsequently the original sample will be checked back in to the SM/C or the sample custodians at the earliest possible time. Normally, all samples and subsamples will be checked back into the SM/C or sample custodians at the end of each work period.

6. The Sample Manager will properly maintain the signed custody forms at all times. The Sample Manager will keep these records for sample tracking purpose, i.e., in order to document the location of all samples and subsamples at all times.

7. The Sample Manager will assure that all samples and subsamples are checked in at the end of each work period.

8. The Sample Manager will maintain the sample storage area and the walk-in refrigerator under the manager's direct supervision or under lock at all times.

9. During normal work periods, the custody of subsamples and digested finals are the responsibility of the depatrment's supervisor and laboratory personnel that checked out the sample batches.

10. Upon completion of sample preparation, the digested finals

will be checked in with the SM/C or sample custodian in order to assure subsample and chain-of-custody integrity prior to analysis.

11. The analyst will checkout the batch of digested finals from the SM/C or sample custodians in order to conduct the required analyses. In order to perform all required analyses the analyst will not use more than the predetermined digest volume for the analyses being conducted. All subsamples will be returned to the Sample Custodian at the end of each work period. The analyst will not dispose of any subsamples. All sample transfers will be documented on the Inorg/Org. Check Out Form.

12. When all analyses and data reviews have been completed and the sample retention requirements have been met, the samples will be disposed of in accordance with SOP "Hazardous Materials Handling".

13. Copies of all Intra-Lab Chain of Custody Forms pertaining to each case will be submitted to the Management Information Systems (MIS) Manager to be maintained in the appropriate case file.

DV092691

INORGANIC CHECKOUT FORM
LENL-Pensacola, FL

SDG:

Client: _____ Case: _____

Location: _____ Calib. Ref. _____ Form Iniated ___/___/___

S=Sample		CHECKED OUT		D=Digestate		Y=Yes		CHECKED IN		N=No
Type S/D	Date	Time	Removal Purpose*	Taken By	Cust. App.	Date	Time	Return By	Cust. App.	Complete Y/N-S/D

*** REMOVAL PURPOSE**

PREPARATION
- A - pH / % Moisture
- B - ICP Digestion
- C - GFAA Digestion
- D - Hg Digestion
- E - Solids
- Y - TCLP Extract - SV/Metals

ANALYSES
- G - ICP
- H - GFAA
- I - Hg-CV
- J - CN
- K - Solids
- L - R/C/I

DISPOSITION
- V - Storage
- W - Return
- X - Consumed/ Disposal
- Z - OTHER (List on Back)

SAMPLES CONSTITUTING THIS BATCH

Matrix:
Level:
Sample Containers:

Sample ID	Analyses Req'd	Sample ID	Analyses Req'd
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	

CHECK OUT/CHECK IN

CUSTODY FORM FOR ORGANICS

DV092691

ORGANIC CHECKOUT FORM
LENL-Pensacola, FL

Client: _____ Case: _____ SDG: _____

Location: _____ Calib. Ref. _____ Form Iniated ___/___/___

S=Sample			CHECKED OUT		X=Extract	Y=Yes			CHECKED IN	N=No
Type S/X	Date	Time	Removal Purpose*	Taken By	Cust. App.	Date	Time	Return By	Cust. App.	Complete Y/N-S/X

*** REMOVAL PURPOSE**

PREPARATION
- A - pH / % Moisture
- B - Extract SV - TPH
- C - Extract SV - Acids
- D - Extract SV - B/N's
- E - Extract SV - B/N/A's
- F - Extract TRPH
- G - Extract Pest/PCBs
- H - Clean-up SV
- I - Clean-up Pest/PCBs
- J - Extract - HPLC
- Y - TCLP Extract - VOA's

ANALYSES
- K - Screening
- L - VOA - GC
- M - VOA - GC/MS
- N - VOA - TPH
- O - SV - GC/MS
- P - SV - TPH
- Q - Pest/PCB - GC
- R - GC/MS Confirmation
- T - HPLC
- U - TRPH

DISPOSITION
- V - Storage
- W - Return
- X - Consumed/ Disposal

Z - OTHER (List on Back)

SAMPLES CONSTITUTING THIS BATCH

Matrix: Level: # Sample Containers:

Sample ID	Analyses Req'd	Sample ID	Analyses Req'd
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	

APPENDIX B

SAMPLE BOTTLE PREPARATION

PREPARATION OF SAMPLE CONTAINERS

1.0 GENERAL

1.1 INTRODUCTION

LENL-Pensacola has implemented a policy where all sample containers are disposable. No sample container is ever reused. (Note: An exception is made for special glass and plastic compositing containers. These undergo a rigorous cleaning depending upon their construction and use). Storage of bulk packages of sample containers is in a non-contaminating environment. LENL practice is to purchase precapped containers. If it should become necessary to purchase containers that are not precapped, when a bulk package is opened, any excess containers are capped and placed in new plastic bags, and sealed to prevent contamination during bulk storage. Bulk packages of caps are treated in a similar fashion.

LENL selects sample container vendors with consideration for the background concetration levels for potential analytes of concern, consistency of container quality and integrity of packaging. New shipments/lots of containers

are evaluated for background levels through a series of QC checks. These QC checks embody residue, nutrient, metallic, and organic scans encompasing regulated pollutants. The results are recorded in the sample container log. Containers that have discernible levels of analytes at the routine level are rejected to preclude any potential contamination/artifact problems due to limitations in the cleaning process.

Comercially cleaned containers may be employed providing they meet the guidelines in 1.2. Commercial containers are still subject to QC checks stated above. LENL-Pensacola utilizes commercially cleaned containers for critical analyses. It is not necessary that sample containers undergo the full cleaning regime in each and every instance. Depending upon background levels in the sample containers, the usage of the data, sample matrix, analyte(s), and concentrations levels of concern, some steps can be reduced or eliminated. The establishment of container requirements is made as part of the Project Quality Assurance Plan (PQAP).

1.2 CLEANING

INORGANIC:

Gross	-	None
Routine	-	1) Rinse 1X with Type II water.
Trace	-	1) Rinse 3X with Type II water.

METALS

Gross	-	1) Rinse 1X with Type II water.
Routine	-	1) Rinse 1X with 1+1 HNO_3, allow to leach 30 minutes.
		2) Rinse 2X with Type II water.
Trace	-	1) Rinse 1X with 1+1 HNO_3, allow to leach 30 minutes.
		2) Rinse 2X with 1+1 HNO_3.
		3) Rinse 2X with Type I water.

ORGANICS

Gross	-	None
Routine	-	
VOA	-	1) Detergent wash.
		2) Rinse 3X with Type II water.
		3) Dry 105^{0}C for one hour.
EXT	-	1) Detergent wash.
		2) Rinse 3X with Type II water.
		3) Rinse 3X with Isopropanol (PG).

Trace -

VOA - 1) Detergent wash.

2) Rinse 3X with type II water.

3) Dry at 105°C for one hour.

1.3 **PRESERVATIVES:**

1.3.1 Preservative Preparation:

Sulfuric Acid - 1+1 with Type water.

Nitric Acid - 1+1 with Type I water.

Hydrochloric Acid- 1+1 with Type I water.

Sodium Hydroxide- 10N (400 g/l) Type I water.

Sodium Thiosulfate- Solid added at normal rate, 75 mg $Na_2S_2O_3$/liter of sample or as needed to reduce Cl_2.

1.3.2 Preservative Addition:

The amounts added, based on the formulations above, are what is necessary to achieve the specifications in Table 6-1. If due to sample matrix, additional preservative is required, it should be added in the field.

1.4 STORAGE OF PREPARED CONTAINERS:

Containers are stored in a non-contaminating environment. They are under the custody of the Sample Manager.

1.5 EMERGENCY SAMPLE CONTAINERS:

New one pint/quart mason jars may be employed as sample containers in emergency situations. They are acceptable for the general scope of inorganic and organic analyses with the exceptions of aqueous matrices for volatile organic analytes.

The rubber sealing ring should not be in contact with the sample and aluminum foil should be used as a liner isolating the sample from the cap and sealing ring. If organic parameters are to be analyzed, then if possible, the jar and foil should be rinsed with pesticide grade methanol and allowed to air dry before use. Several empty container assemblies should be submitted for quality control purposes.

APPENDIX C

LAW STANDARD CLEANING PROCEDURES FROM
"ENGINEERING SUPPORT BRANCH SOP AND QA MANUAL,"
USEPA REGION IV, APRIL 1, 1986

APPENDIX C
STANDARD CLEANING PROCEDURES

1.0 GENERAL

1.1 INTRODUCTION

The cleaning procedures outlined in this appendix are to be used by all Law personnel to clean sampling and other field equipment as well as sample containers prior to field use. Sufficient clean equipment and sample containers should be transported to the field so that an entire inspection or investigation can be conducted without the need for cleaning equipment in the field. However, this will not always be possible when using specialized field equipment. Field cleaning procedures are included to cover these special problem areas. Emergency field sample container cleaning procedures are also included; however, they should not be used unless absolutely necessary. Specific cleaning procedures are presented in the following sections.

These procedures are the standard operating procedures (SOP) for Law; <u>any</u> deviation from them <u>must</u> be documented in field records and investigative reports.

1.2 CLEANING MATERIALS

The cleaning materials referred to in this appendix are defined in the following paragraphs.

The laboratory detergent shall be a standard brand of phosphate-free laboratory detergent such as Alquinox or Liquinox. The use of any other detergent must be justified and documented in the field logbooks and inspection or investigation reports.

The nitric acid solution (10 percent) shall be made from reagent-grade nitric acid and deionized water.

The standard cleaning solvent shall be pesticide-grade isopropanol. However, solvents may be substituted for a particular investigation if needed. Pesticide-grade acetone or methanol are both acceptable. However, it should be noted that if pesticide-grade acetone is used, the detection of acetone in samples collected with acetone rinsed equipment is suspect. Pesticide-grade methanol is much more hazardous to use than either pesticide-grade isopropanol or acetone, and its use is

discouraged. Pesticide-grade hexane and petroleum ether are not miscible with water; therefore, these two solvents are not effective rinsing agents unless equipment is dry. The use of any solvent other than pesticide-grade isopropanol for equipment cleaning purposes must be justified and its use must be documented in field logbooks and inspection or investigation reports.

Tap water may be used from any municipal water treatment system. The use of an untreated portable water supply is not an acceptable substitute for tap water.

1.5 DECONTAMINATION OF EQUIPMENT USED TO COLLECT SAMPLES OF TOXIC OR HAZARDOUS WASTE

Equipment that is used to collect samples of hazardous materials or toxic wastes or materials from hazardous waste sites, RCRA facilities, or in-process waste streams shall be decontaminated before it is returned from the field. At a minimum, this decontamination procedure shall consist of washing with laboratory detergent and rinsing with tap water. More stringent

decontamination procedures may be required, depending on the waste sampled.

1.6 PROPER DISPOSAL OF CLEANING MATERIALS

The solvent used to rinse sampling equipment and containers shall be collected and disposed of by allowing it to evaporate under a fume hood or be containerized and disposed of through an approved hazardous waste disposal contract. Similarly, spent nitric acid shall be collected and disposed of through the same disposal contract. These procedures apply whether the cleaning operations take place in the Branch washroom or in the field.

1.7 USE OF SAFETY PROCEDURES TO BE UTILIZED DURING CLEANING OPERATIONS

The materials used to implement the cleaning procedures outlined in this appendix can be dangerous if improperly handled. Due caution must be exercised by all Branch personnel and all applicable safety procedures shall be followed. At a minimum, the following precautions shall be taken in the washroom and in the field during these cleaning operations.

1. Safety glasses with splash shields or goggles, neoprene gloves, and a neoprene laboratory apron will be worn during all cleaning operations.

2. All solvent rinsing operations will be conducted under a fume hood or in the open (never in a closed room).

3. No eating, smoking, drinking, chewing, or any hand to mouth contact shall be permitted during cleaning operations.

1.8 STORAGE OF FIELD EQUIPMENT AND SAMPLE CONTAINERS

All field equipment and sample containers shall be stored in a contaminant free environment after being cleaned using the procedures outlined in this appendix.

2.0 SPECIFIC QUALITY CONTROL PROCEDURES FOR CLEANING OPERATIONS

2.1 GENERAL

This section establishes guidelines for specific quality control procedures to monitor the effectiveness of the sampling equipment and sample container cleaning procedures outlined in this appendix. These procedures shall be carried out by Branch personnel and the results monitored by the Branch Quality Assurance Officer. All quality control procedures shall be recorded in a logbook maintained in the Branch washroom(s). All quality control data shall be maintained in a separate quality assurance file. Upon receipt of quality control data from the ASB, the Branch Quality Assurance Officer shall review these data to identify any abnormalities or contamination of sampling equipment or sample containers. If problems are detected, the Branch Quality Assurance Officer shall immediately initiate an investigation to determine the cause of the problem(s) and institute immediate corrective action. This process is documented through deficient incident reports.

2.2 RINSE WATER

The quality of the deionized and organic-free water used shall be monitored by collecting samples once per quarter in standard precleaned, sample containers and submitting them to the ASB for a standard ICP scan. Organic-free water will also be submitted for low level pesticide, herbicide, extractable and purgeable compounds analyses. When field deionizing and/or organic-free water units are utilized, more frequent quality control samples will be collected. An initial sample and samples at weekly intervals are the minimum number considered acceptable.

2.3 SAMPLING EQUIPMENT CLEANED IN BRANCH WASHROOM

The effectiveness of the equipment cleaning procedures used in the Branch washroom shall be monitored by rinsing cleaned equipment (equipment used to collect samples for trace organics and metals analyses) with organic-free or Milli-Q water and submitting the rinse water to the ASB for low level analysis of extractable organic compounds including pesticides and a standard ICP scan. At least one piece of field equipment shall be selected for this procedure each time equipment is washed. An attempt should be made to select different pieces of equipment for this procedure, each time equipment is washed, so that a

representative sampling of all equipment is obtained over a 12-month period.

2.4 SAMPLING EQUIPMENT CLEANED IN THE FIELD

The effectiveness of field cleaning procedures shall be monitored by rinsing field cleaned equipment with organic-free water and submitting the rinse water in standard sample containers to the ASB for analysis as outlined in Appendix C 2.3. Any time equipment is cleaned in the field at least one such quality control sample shall be collected. No more than five percent of the equipment cleaned during large scale field studies shall be subjected to these procedures.

3.0 CLEANING PROCEDURES FOR TEFLON OR GLASS FIELD SAMPLING EQUIPMENT USED FOR THE COLLECTION OF SAMPLES FOR TRACE ORGANIC COMPOUNDS AND/OR METALS ANALYSES*

1. Equipment will be washed thoroughly with laboratory detergent and hot water using a brush to remove any particulate matter or surface film.

2. The equipment will be rinsed thoroughly with hot tap water.

3. Rinse equipment with at least a 10 percent nitric acid solution.**

4. Rinse equipment thoroughly with tap water.

5. Rinse equipment thoroughly with deionized water.

6. Rinse equipment twice with solvent and allow to air dry for at least 24 hours.

7. Wrap equipment completely with aluminum foil to prevent contamination during storage and/or transport to the field.

8. Rinse the Teflon or glass sampling equipment thoroughly with tap water in the field as soon as possible after use.

---

* - When this sampling equipment is used to collect samples that contain oil, grease or other hard to remove materials, it may be necessary to rinse the equipment several times with pesticide-grade acetone or hexane to remove the materials before proceeding with Step 1. In extreme cases, it may be necessary to steam clean the field equipment before proceeding with Step 1. If the field equipment cannot be cleaned utilizing these procedures, it should be discarded.

** - Small and awkward equipment such as vacuum bottle inserts and well bailers may be soaked in the nitric acid solution instead of being rinsed with it. Fresh nitric acid solution should be prepared for each cleaning session.

4.0 CLEANING PROCEDURES FOR STAINLESS STEEL OR METAL SAMPLING EQUIPMENT USED FOR THE COLLECTION OF SAMPLES FOR TRACE ORGANIC COMPOUNDS AND/OR METALS ANALYSIS*

1. Wash equipment thoroughly with laboratory detergent and hot water using a brush to remove any particulate matter or surface film.

2. Rinse equipment thoroughly with hot tap water.

3. Rinse equipment thoroughly with deionized water.

4. Rinse equipment twice with solvent and allow to air dry for at least 24 hours.

5. Wrap equipment completely with aluminum foil to prevent contamination during storage and/or transport to the field.

6. Rinse the stainless steel or metal sampling equipment thoroughly with tap water in the field as soon as possible after use.

---

* - When this sampling equipment is used to collect samples that contain oil, grease or other hard to remove materials, it may be necessary to rinse the equipment several times with pesticide grade acetone or hexane to remove the materials before proceeding with Step 1. In extreme cases, when equipment is painted, badly rusted, or coated with materials that are difficult to remove, it may be necessary to steam clean, wire brush, or sandblast equipment before proceeding with Step 1. Any stainless steel sampling equipment that cannot be cleaned using these procedures should be discarded.

5.0 CLEANING PROCEDURES FOR AUTOMATIC WASTEWATER SAMPLING EQUIPMENT

5.1 GENERAL

All ISCO and other automatic samplers will be cleaned as follows:

- The exterior and accessible interior (excluding the waterproof timing mechanism) portions of automatic samplers will be washed with laboratory detergent and rinsed with tap water.
- The face of the timing case mechanism will be cleaned with a clean damp cloth.
- All tubing (sample intake and pump tubing) will be discarded after use.
- New precleaned, silastic pump tubing (see Section C 6.1) will be installed.
- When utilizing the samplers for collecting samples for metals and/or organic compounds analyses, the metal distributor tubes should not be used; only glass or silastic pump tubing should be used for this purpose.
- The ISCO 1680 automatic samplers should <u>not</u> be used for collecting samples for organic compounds analyses in the individual bottle mode because there is no way to properly clean the distributor plate to remove any residual organic compounds. The sample tubing headers may not be used to collect samples for organic compounds analyses for the same reason. The ISCO 2100 automatic samplers may be used to collect samples for organic compounds analyses in the individual bottle mode, if the specific cleaning procedures for the ISCO 2100 glass sequential bottles are followed as outlined in Section C 5.5 and 5.6.

Specific cleaning procedures for components of the ISCO automatic samplers follow.

5.2 ISCO 1680 AUTOMATIC SAMPLER ROTARY FUNNEL AND DISTRIBUTOR

1. Use only for non-organic compounds sample collection using individual sequential bottles.
2. Clean with hot water, laboratory detergent and a brush.
3. Rinse thoroughly with deionized water.
4. Replace in sampler.

5.3 ISCO 1680 AUTOMATIC SAMPLER METAL TUBE

1. Clean as outlined in C 5.2.

5.4 PLASTIC REUSABLE COMPOSITE SAMPLE CONTAINERS*

1. Proceed with the cleaning procedures as outlined in C 5.2 but omit the solvent rinse.

---

* - Plastic reusable sample containers used to collect samples from facilities that produce toxic or noxious compounds or are used to collect in-process waste stream samples at industrial facilities will be disposed of properly (preferably at the facility) at the conclusion of the sampling activities and will not be returned for cleaning. Any plastic composite sample containers that have a visible film, scale, or other discoloration remaining after this cleaning procedure will be discarded.

5.5 ISCO 1680 AND 2100 GLASS SEQUENTIAL SAMPLE BOTTLES AUTOMATIC SAMPLER BASE FOR SEQUENTIAL MODE*

1. Rinse with 10 percent nitric acid.

2. Rinse thoroughly with tap water.

3. Dishwasher, wash cycle, using laboratory detergent cycle, followed by tap and deionized water rinse cycles.

4. Replace bottles in covered, automatic sampler base; cover with aluminum foil for storage.

5. Rinse bottles in the field as soon as possible after using tap water.

5.6 ISCO 2100 GLASS SEQUENTIAL SAMPLE BOTTLES (AUTOMATIC SAMPLER BASE FOR SEQUENTIAL MODE) TO BE USED FOR COLLECTING SAMPLES FOR ORGANIC COMPOUNDS ANALYSES

1. Proceed as outlined in Steps 1-4 in Appendix C 5.5.

2. Rinse twice with solvent and allow to air dry for at least 24 hours.

3. Replace in covered, automatic sampler base; cover with aluminum foil for storage and mark the base as follows: "Cleaned for organic analyses."

---

* - These ISCO 1680 glass sequential sample bottles are not to be used for collecting samples for organic compounds analyses. The ISCO 2100 bottles also are not be used for collecting samples for organic compounds analyses unless the cleaning procedures outlined in C 5.6 are used.

6.0 CLEANING PROCEDURES FOR SAMPLE TUBING

6.1 SILASTIC RUBBER PUMP TUBING USED IN AUTOMATIC SAMPLERS AND OTHER PERISTALTIC PUMPS

New precleaned tubing must be used for each automatic sampler set-up. The silastic rubber pump tubing need not be replaced in peristaltic pumps where the sample does not contact the tubing or where the pump is being used for purging purposes (i.e., not being used to collect samples).

The silastic tubing shall be precleaned as follows:

1. Flush tubing with hot tap water and phosphate-free laboratory detergent.
2. Rinse tubing thoroughly with hot tap water.
3. Rinse tubing with deionized water.
4. Install tubing in automatic sampler or peristaltic pump.
5. Cap both ends of tubing with aluminum foil.

6.2 TEFLON SAMPLE TUBING

Use only new Teflon tubing precleaned as follows for collection of samples for organic compounds analyses:

1. Teflon tubing shall be precut in convenient lengths before cleaning.
2. Rinse outside of tubing with solvent.

3. Flush interior of tubing with solvent.

4. Dry overnight in the ASB drying oven.

5. Wrap tubing and cap ends with aluminum foil to prevent contamination during storage.

6.3 POLYVINYL CHLORIDE (PVC) SAMPLE TUBING (1/8, 1/4, OR 3/8 INCH)

1. Use only new tubing.

2. The tubing will be flushed with sample immediately before use to remove any residues from the manufacturing or extruding process.

3. Polyvinyl chloride tubing will be used selectively where organic compounds are not of concern.

4. Tubing should be stored in original container and not removed from this container until needed.

7.0 MISCELLANEOUS EQUIPMENT CLEANING PROCEDURES

7.1 WELL SOUNDERS OR TAPES USED TO MEASURE GROUND WATER LEVELS*

1. Wash with laboratory detergent and tap water.

2. Rinse with tap water.

3. Rinse with deionized water.

4. Equipment should be placed in a polyethylene bag or wrapped with polyethylene film to prevent contamination during storage or transit.

7.2 SUBMERSIBLE PUMPS AND HOSES USED TO PURGE WATER WELLS*

Proceed as outlined in C 7.1.

7.3 PORTABLE POWER AUGERS SUCH AS THE LITTLE BEAVER

1. The engine and power head should be cleaned with a power washer, steam jenny, or hand washed with a brush using detergent (does not have to be laboratory detergent but should not be a degreaser) to remove oil, grease, and hydraulic fluid from the exterior of the unit. These units should be rinsed thoroughly with tap water.

2. All auger flights and bits shall be cleaned utilizing the procedures outlined in C 4.0 (including footnotes) or C 8.3 (including footnotes if appropriate).

---

* - The same procedure applies whether this equipment is cleaned in the Branch washroom or in the field.

7.4 LARGE SOIL BORING AND DRILLING RIGS

1. The rig should be cleaned before mobilized and brought on-site as outlined in Step 1 of C 7.3.

2. All auger flights, auger bits, drilling rods, drill bits, hollow stem augers, Split Spoon Samplers, Shelby Tubes, or other parts of the drilling equipment that will contact the soil or ground water should be cleaned as outlined in C 4.0 (including footnotes) or C 8.3 (including footnotes if appropriate).

7.5 MISCELLANEOUS SAMPLING AND FLOW MEASURING EQUIPMENT

Miscellaneous flow measuring and sampling equipment shall be washed with laboratory detergent, rinsed with hot tap water, followed by a thorough deionized water rinse, and dried before being stored. This procedure is not used for any equipment utilized for the collection of samples for trace organic compounds or metals analyses.

7.6 VEHICLES

All vehicles utilized by Branch should be washed (if possible) at the conclusion of each field trip. This routine maintenance should minimize any chance of contamination of equipment or samples due to contamination of vehicles. When vehicles are used in conjunction with hazardous waste site inspections, or on

studies where pesticides, herbicides, organic compounds or other toxic materials are known or suspected to be present, a thorough interior and exterior cleaning is mandatory at the conclusion of such investigations. It shall be the responsibility of the project leader and/or field investigators to see that this procedure is followed.

All vehicles shall be equipped with trash bags and/or trash containers to facilitate vehicle cleaning. All Branch personnel are responsible for keeping field vehicles clean by removing all trash and other debris before it accumulates. All contaminated trash and equipment must be kept separate from ordinary trash and must be disposed of properly on-site or upon return to the Athens facility for proper disposal.

8.0 FIELD EQUIPMENT CLEANING PROCEDURES

8.1 GENERAL

Sufficient clean equipment should be transported to the field so that an entire study can be conducted without the need for field cleaning. However, this is not possible for some specialized items of field equipment such as portable power augers (Little Beaver), well drilling rigs, soil coring rigs, and other large pieces of field equipment. In addition, during particularly large scale studies, it is not practical or possible to transport to the field all of the precleaned field equipment required. The following procedures are to be utilized when equipment must be cleaned in the field.

8.2 EQUIPMENT USED FOR ROUTINE SAMPLE COLLECTION ACTIVITIES

For routine operations involving classic parameter analyses, water quality sampling equipment such as Kemmerers, buckets, DO dunkers, dredges, etc. may be cleaned with sample or deionized water between sampling locations. A brush may be used to remove deposits of material or sediment, if necessary. If deionized water is used, water samplers should be flushed with sample at the next sampling location before the sample is collected. It

should be emphasized that these procedures cannot be used to clean equipment for the collection of samples for organic compounds or trace metals analyses.

Flow measuring equipment such as weirs, staff gages, velocity meters, and other stream gaging equipment may be cleaned with tap water after use between measuring locations, if necessary.

8.3 TEFLON, STAINLESS STEEL OR METAL EQUIPMENT USED TO COLLECT SAMPLES FOR ORGANIC COMPOUNDS AND TRACE METALS ANALYSES*

1. Clean with tap water and laboratory detergent using a brush if necessary to remove particulate matter and surface films.
2. Rinse thoroughly with tap water.
3. Rinse thoroughly with deionized water.
4. Rinse twice with solvent.
5. Rinse thoroughly with organic-free water and allow to air dry as long as possible.

---

* - Portable power augers (such as the Little Beaver) or large soil boring or drill rigs should be cleaned as outlined in Step 1 of C 7.3 before boring or drilling operations.

6. If organic-free water is not available, allow equipment to air dry as long as possible. Do <u>not</u> rinse with deionized or distilled water.

7. Wrap with aluminum foil, if appropriate, to prevent contamination if equipment is going to be stored or transported.

9.0 PREPARATION OF DISPOSABLE SAMPLE CONTAINERS

9.1 GENERAL

No sample container (with the exception of the glass and plastic compositing containers) will ever be reused. All disposable sample containers will be stored in their original packing containers. When packages of uncapped sample containers are opened, they will be placed in new plastic garbage bags and sealed to prevent contamination during storage. Specific precleaning instructions for disposable sample containers are given in the following sections. These instructions apply to precleaned disposable sample containers whether they are purchased from a contractor or are precleaned by Branch personnel.

9.2 ONE-PINT STOREMORE, ONE-QUART STOREMORE, ONE-HALF GALLON, AND ONE-GALLON PLASTIC CONTAINERS FOR OXYGEN DEMAND, NUTRIENTS, CLASSIC INORGANIC, SULFIDE, AND CYANIDE ANALYSES

1. Only new containers will be used.

9.3 ONE-HALF AND ONE-GALLON AMBER GLASS BOTTLES (WATER SAMPLES), 8; 16; AND 32-OUNCE CLEAR WIDEMOUTH JARS (SOIL, SEDIMENT, SLUDGE, AND CONCENTRATED WASTE) WITH TEFLON LINED CAPS FOR ORGANIC COMPOUNDS (EXCLUDING PURGEABLES) AND METALS ANALYSIS

1. Wash bottles and jars, Teflon liners, and caps in hot tap water and laboratory detergent.

2. Rinse three times with tap water.

3. Rinse with nitric acid solution.*

4. Rinse three times with deionized water.

5. Rinse bottles, jars, and liners (not caps) with solvent.*

6. Oven dry bottles, jars, and liners at 125 degrees C. Allow to cool.

7. Place liners in caps and cap containers.

8. Store containers in contaminant-free area.

---

* - Some bottle cleaning contractors use pesticide grade methylene chloride to solvent rinse sample containers. Also some of these contractors use 1:1 reagent grade nitric acid to rinse sample containers. For the purpose of cleaning sample containers as outlined in Sections B 9.3 and B 9.5, both of these deviations from the information contained in C 1.2 are permitted.

10.0 EMERGENCY DISPOSABLE SAMPLE CONTAINER CLEANING

New one-pint or one-quart mason jars may be used to collect samples for analyses of organic compounds and metals in waste and soil samples in an emergency. These containers would also be acceptable on an emergency basis for the collection of water samples for extractable and pesticide organic analyses as well as metal analyses. These jars cannot be used for the collection of water samples for purgeable organic analyses.

The rubber sealing ring should not be in contact with the jar and aluminum foil should be used, if possible, between the jar and the sealing ring. If possible, the jar and aluminum foil should be rinsed with pesticide grade methanol* and allowed to air dry before use. Several empty bottles and lids should be submitted to the laboratory as blanks for quality control purposes.

---

* - Pesticide-grade petroleum ether or hexane may also be used. The specific solvent used should be specified.

APPENDIX D
LENL STANDARD LABORATORY GLASSWARE CLEANING PROCEDURES

APPENDIX D
LABORATORY GLASSWARE

1.0 GENERAL

1.1 INTRODUCTION

LENL utilizes dedicated glassware in all of the lab sections to prevent cross contamination (e.g. Organic glassware rinsed with chromic acid could bias graphite furnace analyses for Cr). LENL routinely screens samples as well as using other means to track samples whose concentration levels are such that they present a risk of contaminating the glassware cleaning processes or area.

CLEANING PROCEDURES:

GENERAL:
1. Cleaning: All glassware is rinsed of any chemicals or residues by rinsing with tap water or appropriate solvents prior to placing them in the dish washing solution(s). Glassware is vigorously brushed and visually inspected.

Dish washing solutions should be changed weekly or more frequently based on the amount of glassware washed and how dirty/contaminated it becomes.

The selection of the soap is based on the analytes of concern and the nature of residues to be removed. Soaps used by LENL-Pensacola are anionic/non-toxic based and do not employ phosphorous containing constituents.

2. Rinsing: Glassware is rinsed with tap water as needed to remove soap/cleaning agents and then three times with Type II water.

The glassware is visually inspected and if residues are still apparent, the glassware will be recleaned, using a more aggressive cleaning technique or discarded.

3. Drying: Glassware is allowed to air dry in a non-contaminating environment. If needed, the process can be accelerated by placing in a dedicated glassware drying oven.

4. Storage: Glassware is stored in non-contaminating environments. The orifices of critical glassware are covered with aluminum foil or Teflon as an additional means to preclude contamination.

METALS:

1. Metals glassware is prepared and stored as above with the incorporation of 3X rinsing with 1+1 HNO_3 followed by a 3X rinsing with Type I water.

If residues remain, further attemps at cleaning by either/both an oxidizer not containing heavy metals or dry ashing is attempted. If this is unsuccessful, the glassware is discarded.

ORGANICS:

1. Organics glassware is prepared and stored as above. Additional glassware preparation may be inherent in the method and is performed at the time of sample preparation.

If residues remain, further attempts at cleaning by either/both an oxidizer (Cr_2O_7 / $K_2S_2O_8$) or dry ashing is attempted. If this is unsuccessful, the glassware is discarded.

APPENDIX E

LABORATORY BENCH SHEETS

DV:060990
LENL-Pensacola, FL

Employee Signature/Initials/Tenure Profile

Log ___ Page ___ of ___

Start Date	End Date	Signature	Initials	Title Section	Crd Chk	Rsm	Other
				----------			

DV:060990

System ID: _____

System Profile

LENL-Pensacola, I

Component Description	Manufacturer Vendor	Serial Number	Date Rcvd	Date Inst	Warranty	Service Contract	Maint P&S	Perf. Spec.	Comments

Deficient Incident Report

DV:060990

LENL-Pensacola, FL Section: _____

Analyst: _____ Date: __/__/__ Supervisor: _____ Date: __/__/__

Description

SDG/Samples Affected

Resolution

DV020492

INORGANIC CHECKOUT FORM
LENL-Pensacola, FL

Client: _____ Case: _____ SDG: _____

Location: _____ Calib. Ref. _____ Form Initiated ___/___/___

S=Sample CHECKED OUT D=Digestate						Y=Yes CHECKED IN N=No				
Type S/D	Date	Time	Removal Purpose*	Taken By	Cust. App.	Date	Time	Return By	Cust. App.	Complete Y/N-S/D

* REMOVAL PURPOSE

PREPARATION
- A - pH / % Moisture
- B - ICP Digestion
- C - GFAA Digestion
- D - Hg Digestion
- E - Solids

ANALYSES
- I - ICP
- G - GFAA
- H - HG - CV
- J - CN
- K - Solids
- L - R/C/I

DISPOSITION
- V - Storage
- W - Return
- X - Consumed/ Disposal

Y - TCLP Extract - SV/Metals

Z - Other (List on Back)

SAMPLES CONSTITUTING THIS BATCH

Matrix: Sample ID	Level: Analyses Req'd	# Sample Containers: Sample ID	Analyses Req'd
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	

DV020492

ORGANIC CHECKOUT FORM
LENL-Pensacola, FL

Client: _____ Case: _____ SDG: _____

Location: _____ Calib. Ref. _____ Form Initiated ___/___/___

S=Sample		CHECKED OUT		X=Extract		Y=Yes		CHECKED IN		N=No
Type S/X	Date	Time	Removal Purpose*	Taken By	Cust. App.	Date	Time	Return By	Cust. App.	Complete Y/N-S/X

* REMOVAL PURPOSE

PREPARATION
- A - pH / % Moisture
- B - Extract SV - TPH
- C - Extract SV - Acids
- D - Extract SV - B/N's
- E - Extract SV - B/N/A's
- F - Extract TRPH
- G - Extract Pest/PCBs
- H - Clean-up SV
- I - Clean-up Pest/PCBs
- J - Extract - HPLC
- Y - TCLP Extract - VOA's

ANALYSES
- K - Screening
- L - VOA - GC
- M - VOA - GC/MS
- N - VOA - TPH
- O - SV - GC/MS
- P - SV - TPH
- Q - Pest/PCB - GC
- R - GC/MS Confirmation
- T - HPLC
- U - TRPH
- Z - OTHER (List on Back)

DISPOSITION
- V - Storage
- W - Return
- X - Consumed/ Disposal

SAMPLES CONSTITUTING THIS BATCH

Matrix: Level: # Sample Containers:

Sample ID	Analyses Req'd	Sample ID	Analyses Req'd
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	
/		/	

Law Environmental, Inc.
7215 Pine Forest Road
Pensacola, Florida 32526
904/944-9772

Analytical Request Form

To: _____ Attn: _____

From: _____ _____
(Branch/Company Name) (Dept or Name)

COC Number: _____

Project Name: _____ Project Number: _____

Date Shipped: _____ Date results requested: _____

Sample ID	Analysis Requested	Detection Limits Req.	Sample Type	Method

Comments:

BOTTLE REQUEST FORM

ME: _____
PROJ NAME: _____
PROJ NUMBER: _____

TODAY'S DATE: _____
DATE REQUIRED: _____
SHIPPED BY: _____
AIRBILL #: _____

SHIP TO

Company Name: _____
Street: _____
City/State/Zip: _____
Attn: _____ Phone: ( ) _____

BOTTLE TYPE

AMBER GLASS (LIQUIDS)		
Gallon Jug:		
1000 ml:		
500 ml:		
250 ml:		
125 ml:		
AMBER GLASS (SOLIDS)		
2 oz:		
(Cl 6 oz:		
8 oz:		
4 oz:		
2 oz:		
PLASTIC (HDPE)		
1000 ml:		
500 ml:		
250 ml:		
125 ml:		
VIALS:		
40 ml:		
2 ml:		
4 ml:		
2 soil:		

COMMENTS:

COOLER NUMBERS:

PACKED BY: _____

DATE/TIME: _____
TIME SPENT: _____

Balance Calibration/Maintenance Log#___

System ID: _____

Section: _____

Start Date ___/___/___

End Date ___/___/___

Balance Calibration/Maintenance Log

DV:060990

NL-Pensacola, Fl - System ID: _____ Log # ____ Page ____ of ____

Date	Reference	Observed	Comments	Int

CALIBRATION/MAINTENANCE/RUN LOG #____

Section _____

System ID _____

Start Date ___/___/___

End Date ___/___/___

Calibration/Maintenance/Run Log

DV:060990
NL-Pensacola, Fl System ID: _____ Log # ___ Page ___ of ___

Date	Comments

Meter Calibration/Maintenance Log#___

System ID: _____

Section: _____

Start Date ___/___/___

End Date ___/___/___

Meter Calibration/Maintenance Log

DV:060990

NL-Pensacola, Fl System ID:_____ Log # ___ Page ___ of ___

Date	Reference	Observed	Comments	Int

Oven Calibration/Maintenance Log#___

System ID: _____

Section: _____

Start Date ___/___/___

End Date ___/___/___

Oven Calibration/Maintenance Log

DV:060990

NL-Pensacola, Fl - System ID:_____ Log # ___ Page ___ of ___

Date	Time	Temp	Comments	Int

Reagents Log#_____

Section: _____

Start Date ___/___/___

End Date ___/___/___

Reagents Log

DV:060990
LENL-Pensacola, Fl

Section:_____ Log # ___ Page ___ of ___

Nbr	Description/Preparation/Comments

Reagent Water Log#____

Type: _____

System ID: _____

Section: _____

Start Date ___/___/___

End Date ___/___/___

Reagent Water Type I - Calibration/Maintenance Log

DV:060990

ENL-Pensacola, Fl. System ID: _____ Log # ___ Page ___ of ___

Date	Meter	Cond.	Comments	Int

Reagent Water Type II Calibration/Maintenance Log

DV:060990

NL-Pensacola, Fl System ID: _____ Log # ___ Page ___ of ___

Date	Meter	Cond1	Cond2	Comments	Int

Refrigerator/Freezer Calibration/Maintenance Log#___

System ID: _____

Section: _____

Start Date ___/___/___

End Date ___/___/___

Refrigerator-Freezer Calibration/Maintenance Log

DV:060990
LENL-Pensacola, Fl. System ID:_____ Log # ___ Page ___ of ___

Date	Time	Temp	Comments	Int

Standards Log# _____

Type: _____

Section: _____

Start Date ___/___/___

End Date ___/___/___

LENL-Pensacola, FL

Standards Log

DV:091891

Section _____ Reference Pg. ___ -___

Std. ID	Ref.Pg.	FORWARD REFERENCES Date	Int.	Expired/ Consumed	Date	Int.

DV:060990
LENL-Pensacola,FL

RL # _____
Page ___ of ___

Contract: _____ Case: _____ SAS: _____ SDG: _____

Seq	Comments (continued)

DV:101891
LENL-Pensacola, FL

Cyanide Prep/Analysis Bench Sheet

RL #_____
Page ____ of____

.ient:_____ Case:_____ SDG:_____

Method Reference:_____ QC:_____ Spec: Syst. ID_____ C/M/R_____

Reagents Ref:_____ Stds. Ref:_____

Calib.Curve Data: Slope:_____ Intercept:_____ Corr.Coeff. _____

Prep: Date ___/___/___ Tech:_____ Analysis: Date ___/___/___ Tech:_____

Seq	Sample #	pH >12	S	Cl	Mtx	Hmg	V:L Wt:g	SCF	C: mls	Time	Abs	ug in dist.	Water ug/L	Other mg/Kg	Comments
1	Cal.Blank-S0	X	X	X	X	X	X	X	X				X	X	
2	Cal Std 5ug	X	X	X	X	X	X	X	X				X	X	
3	Cal Std 25ug	X	X	X	X	X	X	X	X				X	X	
4	Cal Std 100ug	X	X	X	X	X	X	X	X				X	X	
5	Dist. Std 50ug	X	X	X	X	X	X	X	X				X	X	% Rec =
6	Dist ICV 50ug	X	X	X	X	X	X	X	X						% Rec =
7	ICB	X	X	X	X	X	X	X	X						
8	PB (W / S)	X	X	X		X									
9	———														
10	———														
11	———														
12	———														
13	———														
14	———														
15	———														
16	———														
17	———														
18	———														
19	———														
20	———														
21	———														
22	———														
23	———														
24	———														
25	———														

$$CN = \frac{A\ ug}{B} \times \frac{50\ ml}{C\ ml}$$

Report waters as ug/L.

Report solids as ug/g or mg/Kg.

where: A = ug CN from Standard Curve

B = L of original sample for distillation for water samples

or: B = g of solid sample for distillation (corrected for % Solids)

C = ml of distillate taken for colorimetric determination

and: 50 ml = volume of original sample aliquot

EP Toxicity Bench Sheet

DV:060990
LENL-Pensacola, FL

Date ___/___/___ Initials _____

RL # _____
Page ___ of ___

Balance: System ID_____ C/M/R Ref:_____ pH: System ID_____ C/M/R Ref:_____

Reagent Ref:_____ Standards Ref:_____

Ref #	Sample ID	Sample Mass,g	Init pH	pH Acid	pH Acid	pH Acid	pH Acid	pH Acid	pH Acid	pH Acid	pH Acid	pH Acid	pH Acid	pH Acid	pH Acid	pH Acid	pH Acid	pH Acid	Total Acid Water
Time																			
1	PB			----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
2				----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
3				----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
4				----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
5				----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
6				----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
7				----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
8				----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
9				----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
10				----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

Ref	Comments

DV:101591
LENL-Pensacola, FL

GF Analysis Log

Contract:_____ Case:_____ SDG:_____

Analyte(s):_____ Method Ref:_____ QC: _____

System ID:_____ Program:_____ Results File ID:_____

Calibration Data

IDL/Linearity Ref:_____ ICV Stds. Ref: _____

C/M/R Ref: _____ MSA Stds. Ref: _____

Cal. Stds. Ref: _____ Reagents Ref: _____

Date ___/___/___ Analyst:_____

Seq	Sample #	Matrix	SCF	DF	Comments
1	Cal.Blank S0	X	X	X	
2	Cal.Std S___	X	X	X	
3	Cal.Std S___	X	X	X	
4	Cal.Std S___	X	X	X	
5	Cal.Std S___	X	X	X	
6	ICV	X	X	X	
7	ICB	X	X	X	
8	CRA	X	X	X	
9	PB (W / S)	X	X	X	
10	PB (W / S)A	X	X	X	
11	LCS (W / S)		1	1	
12	LCS (W / S)A		1	1	
13	---------				
14	---------				
15	---------				
16	---------				
17	---------				
*18	---------				
*19	---------				
20	---------				
21	---------				
22	---------				
23	---------				
24	---------				
25	---------				
26	---------				
27	---------				
28	---------				
29	---------				
*30	---------				

DV:102191
LENL-Pensacola, FL

Hg Cold Vapor Prep/Analysis Bench Sheet

RL #_____

Page_____of_____

Client:_____ Case:_____ SDG:_____

Method Reference:_____ QC: _____ Syst. ID_____ C/M/R_____

Reagents Ref:_____ Stds. Ref:_____

Calib.Curve Data: Slope:_____ Intercept:_____ Corr.Coeff._____

Prep: Date ___/___/___ Tech:_____ Analysis: Date ___/___/___ Time:_____ Tech:_____

Seq	Sample #	pH <2	Mtx	Hmg	Vol,l Wgt,g	SCF	Resp.	Time	Water ug/L	Other mg/Kg	Comments
1	Cal Blank S0	X	X	X	X	X			X	X	
2	Std 0.05 ug	X	X	X	X	X			X	X	
3	Std 0.1 ug	X	X	X	X	X			X	X	
4	Std 0.5 ug	X	X	X	X	X			X	X	
5	Std 1.0 ug	X	X	X	X	X			X	X	
6	ICV 0.6 ug	X	X	X	X	X				X	% Recovery =
7	ICB	X	X	X	X	X				X	
8	PB (W / S)	X		X							
9	--------										
10	--------										
11	--------										
12	--------										
13	--------										
14	--------										
15	--------										
16	--------										
17	--------										
*18	--------										
*19	--------										
20	--------										
21	--------										
22	--------										
23	--------										
24	--------										
25	--------										

COMMENTS

Seq	

DV:101691
LENL-Pensacola, FL

ICP Analysis Log

RL #_____
Page ___ of ___

lient:_____ Case:_____ SDG:_____
Analyte(s):_____ Method Ref:_____ QC:_____
System ID: _____ Program: _____ Results File ID: _____
Calib. Data: Cal. Stds. Ref:_____ ICV Stds. Ref: _____
IDL/LNRTY/IEC Ref: _____ ICS Stds. Ref: _____
C/M/R Ref: _____ CRI Stds. Ref: _____
Date ___/___/___ Analyst:_____

Seq	Sample #	Matrix	SCF	DF	Comments
1	Cal.Blank S0	X	X	X	
2	Cal Std 1	X	X	X	
3	Cal Std 2	X	X	X	
4	Cal Std 3	X	X	X	
5	Cal Std 4	X	X	X	
6	ICV	X	X	X	
7	ICB	X	X	X	
8	ICSAI	X	X	X	
9	ICSABI	X	X	X	
10	CRII	X	X	X	
11	PB (W / S)		1	1	
12	PB (W / S)		1	1	
13	---------				
14	---------				
15	---------				
16	------				
17	------				
*18	------				
*19	-------				
20	---------				
21	---------				
22	---------				
23	---------				
24	---------				
25	---------				
26	---------				
27	---------				
28	---------				
29	---------				
*30	---------				

DV:060996
LENL-Pensacola, FL

Inorganics Solids Bench Sheet

RL # _____
Page ___ of ___

Contract: _____ Case: _____ SAS: _____ SDG: _____

Method Reference: _____ QC: _____ Date: ___/___/___ Analyst _____

Balance: System ID _____ C/M/R Ref: _____

Oven: System ID _____ C/M/R Ref: _____ Drying Time In/Out: _____

	Sample #	Frac.	Hmg.	Free Lqd.	Dish Net,g	Wet Gross,g	Dry Gross,g	% Solids	Comments
1	--------								
2	--------								
3	--------								
4	--------								
5	--------								
6	--------								
7	--------								
8	--------								
9	--------								
10	--------								
11	--------								
12	--------								
13	--------								
14	--------								
15	--------								
16	--------								
17	--------								
18	--------								
19	--------								
20	--------								
21	--------								
22	--------								
23	--------								

DV:101491
L-Pensacola, FL

Metals Digestion Bench Sheet

RL #_____
Page_____ of_____

Client:_____ Case:_____ SDG:_____

Method Ref.:_____ Fraction:_____ QC:_____ Date__/__/__ Tech:_____

Balance:Syst.ID:_____ CMR Ref._____ LCS Ref.:_____

Reagents Ref.:_____ MSS Ref.:_____

Seq	Sample #	pH <2	Mtx	Hmg	Vol:L Wgt:g	QS Vol L	SCF	Color B	Color A	Clarity B	Clarity A	Tex	Art	Comments
1	--------													
2	--------													
3	--------													
4	--------													
5	--------													
6	--------													
7	--------													
8	--------													
9	--------													
10	--------													
11	--------													
12	--------													
13	--------													
14	--------													
15	--------													
16	--------													
17	--------													
18	--------													
19	--------													
20	--------													
21	--------													
22	--------													
23	--------													
24	--------													

KEYS:

Matrix	Color		Clarity	Texture
LW = Low Water	Co = Colorless		C = Clear	F = Fine
MW = Med Water	R = Red	Or = Orange	Cd = Cloudy	M = Medium
LS = Low Soil	Bl = Blue	W = White	O = Opaque	Cr = Coarse
MS = Med Soil	Y = Yellow	Br = Brown		
	Gr = Green	Gy = Grey		

DV:060990
LENL-Pensacola, FL

Metals Header Data Bench Sheet

Page ___ of ___

ontract: _____ Case: _____ SAS: _____ SDG: _____

QC: _____

********** ICP **********

Analyte(s):				
Method Ref:				
System ID:				
IDL/Lin./IEC Ref:				
C/M/R Ref:				
Calib. Stds. Ref:				
ICV Std Ref:				
ICS Std Ref:				
Date				
Analyst				
Program				
Results File ID				
Run Log #				

Comments: _____

********** GF **********

Analyte:				
Method Ref:				
System ID:				
IDL/Linearity Ref:				
C/M/R Ref:				
Calib. Stds. Ref:				
ICV Std. Ref:				
MSA Std. Ref:				
Reagents Ref:				
Date				
Analyst				
Program				
Results File ID				
Run Log #				

Comments: _____

DV:060990
LENL-Pensacola, FL

Meterable Parameters Bench Sheet

RL # _____
Page ___ of ___

Contract: _____ Case: _____ SAS: _____ SDG: _____

Analyte: _____ Method Reference: _____ QC: _____

Meter: Syst.ID _____ C/M/R Ref: _____ Analysis: Date ___/___/___ Analyst _____

Standards Ref: _____ Reagents Ref: _____

Calib.Curve Data: Slope: _____ Intercept: _____ Corr.Coeff: _____

Seq	Sample #	Mtrx.	Pres.	Hmg.	Sample V/M	DF	Obs 1	Delta	Obs 2	Delta	Obs 3	Result	Unit
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													

Seq	Comments

DV:060990
LENL-Pensacola, FL

Phenol Prep/Analysis Bench Sheet

RL #_____
Page ___ of ___

Contract:_____ Case:_____ SAS:_____ SDG:_____

Method Reference:_____ QC:_____

Reagents Ref:_____ Stds. Ref:_____

pH: Syst.ID_____ C/M/R Ref:_____ Spec: Syst.ID_____ C/M/R Ref:_____

Calib.Curve Data: Slope:_____ Intercept:_____ Corr.Coeff:_____

Prep: Date ___/___/___ Tech:_____ Analysis: Date ___/___/___ Tech:_____

Seq	Sample #	pH ≤2	Cl_2	Mtx.	Hmg.	Vol,l Wgt,g	SCF	A.Vol mls	Abs.	Time	Water mg/L	Other mg/Kg	Comments
1	S0	X	X	X	X	X	X	X			X	X	
2	S1	X	X	X	X	X	X	X			X	X	
3	S2	X	X	X	X	X	X	X			X	X	
4	S4	X	X	X	X	X	X	X			X	X	
5	S5	X	X	X	X	X	X	X			X	X	
6	PB	X	X	X	X	X	X	X				X	
7	LCS3	X	X	X	X	X	X	X				X	
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													

Seq	Comments

DV:060990
LENL-Pensacola, FL

Solids-Residue Bench Sheet
TS,SS,TDS,TVDS,TVS,TVSS

RL # _____
Page ___ of ___

Contract: _____ Case: _____ SAS: _____ SDG: _____

Analyte: _____ Method Reference: _____ QC: _____ Date: ___/___/___ Analyst: _____

Balance: System ID _____ C/M/R Ref: _____

Oven: System ID _____ C/M/R Ref: _____ Dry/Ash Time In/Out: _____

Seq	Sample #	Parm.	Mtrx.	Hmg.	Free Lqd.	Dish ID	Sample Vol, l	Dish Net, g	Wet Gross,g	Dry Gross,g	Ash Gross,g	Result mg/l:mg/kg	Comments
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													

Seq	Comments

LENL-Pensacola, FL

Organic Standards Log

DV:091891

Section _____ Intermediate / Working Reference Pg. ___ -___

Analyte(s) _____

Protocol _____ Method _____

Matrix _____ Conc. _____

PREPARATION

Back Ref.	Lot Number	Amount	Description

Storage: Location _____
Packaging _____
Conditions _____

Prep. Date ___/___ /___ Exp. Date ___/___/___ Initials _____

Disposition if not consumed prior to expiration: _____

Comments (Note ID of separate aliquots) _____

Forward References

Std. ID	Ref. Pg.	Date	Int.	Expired/ Consumed	Date	Int.
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	
		__/__/__			__/__/__	

DV:082891
LENL-Pensacola, FL

TPH Volatiles Prep Log
MS Ref:_____

RL #
Page ___ of ___

ılance ID:_____ CMR:_____ Oven ID:_____ CMR:_____

Seq	Int	Hmg	Lqd	Color	Clrty	Total Solids Dish	Wet	Dry	DTS	Analysis Vol/Mass	DWB
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
.6											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											

Seq	Comments

DV:060990
LENL-Pensacola, FL

TPH-X Extraction Bench Sheet

RL # _____
Page ___ of ___

Contract: _____ Case: _____ SAS: _____ SDG: _____

Analyte(s): _____ Matrix: _____ Level: _____

Method Reference: _____ Method: SepF / CLLE / Soxhlet / Sonc / Other - _____

Begin Date: ___/___/___ Time: _____ End Date: ___/___/___ Time: _____ Tech: _____

Balance: System ID _____ C/M/R Ref: _____ Oven: System ID _____ C/M/R Ref: _____

SS Ref: _____ MS Ref: _____ Reagents Ref: _____

Seq	Sample #	Int	Hmg	Color		Clrty		Total Solids			DTS	Ext V/W mls/g	C.Vol mls	Comments
				B	A	B	A	Dish	Wet	Dry				
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														

DV:052992
LENL-Pensacola, FL

GC Analysis Log

RL #
Page ___ of ___

Contract:_____ Case:_____ SAS:_____ SDG:_____

Analyte(s):_____ Method Ref:_____ QC:_____

Begin: Date / / Time _____ Analyst _____

End: Date / / Time _____ Analyst _____

System ID:_____ Program: GC _____ Det _____

Calibration:

Eval. Test(s) Ref: _____ Standard(s) Ref:_____

Initial Calib. Ref: _____ Standard(s) Ref:_____

C/M/R Ref: _____ Standard(s) Ref:_____

Seq	Sample #	Matrix	SCF	DF	File ID	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						

DV:082691
LENL-Pensacola, FL

TPH Volatiles Analysis Log

RL #
Page ___ of ___

ontract:_____ Case:_____ SDG:_____

Analyte(s):_____ Method Ref:_____ QC:_____

Begin: Date / / Time _____ Analyst _____

End: Date / / Time _____ Analyst _____

System ID:_____ Program: GC _____ Det _____

Calibration: C/M/R Ref:_____ Standard(s) Ref:_____

Initial Calib. Ref: _____ Standard(s) Ref:_____

Seq	Sample #	SCF	Matrix	File ID	Conc. ppm	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						

DV:082691
LENL-Pensacola, FL

TPH-X Analysis Log

RL #
Page ___ of ___

ontract: _____ Case: _____ SDG: _____

Seq	Sample #	Matrix	DF	File ID	Conc. ppm	Comments
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						
52						
53						
54						
55						
56						
57						
58						
60						

Seq.	Comments

DV:062190
LENL-Pensacola, FL

Appendix E

GC Volatiles Analysis Bench Sheet

RL # _____
Page ___ of ___

Contract: _____ Case: _____ SAS: _____ SDG: _____

Analyte(s): _____ Method Ref: _____ QC: _____

System ID: _____ Program: GC _____ Det _____

Begin: Date ___/___/___ Time _____ End: Date ___/___/___ Time _____ Analyst(s) _____

Calibration:

Initial Calib. Ref: _____ Standard(s) Ref: _____
C/M/R Ref: _____ Standard(s) Ref: _____
Surrogate Std Ref: _____ Matrix Std Ref: _____

Balance: System ID _____ C/M/R Ref: _____ Oven: System ID _____ C/M/R Ref: _____

Ref#	Sample #	File ID	Int	Hmg	Lqd	Color	Clarity	Anl.V/M mls/g	Total Solids Dish	Total Solids Wet	Total Solids Dry	PP	SS	AS	Run #	DTS DWB	SCF
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	

DV:021892
LENL-Pensacola

TCLP PREP SHEET

TECH:_____ RL#_____

EXTRACTION INFORMATION:
BEGIN DATE:_____ TIME:_____

END DATE:_____ TIME:_____

C/M/R: BALANCE ____:_____ OVEN 006:_____

FLUID #1 REF:_____
FLUID #2 REF:_____

SAMPLE I.D.	FLUID TYPE	WGT. OF SAMPLE EXTR.	WGT. OF FLUID	AMOUNT OF FLUID COLLECTED	Final pH	COMMENTS

DV:021892
LENL-Pensacola

TCLP CHARACTERIZATION BENCH SHEET
SEMI-VOLATILES

ANALYSIS REQUESTED:
BNA:_____
PEST:_____
HERB:_____
VOA:_____
METALS:____

DATE:_____
TECH:_____

CLIENT(S):_____

C/M/R: BALANCE ____:_____ pH METER:_____:_____ OVEN 006:_____

SAMPLE I.D.	F WGT.	TV WGT.	TV+S WGT.	WGT. OF T-SMPL	CV WGT.	CV+S WGT.	WGT. C-SMPL	F+SLDS WGT.	% SOLIDS WET / DRY		pH INT./FINL	

F=FILTER, S=SAMPLE, CV=COLLECTION VESSEL, TV=TRANSFER VESSEL,
T-SMPL=TRANSFERED SAMPLE, C-SMPL=COLLECTED SAMPLE, SLDS=SOLIDS

DV:060990
LENL-Pensacola, FL

TRPH Preparation Bench Sheet

RL # _____
Page ___ of ___

lance ID: _____ CMR: _____ Oven ID: _____ CMR: _____

Reagents Ref: _____ SS Ref: _____

Ref#	Int	Hmg	Lqd	Color	Clrty	Total Solids Dish	Wet	Dry	DTS	Analysis Vol/Mass	Fnl Vol
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											

Seq	Comments

LENL-Pensacola DV:092391 Organics Extraction Bench Sheet RUN LOG #_____

Client:_____ Case:_____ SDG:_____ START_____

Type: BNA / PP / TPH / Other- _____ Matrix: WAT / SOIL / ORG LEVEL: LO / MED-HI END:_____

Sep F/ L-L/ Sonc/ Diltn/ Tumble SURR:_____ SPIKE:_____

Balance:004 _____ Oven:001 _____ pH:001 _____ Reagents:_____

Analysts: Prep_____ Surr_____ Extr_____ Dry_____ Conc_____

Seq	Sample #	Vol/ Wt	End Vol	pH	% Sol.	Dish	Wet	Dry	Appearance		Comments
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											

DV:060990
LENL-Pensacola, FL

Organics Solids-Moisture/pH Bench Sheet

RL # _____
Page ___ of ___

Contract: _____ Case: _____ SAS: _____ SDG: _____

pH: System ID _____ C/M/R rEF: _____ Date: __/__/__ Analyst _____

Balance: System ID _____ C/M/R Ref: _____ Date: __/__/__ Analyst _____

Oven: System ID _____ C/M/R Ref: _____ Drying Time In/Out: _____

	Sample #	Frac.	Type	Hmg.	Free Liq.	Dish Net,g	Wet Gross,g	Dry Gross,g	% Solids	% Moist.	pH	Comments
1	--------											
2	--------											
3	--------											
4	--------											
5	--------											
6	--------											
7	--------											
8	--------											
9	--------											
10	--------											
11	--------											
12	--------											
13	--------											
14	--------											
15	--------											
16	--------											
17	--------											
18	--------											
19	--------											
20	--------											
21	--------											
22	--------											

Organics Screening Bench Sheet

DV:110591
LENL-Pensacola, FL

RL # _____
Page 1 of 2

Client: _____ Case: _____ SDG: _____

GC System ID _____ Calib. Ref: _____ Date: ___/___/___ Analyst: _____

Seq	Sample ID	Level	X Factor	File ID	Clean Up	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						

DV:012692 GC/MS VOA #1 Log Book LENL - Pensacola

OPERATOR_____ DATE__/___/9__ CLIENT(S)_____ SDG_____

GC PROGRAM CRYO1_____ -10 HOLD 3 MIN.: THEN 15 /MIN TO 30 ; HOLD 0 MIN.:
THEN 7 /MIN TO 160 ; HOLD 0 MIN

SCAN RANGE: 35 - 260 TUNE FILE: TUNER 1 EM:_____ SEQ. FILE: SEQ B1 SEQ_V1 I.D.LIST: ID_____

QUANT/UPLOAD ___/___/9__ UPLOAD FILE: VDMP__ ACQUISITION CRN: D_____ STDS: ISSS* VSTD* MSTC*

Seq	FRN	Sample #	LAB #	MPM POS	VOLUME	Comments	pH <2?	QC OK?	QAREA QDEL
1	>2		Column Condit	1	5ul/5ppt BFB	STD		X	X
2	>2		BFB	2	5ul/50ng BFB	Daily Tune Scan # Area =			Time :
3	>2			3					---
4	>2								---
5	>2								---
6	>2								---
7	>2								---
8	>2								---
9	>2								---
10	>2								---
11	>2								---
12	>2								---
13	>2								---
14	>2								---
15	>2								---
16	>2								---
17	>2								---
18	>2								---
19	>2								---
20	>2								---
21	>2								---
22	>2								---
23	>2								---
24	>2								---
25	>2								---
26	>2								---
27	>2								---
28	>2								---

SIGNED_____ COSIGNED_____

☐ - ARCHIVED ☐ - TIC'S ☐ - EXTENDED REPORTS

DV:012692 GC/MS VOA #2 Log Book LENL - Pensacola

OPERATOR_____ DATE___/___/9__ CLIENT(S)_____ SDG_____

GC PROGRAM CRYO2_____ -10 HOLD 3 MIN.: THEN 15 /MIN TO 30 ; HOLD 0 MIN.:
THEN 7 /MIN TO 160 ; HOLD 0 MIN

SCAN RANGE: 35 - 260 TUNE FILE: TUNER 1 EM:_____ SEQ. FILE: SEQ_B2 SEQ_V2 I.D.LIST: ID_____

QUANT/UPLOAD ___/___/9__ UPLOAD FILE: VDMP__ ACQUISITION CRN: D_____ STDS: ISSS* VSTD* MSTC*

Seq	FRN	Sample #	LAB #	MPM POS	VOLUME	Comments	pH <2?	QC OK?	QAREA QDEL
1	>4		Column Condit	1	5ul/5ppt BFB	STD		X	X
2	>4		BFB	2	5ul/50ng BFB	Daily Tune Scan # Area =			Time :
3	>4			3					---
4	>4								---
5	>4								---
6	>4								---
7	>4								---
8	>4								---
9	>4								---
10	>4								---
11	>4								---
12	>4								---
13	>4								---
14	>4								---
15	>4								---
16	>4								---
17	>4								---
18	>4								---
19	>4								---
20	>4								---
21	>4								---
22	>4								---
23	>4								---
24	>4								---
25	>4								---
26	>4								---
27	>4								---
28	>4								---

SIGNED_____ COSIGNED_____

☐ - ARCHIVED ☐ - TIC'S ☐ - EXTENDED REPORTS

GC/MS SVO #1 LOG BOOK

OPERATOR _____ DATE _____ CLIENT _____ SDG _____

GC PROGRAM _____ FOR _____ MIN. & _____ RATE TO _____ HOLD _____ MIN

INST. I.D. _____ SCAN RANGE _____ - _____ TUNE FILE _____

EM _____ SEQ. FILE _____ I.D. LIST _____ QUANT/UPLOAD DATE _____

UPLOAD FILE NAME _____ ACQUISITION CRN _____ STANDARDS _____

SEQ#	FRN	SAMPLE #	LAB #	AUT POS	SCF	COMMENTS	QC OK?	QAREA ODEL
1	>							
2	>							
3	>							
4	>							
5	>							
6	>							
7	>							
8	>							
9	>							
10	>							
11	>							
12	>							
13	>							
14	>							
15	>							
16	>							
17	>							
18	>							
19	>							
20	>							

SIGNED _____ COSIGNED _____

GC/MS SVO #2 LOG BOOK

OPERATOR _____ DATE _____ CLIENT _____ SDG _____

GC PROGRAM _____ FOR _____ MIN. & _____ RATE TO _____ HOLD _____ MIN.

INST. I.D. _____ SCAN RANGE _____ - _____ TUNE FILE _____

EM _____ SEQ. FILE _____ I.D. LIST _____ QUANT/UPLOAD DATE _____

UPLOAD FILE NAME _____ ACQUISITION CRN _____ STANDARDS _____

SEQ#	FRN	SAMPLE #	LAB #	AUT POS	SCF	COMMENTS	QC OK?	QAREA QDEL
1	>							
2	>							
3	>							
4	>							
5	>							
6	>							
7	>							
8	>							
9	>							
10	>							
11	>							
12	>							
13	>							
14	>							
15	>							
16	>							
17	>							
18	>							
19	>							
20	>							

SIGNED _____ COSIGNED _____

CHEMTEX

Environmental & Industrial Hygiene Services

3082, 25th Street
Port Arthur, TX 77642
Phone: (409) 983-4575
FAX: (409) 982-1522

QA Plan, Experience & Statement of Qualifications

Submitted to

Mr. Blake Riggs
Bailey Disposal Site
OHM Remediation Services Corporation
225 W. Airtex Blvd
Houston, Texas 77073
Phone: (713) 775-7629
FAX: (713) 775-7659

Facilities are also available at
1825, N.P.I.D., Corpus Christi, TX 78408; Phone: (512) 299-9900; FAX: (512) 299-1155
16550, Highland Road, Baton Rouge, LA 70810; Phone: (504) 752-5100; FAX: (504) 753-1782
138, N.Cities Service Highway, Sulfur, LA 70663; Phone: (318) 625-4613: FAX: (318) 625-4168

Contents

1. Project Experience/Client References

2. Qualifications of the key personnel

3. Facility layout

4. Major Instrumentation

5. Quality Assurance Program Plan

6. Accreditations/Certifications

7. Statement of Qualifications

8. US EPA Water Pollution Study Results

9. US EPA Water Supply Study Results

10. AIHA's Proficiency Analytical Test Results

Project Experience

Client Name & Address	Contact & Phone No.	Nature of Work	Project Start Date	Exp. Date
Citgo Petroleum Corporation Hwy. 108 P. O. Box 1562 Lake Charles, LA 70602	Debra Richards 318-497-340	Industrial Hygiene Services & Analyses	1/1/90	Continuing
Citgo Petroleum Corporation Hwy. 108 P. O. Box 1562 Lake Charles, LA 70602	David Waters 318-497-7370	Industrial Hygiene Services & Analyses	1/1/90	Continuing
Naval Air Station/ Corpus Christi Army Depot Suite 143 Corpus Christi, TX 78419-5021	**Arthur Ruiz 512-939-3776**	**Hazardous Waste Characterization**	**1/1/95**	**Continuing**
Mody K Boatright 629 Santa Monica Corpus Christi, TX 78411	Mody K Boatright 512-852-6639	Ground water Monitoring	3/8/96	Continuing
Terra Technologies 1500 S.Dairy Ashford, Ste 225 Houston, TX 77077	Mr. Rick Klopp 713-497-1188	Ground Water Monitoring	6/8/95	Continuing
Texas A&M University Campus Box 213 Kingsville, TX 78363	Mr.Rod Larson, CIH 512-595-2742	Industrial Hygiene Services & Analyses	4/27/95	Continuing
Fina Oil & Chemical 14950, Heathrow Forest Pkwy Houston, TX 77032	Mr. Bill Kirby 512-643-2545	Rigs and Pits Monitoring	3/11/96	Continuing
Aker Gulf Marine P. O. Box C Ingleside, TX 78362	Steve Hubbard 512-776-2833	Contaminated Soil & Hazardous Waste Analysis	1/1/90	Continuing

Emtech Environmental Service 7889 Leopard St Corpus Christi, TX 78409	J Allen 800-336-0909 512-289-7596	Waste water & Hazardous Waste Analysis	1/31/96	Continuing
Emtech Environmental Service 7889 Leopard St Corpus Christi, TX 78409	Mary McCoig 800-336-0909 512-289-7596	Waste water & Hazardous Waste Analysis	1/31/96	Continuing
Emtech Environmental Service 7889 Leopard St Corpus Christi, TX 78409	Gary McCoig 800-336-0909 512-289-7596	Waste water & Hazardous Waste Analysis	1/31/96	Continuing
Allwaste P. O. Box 113 Sulphur, LA 70664-113	Robert Palmero 800-460-4976	Asebestos & Hazardous Waste Analysis	1/1/90	Continuing
Ameripol Synpol 1215 Main Street P. O. Box 667 Port Neches, TX 77651	Richard Saunders 409-721-1547	NPDES Sampling & Analysis, Solid Waste Sampling/Hazardous Waste Sampling & Monitoring	1/1/86	Continuing
City of Beaumont P. O. Box 3827 Beaumont, TX 77704	Gloria Broussard 409-866-0023	City Effluent, Influent, and Sludge Characterization EPA Storm Water Sampling	1/1/87	Continuing
American Safety Corp. 1334 Tenth St. Slidell, LA 70458-2902	Bob Miller,CIH 504-641-2502	Industrial Hygiene Services & Analyses	6/1/96	Continuing
Environmental Measurements Corp. 5132 Payne Baton Rouge, LA 70809	Steve Verret, CIH,CSP 504-767-7820	Industrial Hygiene Services & Analyses	1/1/93	Continuing
E T S 10461 Mammoth Dr. Baton Rouge, LA 70814	Barry Gibson 504-925-8405	Stack Sampling Analyses, Incinerator Burn Analyses and Ambient Air Monitoring Services	1/1/87	Continuing

Entergy 350 Pine St. Beaumont, TX 77704	Gene Cotton 409-827-5102	Contamination Survey, Sampling & Analyses for PCB's	8/1/95	Continuing
Fina Oil & Chemical P. O. Box 849 Port Arthur, TX 77642	Alan Brown 409-963-6806	Industrial Hygiene & Asbestos Services & Analyses	1/1/93	Continuing
Four Seasons Environmental 3449 I-10 Frontage Rd. Port Allen, LA 70767	John Quinn 504-344-6570	Industrial Hygiene Services & Analyses	1 /1/93	Continuing
Gulf Coast Safety & Health P. O. Box 1636 Pasadena, TX 77501-1636	Annette Owens 713-910-3800	Industrial Hygiene Services &Analyses	1/1/93	Continuing
Gray Environmental P. O. Box 58249 Houston, TX 77258-8249	Don Gray 713-333-2350	Asbestos, Lead, & Hazardous Waste Services & Analyses	1/1/93	Continuing
Hamlin & Harris 1728 Cloverdale Baton Rouge, LA 70808	Dr. Mike Harris 504-387-2847	Environmental & Industrial Hygiene Services & Analyses	1/1/93	Continuing
Huntsman Corp. P. O. Box 847 Port Neches, TX 77651	Dave Mohr 409-723-3422	Hazardous Waste Characterization, Soil & Water Sampling & Analyses for EPA Priority Pollutants, NPDES Permit Analyses	1/1/93	Continuing
Industrial Hygiene Services, Inc. P. O. Box 15075 Baton Rouge, LA 70895	Joe Wood, CIH 504-923-0125	Industrial Hygeiene & Asbestos Services & Analyses	1/1/95	Continuing
Mobil Chemical BCSP P. O. Box 215 Beaumont, TX 77704	Scott Arnold 409-839-1543	Industrial Hygiene Services & Analyses	1/1/93	Continuing

NALCO Chemical Co. P. O. Drawer 1 River Rd. (LA Hwy. 44) Garyville, LA 70051	Rodney Bourgeois 504-535-2221	NPDES Permit Analyses & Hazardous Waste Characterization	1/1/93	Continuing
Northrup-Grumman 4400 Legion St. Lake Charles, LA 70615	**Rick Keen 318-493-3824**	**Industrial Hygiene Services & Analyses**	**1/1/95**	**Continuing**
O H M Corporation 225 W. Airtex Blvd. Houston, TX 77090	**Chet Scheibel 713-775-7629**	**Bailey Superfund Site-Bridge City, TX Monitoring Services & Analyses**	**1/1/96**	**Continuing**
Petroleum Laboratories 109 Cleveland St. Houma, LA 70360	Dudley Smith 504-868-4820	Hazardous Waste Classification, Monitoring & Analyses	1/1/93	Continuing
Safety, Inc. P. O. Box 2034 Nederland, TX 77627	Kenneth Wines 409-727-2811	Asbestos & Lead Services & Analyses	1/1/93	Continuing
Star Enterprise P. O. Box 713 Port Arthur, TX 77640	Dennis Brown 409-989-7172	NPDES Permit Analyses, Plant Wide Effluent Monitoring Services & Analyses	1/1/93	Continuing
Texaco Research & Development P. O. Box 5519 Port Arthur, TX 77642	Jerry Telschik 409-989-2855	Hazardous Waste Characterization, Industrial Hygiene Analyses, Outfall Monitoring & Analyses	1/1/93	Continuing
Texas Drydock P. O. Box 968 Orange, TX 77631	Bill Hardy 409-985-6790	Hazardous Waste Characterization & Analyses	1/1/94	Continuing

U S Army Health Clinic Bldg. 458 Red River Army Depot Texarkana, TX 75507-5000	**Ronnie Evans 903-334-4192**	**Industrial Hygiene & Air Monitoring, Asbestos Analyses**	**1/1/93**	**12/31/95**
Woodward-Clyde 1709 Prien Lake Rd Lake Charles, LA 70601	**Charles Self 318-478-5532**	**Industrial Hygiene Services & Analyses**	**1/1/93**	**Continuing**
Goodyear Tire & Rubber Co. P. O. Box 26003 Beaumont, TX 77720-6003	Phil Potter 409-794-5281	Asbestos Analyses	1/1/93	Continuing
Basic Industries P.O. Box 2172 Nederland, TX 77627	Doug Phelps 409-722-7897	Asbestos Bulk & Air Analyses	1/1/93	Continuing
Baytown Public Works 1200 Lee Drive Baytown, TX 77520	Mike Hughes 713-420-3508	Sludge, Sewage and Wastewater Analyses	1/1/93	Continuing
Compliance Consultants, Inc. 11745 Bricksome Ave Baton Rouge, LA 70809	Steve Field 504-292-8488	Ground Water Monitoring, Effluent Analyses, & Hazardous Waste Characterization	1/1/93	Continuing
Firestone P. O. Box 1269 Orange, TX 77631	Robert Bucklin 409-883-1745	Asbestos Bulk & Fiber Analyses, and Industrial Hygiene Services	1/1/93	Continuing
Health & Safety Management P. O. Box 21572 Beaumont, TX 77720-1572	Richard Griffin 409-842-4094	Industrial Hygiene & Environmental Analyses	1/1/86	Continuing
Jones & Neuse, Inc. 2300 Hwy. 365, Ste. 250 Nederland, TX 77627	Bob Davis 409-721-6863	Soil Sampling, Hazardous Waste Characterization, Groundwater Monitoring & Analyses	1/1/93	Continuing

Morton International Inc. P. O. Box 500 New Iberia, LA 70562	Mike Broussard 318-867-4263	Ground water Monitoring & Analyses for Tebuthiuron	1/1/93	Continuing
Subra Co. P O. Box 9813 New Iberia, LA 70562	Wilma Subra 318-367-2216	NPDES Discharge Analyses for Carbofuran & Carbosulfan	1/1/93	Continuing
Unocal P. O. Box 237 Nederland, TX 77627	Ray Hoffpauir 409-724-3207	NPDES Permit Analyses	1/1/93	Continuing
Dupont P. O. Box 3269 Beaumont, TX 77704	Berlin Cassidy 409-727-9697	Industrial Hygiene Analyses	1/1/93	Continuing
North Star Steel P. O.Box 2390 Beaumont, TX 77704	John Nelson 409-769-1030	Steel Product Testing & Analyses	1/1/93	Continuing
Four Seasons Environmental 3107 South Elm Eugene St. Greensboro, NC 27406	Mark Sackman 800-868-2718	Industrial Hygiene Services & Analyses	1/1/93	Continuing
Mobil Exploration & Producing USA P. O. Box 239 Saratoga, TX 77585	Stephen Brents 409-274-5741	Oil Field Soil Contamination Survey, Sampling & Analyses	1/1/93	Continuing
Allied Signal Farm Road 1006 P. O. Drawer 640 Orange, TX 77631-0640	Gene Atkins 409-882-3652	NPDES Permit Analyses for Organics & Inorganics	1/1/95	Continuing
Baylor College of Medicine Office of Environmental Safety One Baylor Plaza, BCM-K111 Houston, TX 77030-3498	Tom Doyle 713-798-3498	Industrial Hygiene Services & Analyses	1/1/93	Continuing

Evans Cooperage of Houston, Inc. 10521 Sheldon Houston, TX 77044	Sharon Fisher 713-456-8333	Industrial Hygiene Services & Analyses	1/1/93	Continuing
Explorer Pipeline P. O. Box 5231 Port Arthur, TX 77640	Vaughn Robertson 409-736-4262	Outfall Monitoring & Organic Analyses	1/1/93	Continuing
Betz Laboratories P. O. Box 1600 Route 9 Beaumont, TX 77713	Doug Stafford 409-866-4778	Sewage and Wastewater Outfall Monitoring & Organic Analyses	1/1/93	Continuing
Jones & Neuse, Inc. 912 Capital of Texas Hwy. South, Suite 300 Austin, TX 78746	**Robert Hahn 800-580-9840**	**JBS/JCS Superfund-Site-Texas, Asbestos & Lead Monitoring & Analyses**	**1/1/93**	**Continuing**
Jones & Neuse, Inc. 912 Capital of Texas Hwy. South, Suite 300 Austin, TX 78746	**Robert Hahn 800-580-9840**	**Bergstrom Airforce Base, Austin, TX**	**1/1/93**	**Continuing**
O H M Corporation 2011 Vandevelde Alexandria, LA 71303	**Mark Proctor 318-473-4240**	**England Airforce Base, Alexandria, LA**	**1/1/94**	**Continuing**
Ausimont USA, Inc. Farm Road 1006 P. O. Box 3860 Orange, TX 77631-3860	Tom Lanza 409-883-5930	Environmental & Industrial Hygiene Services & Analyses	1/1/93	Continuing

Qualifications of the Key personnel

Dr. C.N. Reddy, M.S., Ph.D., CIH, ASP, Director.

Professional Qualification: March 86 - Present, Responsible for day to day operation of the laboratory, providing the facilities for all the laboratories under the Chemtex and in-charge of confidentiality, security and integrity of the laboratories and as well as the analytical data.

November 80 - March 86: Supervisor, Kemron Laboratory.
Certified Industrial Hygienist 1993.
Associate Safety Professional 1993.

Education: Post Doctoral Fellow: May 78 - November 80, Louisiana State University, Baton Rouge, LA.
Ph.D.: 1978 - Soil Chemistry - Louisiana State University, Baton Rouge, LA.
M.S.: 1973 - Soil Science & Agricultural Chemistry, Indian Agricultural Research Institute, New Delhi, India.

Affiliations: American Chemical Society.
American Society Agronomy.
American Society of Soil Science.
American Industrial Hygiene Association.
American Society of Safety Engineers.

Dr. Ramesh K. Cherivirala, M.S., Ph.D., QA/QC Coordinator.

Professional Qualifications: June 1995 - Present, Responsible for the day to day QA/QC operations of the laboratory and data validation, reduction and reporting of the analytical results. Training of the personnel in organic division of the laboratory.

April 1992 - June 95, Responsible for the analysis of Organic pollutants in different matrices, such as Soil, Water, Waste Water, Sludge and Industrial Hygiene Samples by GC, HPLC, IC and IR spectrophotometer at CHEMTEX.

Education: Ph.D 1991, Organic Chemistry, "Synthesis, Reactivity and Spectral studies of isoxazole derivatives" Osmania University, India.
M.S. 1986, Organic Chemistry, Kakatiya University, India.

Affiliations: American Chemical Society.
Gulf Coast Deep South Section of American Industrial Hygiene Association.

Mr. Prasad K Lavu, M.S., Biologist/Microscopist.

Professional Qualifications: October 1991 - Present, Responsible for the analysis of various Classic Wet Chemical parameters, microbiological analysis, asbestos analysis and fiber counting.

Education: Doctoral Student, 1989-91, University of Southwestern Louisiana, Louisiana.
M.S. 1987, Biology, S.K. University, India.
B.S. 1984, Physical and Chemical Sciences, S.K. University, India.

Dr. V.N.R.Mukku, M.S., Ph.D., Physicist/Chemist.

Professional Qualifications: Jan 1992-Present: Responsible for the analysis of Semi-Volatile analysis using GC/MS and responsible for the analyses of Pesticides, Herbicides and PCB's using GC/ECD.

Education: 1979, M.S.: Physics, University of Roorkee, India.
1983, Ph.D: Atmospheric Studies, Kashmir University, Srinagar, India.

Dr. Sriramoji Manohar, M.S., Ph.D., Senior Chemist.

Professional Qualifications: January 1994 - Present, Responsible for the analysis of metals by AA (Flame and Furnace) and ICP.

Education: Post-doctoral Fellow: 1992 - January 94, University of Oklahoma, Norman, Oklahoma.
Ph.D.: 1990, Physical Chemistry, Osmania University, India.
M.S.: 1985, Physical Chemistry, Osmania University India.

Affiliations: American Chemical Society.

Dr. Mulam, M.S., Ph.D., Organic Chemist

Professional Qualifications: June 1994 - Present, Organic Chemist, Responsible for the analysis of Volatile organics present in multimedia samples by GC/MS.

February 1992 - May 1994, Research Associate at Tini Pharma Ltd, India.

Education: Ph.D. Sri Venkateswara University, India 1992. "Synthesis, Spectral and Biological Studies of some Organophosphorus Heterocyclic Compounds."

Dr. S.R. Kor, M.S., Ph.D., Senior Chemist

Professional Qualifications: Jan 1994 - Present, Responsible for the analysis of metals by ICP and AA.
November 1993 - Jan 94: Responsible for the analysis of metals by using AA (Flame and Furnace) and ICP at CHEMTEX.

November 1990 - December 1992, Chief Environmental Chemist, Environmental Control Division, Ministry of Health, Govt of Jamaica, Govt of Jamaica, West Indies.

Education: Project Assistant: August 1989 - October 1990, S.V. University , India.
Ph.D.: December 1990, Analytical Chemistry, S.V. University, India.
M.S.: August 1986, Environmental Chemistry, S.V. University, India.

Affiliations: Gulf Coast Deep South Section and Coastal bend of American Industrial Hygiene Association.

Dr. S.R. Gosala, M.S. Ph.D., Chemist

Professional Qualifications: June 95 - present: Responsible for the analysis of Volatile Aromatic Hydrocarbons using Gas Chromatography and Total Petroleum Hydrocarbons.
1993 - May 95, Research Fellow, Japanese University, Photocatalysts. Purification of drinking water using semiconductor materials on presence of sun light.
1991 - 93, Research Associate, IIT, Bombay Photoelectro Chemistry.

Education: Ph.D.: 1987 - 1991, Analytical Chemistry, S.V. University, Tirupati, India.

Vishnu Battula, M.S. Chemist.

Professional Qualifications: March 1995 - Present, Responsible for classical Wet Chemical parameters. Also responsible for Asbestos Analysis, Fiber Counting, and Bulk Analysis

1991 - 1992, B.R. Engineering Works. Responsible for monitoring ground water resources; excavation of canals and other irrigation resources.

Education: M.S. Environmental Science and Engineering, University of New Haven, New Haven, CT, 1994.

Dr. H.R. Goolla, M.S. Ph.D., Organic Chemist

Professional Qualifications: May 1995-Present: Working with IC and Gas chromotographs for multimedia environmental and industrial hygiene samples.

June 1986 - May 1995: Worked on development of a process in synthesis of automerlvi drugs used during chromotoghraphy to treat cancer patients as young scientists fellow in school of Chemistry. Used different spectral and separation techniques like NMR, MASS, Chromatography and HPLC.

Education: 1983, M.S.: S.K. University Anantapur, India.
1986, Ph.D.: S.K. University Anantapur, India.

Dr. R.P. Kankati, M.S., Ph.D., Organic Chemist.

Professional Qualifications: May 1995-Present: Responsible for the analysis of purgeable aromatic hydrocarbons using Gas Chromatography and Semi-Volatile analysis using GC/MS.
1993 - 1995, As a post-doctorine research scientist at "Institute of Chemistry" National Autonomous University of Mexico, Mexico, D.F.
1992 - 1993, Research Associate at Dept. of Chemistry Osmania University, Hyderabad, India.

Education: 1984, M.S.: Organic Chemistry.
1992, Ph.D: Organic Chemistry. "Synthesis and Physiological Activity of 3-Heteryl and 3, 4 annelated AZA heterocycles derived from 3-amino Coumarins".

Affiliations: American Chemical Society.

Dr. M.R. Polala, MS., Ph.D., Biologist/Microscopist.

Professional Qualifications: Jan 1996 - Present: Responsible for the analysis of asbestos and fiber counting and microbiological analysis.

May 1992- 96: Post-doctoral fellow, S.K.University, India, Worked on acute toxicicity tests like LC_{50}, safe level concentrations of pesticides, metals are evaluated with reference to aquatic organisms. The toxic impact of pollutants on biochemical and physiological changes in animals are noticed.

Eduction: 1983, M.S., S.K. University, India.
1986, M.Phil, S.K. University, India.
1991, Ph.D., Environmental Biology, S.K. University, India.

Dr.K.C.K.Reddy, M.S., Ph.D., Environmental Soil Chemist

Professional Qualifications: May 1996 - Present: Responsible for the analysis of wet chemical parameters, metals, radio chemical, and silica.

Sept 1976 - May 96: Worked as a senior scientist and project co-ordinator in Indian Council of Agricultural University, Hyderabad, India. Performed research in the field of soil testing and plant nutrition in relation to major secondary and micro-nutrients leading to optimization and prevention of pollution of the agricultural sites. Coordinated multilocation research projects on soil testing and soil health care.

Education: 1976; Agricultural Research Services (ARS).
1972 - 76: Ph.D., Soil Sciences, Indian Agricultural Research Institute, New Delhi, India.
1969 - 72: M.S., Soil Sciences, GB Pant University of Agriculture and Technology, Pant Nagar, U.P., India.
1965 - 69: B.S., Agriculture, A.P. Agriculture University, Hyderabad, India.

Affiliations: Member of Indian Society of Soil Sciences.

Mr.Prashant Bagade., M.S., Ph.D Student., Biologist/Chemist

Professional Qualifications: July 1996 - Present: Responsible for the analysis of Microbiological organisms and asbestos.

Education: August 1991 - Present. Ph.D. (dissertation pending): Virginia Polytechnic Institute and State University, Blacksburg, Virginia. Conducted research on virus resistance in soybean.
July 1988 - March 91: M.S., Genetics, G.B Punt University of Agriculture and Technology, Pant Nagar, U.P., India.

Affiliations: Member of American Society of Agronomy.

Mrs. Malathi Palem., M.S., Chemist.

Professional Qualifications: May 1996 - Present: Responsible for the analysis of wet chemical parameters.

Education: May 1987 - 89: M.S., Analytical Chemistry, S.K. University, Ananthapur, India.
June 1984 - 87: B.S., S.K. University, Ananthapur, India.

Facility Layout

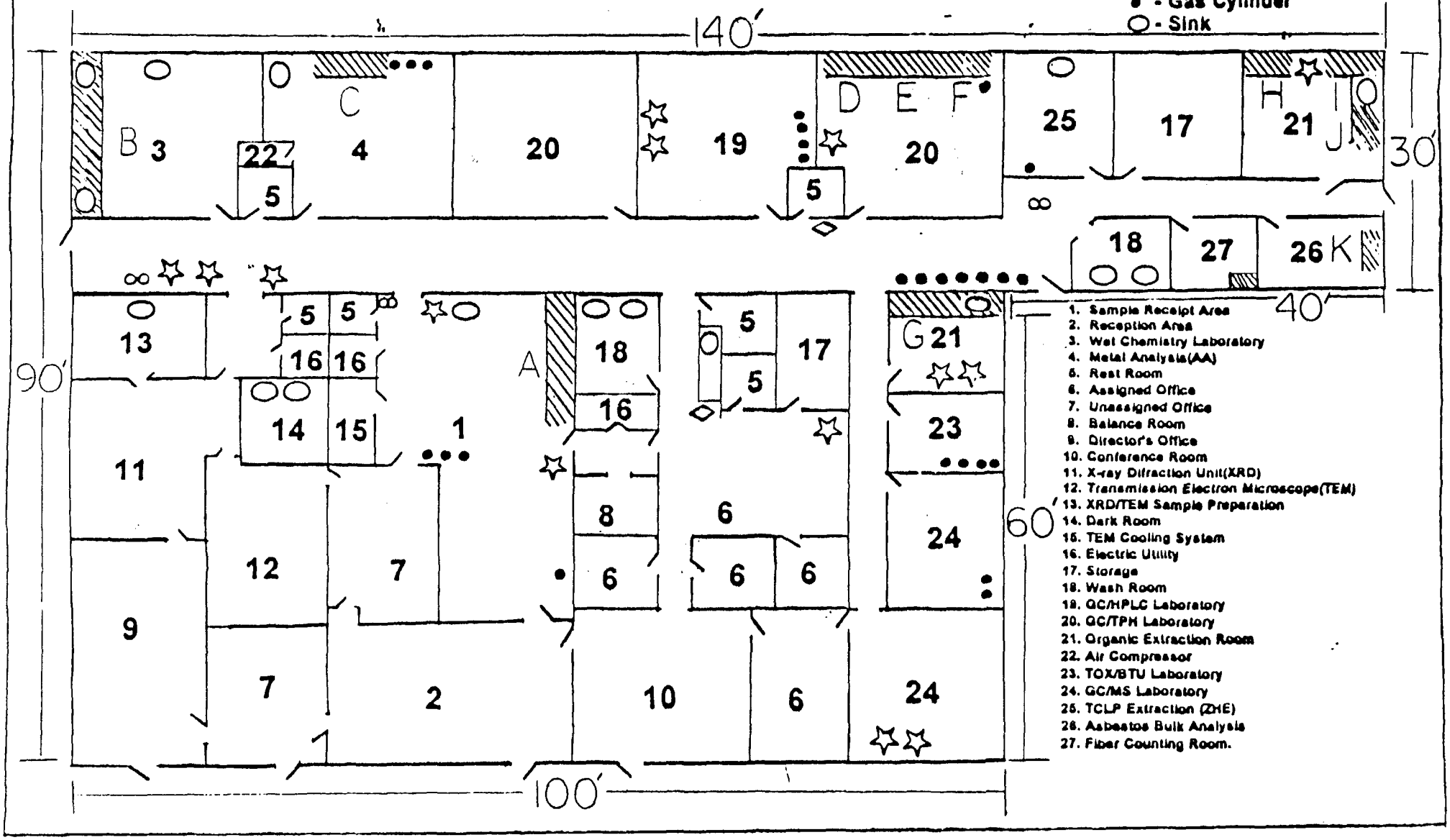
CHEMTEX

Environmental & Industrial Hygiene Services

3082 25th Street, Port Arthur, Texas 77642

FACILITY LAYOUT

- Exhaust Hood
- Refrigerator
- Drinking water Cooler
- Eye Wash
- Gas Cylinder
- Sink



Major Instrumentation

LIST OF MAJOR ANALYTICAL EQUIPMENT

Serial #	Name of the Instrument	Make/Model	Detector/System
1	GC/Mass Spectrophotometer - Purge & Trap Autosampler - Concentrator	HP 5890 ALS 2000 LSC 2016	HP MSD 5970
2	GC/Mass Spectrophotometer - Autosampler	HP 5890 HP 7673	HP MSD 5970
3	GC/Mass Spectrophotometer - Purge & Trap System	HP 5890, Series II OI Analytical	HP MSD 5970
4	GC/Mass Spectrophotometer - Autosampler	HP 5890, Series II HP 7673	HP MSD 5970
5	GC/Mass Spectrophotometer - Autosampler	Perkin Elmer GC 1020	MSD QMS 910
6	GC/Mass Spectrophotometer - VOC Autosampler - Cryogenic Concentrator	HP 5890, Series II Nutech 3600 Nutech 3550A Series	HP MSD 5972
7	Gas Chromatograph - Autosampler	HP 5890 HP 7673	FID
8	Gas Chromatograph - Autosampler	HP 5890 HP 7673	FID
9	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID
10	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID
11	Gas Chromatograph - Autosampler	HP 5890 HP 7673	FID
12	Gas Chromatograph - Autosampler	HP 5890 HP 7673	FID
13	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID
14	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID

Serial #	Name of the Instrument	Make/Model	Detector/System
15	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673	FID
16	Gas Chromatograph - Autosampler	HP 5890 HP 7673	FID
17	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673	FPD
18	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID
19	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID
20	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673	NPD
21	Gas Chromatograph - Purge & Trap Autosampler - Concentrator	HP 5890, Series II ALS 2000 LSC 2016	PID
22	Gas Chromatograph - Purge & Trap Autosampler - Concentrator	HP 5890, Series II ALS 2000 LSC 2016	PID
23	Gas Chromatograph - Autosampler	HP 5890, Series HP 7673	ECD
24	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673	ECD
25	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	ECD
26	Gas Chromatograph	HP 5880	TCD
27	Gas Chromatograph	HP 5880	FID
28	Gas Chromatograph	HP 5880	FID
29	Gas Chromatograph	HACH	TCD
30	Gas Chromatograph	SRI Instruments	ECD
31	Gas Chromatograph	SRI Instruments	FID
32	Gas Chromatograph	SRI Instruments	FID

Serial #	Name of the Instrument	Make/Model	Detector/System
33	Gas Chromatograph - Autosampler	SRI Instruments	PID
34	Gas Chromatograph - Autosampler	SRI Instruments	ECD
35	Inductively Coupled Plasma Spectrophotometer	Leeman Labs	AES
36	Inductively Coupled Plasma Spectrophotometer	Perkin Elmer	AES
37	Atomic Absorption Spectrophotometer	Varian 400 Zeeman	Flame
38	Atomic Absorption Spectrophotometer	Varian 400 Zeeman	Furnace
39	Atomic Absorption Spectrophotometer	Perkin Elmer 5100	Flame
40	Atomic Absorption Spectrophotometer	Perkin Elmer 5100	Flame
41	Atomic Absorption Spectrophotometer	Perkin Elmer 5100	Furnace
42	Atomic Absorption Spectrophotometer	Perkin Elmer 5100	Furnace
43	Atomic Absorption Spectrophotometer	Perkin Elmer 5000	Flame
44	Atomic Absorption Spectrophotometer	Perkin Elmer 560	Flame
45	High Performance Liquid Chromatograph	DIONEX, VDM-2	UV/VIS
46	High Performance Liquid Chromatograph - Autosampler	DIONEX, VDM-2 DIONEX, ASM-2	UV/VIS
47	Ion Chromatograph	DIONEX, CDM-2	Conductivity
48	Ion Chromatograph - Autosampler	DIONEX, CDM-2 DIONEX, ASM-2	Conductivity
49	Ion Chromatograph - Autosampler	DIONEX, CDM-3 DIONEX, ASM-2	Amperometric
50	Ion Chromatograph - Autosampler	DIONEX, ADM-2 DIONEX, ASM-2	Conductivity
51	X-Ray Diffraction	Diano series 9000	X-Ray
52	Transmission Electron Microscope	JEOL JEM 100 CX11	
53	Total Organic Carbon Analyzer	Beckman	

Serial #	Name of the Instrument	Make/Model
54	Total Organic Halide Analyzer	Dohrmann
55	Total Organic Halide Analyzer	Dohrmann
56	Infrared Spectrophotometer	Buck Scientific
57	Mercury Analyzer	Buck Scientific
58	Microscope	Nikon, Labophot
59	Microscope	Nikon, Labophot
60	Phase Contrast Microscope	Nikon, Labophot
61	Phase Contrast Microscope	Nikon, Labophot
62	Phase Contrast Microscope	Nikon, Labophot
63	Phase Contrast Microscope	Nikon, Labophot
64	Phase Contrast Microscope	Nikon, Labophot
65	Stereo Microscope	Nikon, SMZ-1
66	Stereo Microscope	Nikon, SMZ-1
67	Stereo Microscope	Nikon, SMZ-1
68	Stereo Microscope	Nikon, SMZ-1
69	Polarized Light Microscope	Nikon, Labophot
70	Polarized Light Microscope	Nikon, Labophot
71	Polarized Light Microscope	Nikon, Labophot
72	Polarized Light Microscope	Nikon, Labophot

CHEMTEX

Environmental & Industrial Hygiene Services

QUALITY ASSURANCE PROGRAM PLAN

Document #: QAPP.001
Revision: V
Date: January, 1997

3082 25th Street, Port Arthur, TX 77642; Phone: (409) 983-4574: FAX (409) 982-1522

CHEMTEX

Environmental & Industrial Hygiene Services

QUALITY ASSURANCE PROGRAM PLAN

Approved By: Ch. Ramesh 1/20/97

Dr. Ramesh K. Cherivirala, QA/QC Coordinator

CNReddy 1/20/97

Dr. C.N. Reddy, Director

Document #: QAPP.001
Revision: V
Date: January, 1997

3082 25th Street, Port Arthur, TX 77642; Phone: (409) 983-4574: FAX (409) 982-1522

TABLE OF CONTENTS

Chapter	Page
1. INTRODUCTION	2
2. QUALITY ASSURANCE OBJECTIVES	3
3. QUALITY ASSURANCE OPERATIONS	6
A. Laboratory Materials	
B. Control of Analytical Performance	
4. SAMPLING PROCEDURES	10
5. SAMPLE MANAGEMENT/CUSTODY	17
A. Sample Receipt	
B. Sample Tracking	
6. INSTRUMENT CALIBRATION	21
7. ANALYTICAL PROCEDURES	26
8. INTERNAL QUALITY CONTROL CHECKS	35
A. Metal Analysis	
B. Organic Analysis	
C. Conventional Pollutants	
9. DATA REDUCTION, VALIDATION, AND REPORTING	55
A. Data Reduction	
B. Data Validation	
C. Data Reporting	
D. Data Confidentiality	
10. SYSTEM AND PERFORMANCE AUDITS	57

TABLE OF CONTENTS

Chapter	Page
11. PREVENTIVE MAINTENANCE	60
12. SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS	64
A. Precision	
B. Accuracy	
C. Completeness	
D. Representativeness	
E. Comparability	
13. STATISTICAL FORMULAE AND DEFINITIONS	67
14. CORRECTIVE ACTION	68
15. COMPLAINTS	70
APPENDIX "A"	
1. Laboratory Equipment	
2. Key Personnel	
3. Organizational Chart	

QUALITY ASSURANCE PROGRAM PLAN

Revision V - January 1997

1. INTRODUCTION

Appropriate use of data generated under the great range of analytical conditions encountered in Environmental Analysis require reliance on the quality control procedures and criteria incorporated into the methods and procedures. The purpose of this manual is to describe the Quality Assurance (QA)/Quality Control (QC) Program activities of CHEMTEX Environmental & Industrial Hygiene Services, Inc. Services include sample analysis for metals, extractable and volatile Organics, pesticides/PCBs, wet chemistry and waste water. This Quality Assurance Plan is a written document of the QA/QC structures employed by CHEMTEX to ensure that all data is accurate and defensible.

2. QUALITY ASSURANCE OBJECTIVES

CHEMTEX consistently produces analytical data which is accurate, defensible, and fully meet clients' data quality objectives. The contents of this Quality Assurance Program Plan describes the activities which are utilized in order to ensure this commitment:

"CHEMTEX is committed to generate precise, accurate data that is satisfactory and dependable, which addresses the client's concern in the area of accountability, documentation, security and analytical performance of the sample supplied."

All the data reported is generated and calculated according to methods which are recognized standards of the Environmental Laboratory Industry. This manual is a written description of a working standard for all operating procedures, analytical methodologies, data reduction and validation and reporting that are maintained at CHEMTEX. It also permits outside agencies to evaluate the reliability of the performance of CHEMTEX.

Quality Assurance shall be defined as all activities, systems, and operations required to maintain high quality performance of the laboratory and provide a high degree of confidence in the quality of the laboratory results. Quality Control shall be defined as specific actions applied to the analytical data and to document the quality of the data.

Data quality is assessed by precision, accuracy and completeness. These limits employed by CHEMTEX are taken from the EPA's SW-846, and methods of chemical analysis of water and waste water in addition to the EPA CLP statement of work (organics and inorganics.) The laboratory quality control Coordinator in association with the analyst, under the supervision of the laboratory Director, ensures that all quality control parameters mentioned in the laboratory quality manual are met. Supporting documentation such as control charts, equipment maintenance, calibration records, and other qualifying test records are maintained and available for review or inspection.

All the analytical methods, that are being used at CHEMTEX, are adopted from the EPA protocols. All these procedures are critically evaluated before adopting a SOP (Standard Operating Procedure), this includes the data collection, instrumental response and establishing the laboratory control limits, which should satisfy the method criteria. Besides the laboratory control limits, CHEMTEX also establishes

acceptable criteria for matrix spike recoveries and surrogate recoveries, if involved, as well as retention time windows.

This manual is reviewed and updated annually to include all changes and revisions in organization, facilities, procedures and key personnel.

3. QUALITY ASSURANCE OPERATIONS

A. LABORATORY MATERIALS

Generation of reliable and accurate data is a function of a number of factors in addition to right instrumentation and methodology. These include materials and reagents used to preform analysis. CHEMTEX uses standard reagents, highly pure solvents, eluents and gases for all analyses. In addition there are quality control checks for all laboratory material used.

1.*Deionized water.* Deionized water is produced using commercially manufactured ion exchange resin columns. Deionized water is used for dilution, preparation of reagent solutions and final rinsing of glassware. Daily checks of conductivity of deionized water are maintained and monitored. The deionized water is produced with a maximum conductivity of 1-2 umbos/cm which meets the ASTM type II reagent water specifications.

2 *Standards and Reagents:* All reagents used for inorganic analyses are AR grade if available, as ACS or better. Standards used are standardized against commercially prepared standard reagents. Standard solutions made shall be used only for a specified shelf time. Fresh reagents shall be prepared beyond the shelf time and a new standard curve generated whenever new reagents are prepared. Material subjected to prolonged exposure to ambient air, such as oxidation, absorption or loss of moisture etc., are not used as quantitative reagents without prior

assay or standardization. Materials are discarded when their expiration date has passed. Under no circumstance are those materials used for qualitative purpose beyond their expiration date. For Organic analyses, all reagents used are of high purity and references standards used are obtained from authenticated sources like the EPA or EPA certified commercial suppliers. Standards prepared from pure reagents are used only when demonstrated to be very close to the true value of the EPA standards. All standards, if stored, shall be stored in borosilicate vials with Teflon lined caps. Solvents used for GC and HPLC analysis are of HPLC grade. Helium and Argon/Methane used for FID/ECD analyses shall be passed through hydrocarbon removable filters to remove impurities. All cylinder gases shall be replaced when the pressure falls below 100 psi.

3.*Glassware:* All glassware used for volummetric measurements shall be of class "A" type as defined in applicable ASTM standards. Glassware used for gravimetric measurements shall be conditioned before use. Glassware shall be thoroughly cleaned before use, as given in the SOP for glassware cleaning.

B. CONTROL OF ANALYTICAL PERFORMANCE

This part of the manual pertains to the Quality Control procedures in use at CHEMTEX. The analytical process is continually checked and verified through the analysis of method blanks, instrument blanks, matrix spikes, duplicate matrix spikes and sample duplicates. Precision of analysis will be evaluated by analyzing sample

duplicates and matrix spike duplicates. Analytical accuracy will be monitored by performing the analytes from surrogate spikes, matrix spikes, performance evaluation samples. For accuracy and precision, CHEMTEX encompasses a number of parameters in the evaluation of the overall effectiveness of such a quality control programs These quality control measures offer a means of monitoring the quality of the data and identifying the need for corrective action. Any activity which is not performed in accordance with the laboratory procedure or SOP, is considered as a deviation from the quality control activity. Analyst is not authorized to change or modify the SOP; if any instance where a SOP or method need to be modified to accommodate client requirements; written approval from the client is necessary. Laboratory director and QA/QC Coordinator will authorize the analyst to perform the analysis. This specific departure will be documented in the analytical report.

The objectives for accuracy and precision of the analytical procedures used at CHEMTEX have been developed. QA objectives for data quality for the most commonly requested methods are described in Tables 8.2 and 8.6 to 8.10. Each method specifies the use and frequency of blank analysis calibration standard, calibration check analysis, and surrogate/matrix spikes to monitor method performance. The quality control audits and frequency employed by the laboratory are described in Tables 8.1 and 8.3 to 8.5.

Precision of analyses will be evaluated using sample or matrix spike duplicates. Analytical accuracy will be monitored using recovery of analytes from surrogate spikes, matrix spikes, EPA reference check standards, and performance evaluation (PE) samples. Quality Control frequencies and audits as well as Quality Assurance criteria for accuracy and precision are summarized in Tables 8.1 to 8.12. EPA established control limits are used to judge acceptability of data generated by CHEMTEX. If there are no published control limits, statistical control limits are instituted in the laboratory.

All incoming new work will be evaluated by the laboratory director based on the a). customer requirements for turn around times b). range of the test to be performed c). volume of the samples d). available resources including equipment, staff, space and work load. In case of large number of tests and volume of the work involved laboratory director will review the customer requirements with laboratory supervisor, QA/QC co-ordinator and also with the corresponding analysts. If the laboratory has the capacity to perform the additional work to meet all the customer requirements, the laboratory director will accept the incoming new work. If small number of tests are involved, the laboratory supervisor will accept the work.

4. SAMPLING PROCEDURES

CHEMTEX does not routinely collect samples in the field. However CHEMTEX shall coordinate with field personnel, as possible, to assure that samples are collected and preserved as outlined in the SW-846, Methods of Chemical Analysis of Water and Waste water and the 40 CFR, Part 136. Table 4.1 describes the type of sampling containers and preservation requirements.

TABLE 4.1 - REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter	*Sample Size/ Volume Required*	Container[1]	Preservative[2]	Holding Time
Acidity	100 ml	P,G	3	14 days
Alkalinity	100 ml	P,G	3	14 days
BOD	1000 ml	P,G	3	48 hours
COD	50 ml	P,G	3, 4	28 days
Chloride	50 ml	P,G	5	28 days
Chlorine,Residual	200 ml	P,G	5	AI[12]
Chromium VI	200 ml	P,G	3	24 hours
Coliform, Fecal	100 ml	Sterile	3, 6	6 hours[22]
Coliform, Total	100 ml	Sterile	3, 6	6 hours[22]
Conductivity	100 ml	P,G	3	28 days
Cyanide, amenable	1000 ml 100 g	P,G P,G	3, 7 3	14 days[13] 14 days
Cyanide, Total	1000 ml 100 g	P,G P,G	3, 7 3	14 days 14 days
Fluoride	300 ml	P	5	28 days
Mercury	200 ml 5 g	P,G P,G	3, 8 3	28 days 28 days
Flashpoint	100 ml 5 g	G G	5 5	------- -------
Metals (except Hg, CrVI)	200 ml 5 g	P,G P,G	3, 8 3	6 months 6 months
Ammonia-N	400 ml	P,G	3	28 days
Kjeldahl-N	500 ml	P,G	3, 4	28 days
Nitrate-N	100 ml	P,G	3, 4	48 hours
Nitrite-N	50 ml	P,G	3, 15	48 hours
Organic-N	1000 ml	P,G	3	28 days

Parameter	*Sample Size Volume Required*	Container[1]	Preservative[2]	Holding Time
Oil & Grease	1000 ml 100 g	G G	3, 4 3	28 days 28 days
Oxygen, Dissolved	300 ml	G-bt	5	AI[12]
pH	100 ml 10 g	P, G P, G	5 5	AI[12] -------
Phenolics	500 ml 50 g	G G	3, 4 3	28 days 28 days
Phosphate, ortho-	50 ml	G*	3, 9	48 hours
Phosphate, total	50 ml	G*	3, 4	28 days
Phosphorus, total	50 ml	G*	3, 4	28 days
Solids (except Settleable)	100 ml 10 g	P, G P, G	3 3	7 days 7 days
Solids, Settleable	1000 ml	P, G	3	48 hours
Specific Conductance	100 ml	P, G	3	28 days
Sulfate	50 ml	P, G	3	28 days
Sulfide	500 ml	P, G	3, 10	7 days
Total Organic Carbon	25 ml 10 g	G G	3, 4 3	28 days 28 days
Total Organic Halides	1000 ml 100 g	G G	3, 4 3	28 days 28 days
Total Petroleum Hydrocarbons	1000 ml 100 g	G G	3, 4 3	14 days 14 days
Turbidity	100 ml	P, G	3	48 hours
Radiochemistry Gross Alpha	100 ml	P, G	7	6 months
Gross Beta	100 ml	P, G	7	6 months
Radium 226	1000 ml	P, G	7	6 months
Radium 228	1000 ml	P, G	7	6 months
Total Alpha Emitting Radium	1000 ml	G	7	6 months

Parameter	*Sample Size: Volume Required*	Container[1]	Preservative[2]	Holding Time
TCLP Solid (non aqueous)	1000 g	G	3	14 days
TCLP (aqueous)	4000 ml	G	3	14 days
Purgeable Halocarbons (EPA 601 Waste water)	2 x 40 ml, no headspace	G-s	3	14 days[17]
Purgeable Halocarbons (EPA 8010A, aqueous)	2 x 40 ml, no headspace	G-s	3	14 days[17]
Purgeable Halocarbons (EPA8010Anonaq)	2 x 40 ml, no headspace	G-s	3	14 days
Purgeable Aromatic Hydrocarbons (EPA 602 Waste water)	2 x 40 ml, no headspace	G-s	3, 16	14 days[17]
Purgeable Aromatic Hydrocarbons (EPA 8020A, aqueous)	2 x 40 ml, no headspace	G-s	3, 16	14 days[17]
Purgeable Aromatic Hydrocarbons (EPA 8020Anonaq)	2 x 40 ml, no headspace	G-s	3	14 days
Phenols (EPA 604 Waste water)	1000 ml	G-c	3, 11, 6	7/40 days[14]
Phenols (EPA 8040, aqueous)	1000 ml	G-c	3, 11, 6	7/40 days[14]
Phenols (EPA 8040nonaqueous)	250 g	G-c	3, 11, 6	14/40 days
Pesticides/PCBs (EPA 608 Waste water)	1000 ml	G-c	3, 11, 6, 18, 19, 20	7/40 days[14]
Pesticides/PCBs (EPA 8080/8081, aq)	1000 ml	G-c	3, 11, 6	7/40 days[14]
Pesticides/PCBs (EPA8080/8081nonaq)	250 g	G-c	3, 11	14/40 days
Herbicides (EPA 8150, aqueous)	1000 ml	G-c	3, 11	14/40 days
Herbicides (EPA 8150nonaqueous)	250 g	G-c	3, 6	14 days[17]
Purgeables (EPA 8260A, aqueous)	2 x 40 ml, no headspace	G-s	3, 6	14 days[17]
Purgeables (EPA 8260Anonaq)	2 x 40 ml, no headspace	G-s	3	14 days

Parameter	*Sample Size Volume Required*	Container[1]	Preservative[2]	Holding Time
Base - Neutrals Acids (EPA 625Waste waterr)	1000 ml	G-c	3, 11, 6, 18	7/40 days[14]
Base Neutrals/Acids (EPA8250.8270Baq)	1000 ml	G-c	3, 11, 6, 18	7/40 days[14]
Base Neutrals/Acids (EPA8250, 8270B nonaqueous)	250 g	G-c	3, 11	14/40 days

NOTES

1. P - Polyethylene bottle
   G - Glass bottle
   G-bt - Glass bottle and glass top
   G-s - Glass bottle with Teflon-lined septum, normally 40 ml
   G-c - Glass bottle with Teflon lined cap

2. Sample preservation should be performed immediately upon collection. For composite chemical samples, each aliquot should be preserved at the time of collection. When use of an automatic sampler makes it impossible to preserve each aliquot, chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting are completed.

3. Cool to 4°C

4. H_2SO_4 to pH < 2

5. None required

6. If residual chlorine is present, 0.008% $Na_2S_2O_3$ should be added.

7. NaOH to pH > 12; 0.6g ascorbic acid in the presence of residual Cl.

8. HNO_3 to pH < 2.

9. Filter Immediately

10. Add 2 ml 1M zinc acetate, add NaOH to pH > 9

11. Store in dark.

12. Analyze immediately.

13. 24 hour maximum holding time when sulfide is present. Samples may be tested with lead acetate paper before pH adjustment to determine if sulfide is present. Sulfide can be removed by adding cadmium nitrate powder until a negative spot test is obtained, filtering sample and adding NaOH to pH > 12.

14. Holding time for sample preparation/Holding time after sample preparation.

15. For samples from non-chlorinated drinking water supplies, concentrated H_2SO_4 should be added to lower sample pH to less than 2. The sample should be analyzed before 14 days.

16. HCl or H_2SO_4 to pH < 2

17 .Sample receiving no pH adjustment must be analyzed within 7 days of sampling.

18. When the extractable analytes of concern fall within a single chemical category, observe the specified preservative and maximum holding times 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 pH to 6-9; samples thus preserved may be held for seven days before extraction and for forty days after extraction.

19. pH 5-9

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% $Na_2S_2O_3$.

21. TCLP holding time is 14 days from sampling to completion of TCLP extraction. When the extraction is complete, the analysis holding time begins.

22. Holding time for coliform listed is specific for NPDES work. Holding time for potable water samples cannot exceed 30 hours.

Reference: 40 CFR 136, July 1, 1992.

5. SAMPLE MANAGEMENT/CUSTODY

Sample management is an important part of documentation which involves the transfer of custody for each sample from sample collection through sample analysis to the reporting of analytical results.

A. SAMPLE RECEIPT

All samples accepted for analysis are accompanied by a Chain-of-Custody form which requests and provides information for each sample. Whenever a sample is brought in without a chain-of-custody, a form is made with all the information obtained from the sample container and is signed by the person relinquishing them. When samples arrive at CHEMTEX, the sample custodian or a designee shall inspect the condition of the packing and the sample, and initial the date and time when it was received. Any discrepancies in the nature of the sample container, sample identification, packing, abnormal temperatures for sample shipment, broken vials, or physical appearance and other pertinent comments are noted on the chain-of-custody and also informed to the client.

The sample is immediately recorded in the master log book by the sample custodian, and assigned a unique seven-digit CHEMTEX identification number to maintain the identity throughout receipt, analysis and storage. The laboratory number shall also be recorded on the chain-of-custody which shall be returned to the client along with the analysis report. The sample custodian shall also label the sample containers with the CHEMTEX serial numbers before placing them in the

appropriate storage environment. It is the responsibility of the sample custodian to see that the following operating procedures are adhered to:

- All samples and standards are stored at 4°C.
- VOA Samples are stored separately.
- Semi-volatiles are stored separately from all other samples/standards.
- VOA and Semivolatile standards are stored separately.
- Samples are not stored together with standards.
- Sample extracts are stored in separated freezer(s).
- The storage area will be kept secure at all times.
- After all analyses have been completed, the sample is transferred to shelves in a storage room. These samples are retained on the shelves for three (3) months from the date of receipt unless requested by the client.

Samples for organic analysis are stored in separate refrigerators where no standards or solvents are stored. All samples for inorganic analysis are stored separately. The sample custodian shall also inform the analyst if any sample must be analyzed immediately because of holding time or turnaround requirements. Refrigerator locations for different kinds of samples/standards are enclosed.

B. SAMPLE TRACKING

A system of sample tracking is required and each step shall be documented by the analyst. Analysts shall record all observations in their individual analysts' notebook clearly indicating the Client's sample Identification and the CHEMTEX

identification number of the sample. Sample preparation information, and any other relevant information, shall be recorded separately for each parameter in the respective data notebooks, also listing the sample identification, laboratory serial number, date of analysis and the respective QA values. Results shall be immediately recorded in the data note books which shall be maintained in the laboratory for at least three years. The Appendix includes formats of data sheets used for each analysis. Analysis logs and instrument logs shall be maintained for each parameter and instrument. Organic extraction of samples shall be recorded in a separate extraction log book, also indicating the sample identification, CHEMTEX serial number and extraction procedure.

CHEMTEX REFRIGERATORS

REFRIGERATOR #	CONTENTS
1	Samples for Organic Analysis (Water/Soil)
	Including TCLP
	Freezer: Industrial Hygiene Samples
2	Samples for Inorganic Analysis (Water)
3	Samples for Inorganic Analysis (Soil & Sludges)
4	Inorganic Standards
5	Industrial Hygiene Samples
6	GC/PID Standards
7	GC/PID Samples, Water, Soil, MeOH Extracts
8	BNA Standards
9	Organic Extracts (BNA/TPH)
	Freezer: Pesticide & Herbicide Standards
10	Organic Standards (Pure)
11	Organic Standards (Stock)
12	GC/MS VOA Standards
13	Samples for VOA Analysis (GC/MS)
14	VOA Post Analysis Samples
15	Samples on Hold
16	Organic Working Standards
17	Food and Drinks

6. INSTRUMENT CALIBRATION

Instrumentation is one of the very important requirements for producing reliable data. CHEMTEX purchases and maintains the best, state-of-the-art instrumentation available on the market. Instrument performance is a faction of its maintenance and sensitivity limits which can fluctuate often enough to produce misleading results unless monitored by regular calibration. Adherence to calibration frequency is considered an important factor in the quality control programs. Each type of instrumentation is calibrated prior to sample analysis according to method criteria. Hard copy records of all instrument calibrations are maintained in a log book along with maintenance or service operations preformed. A list of all equipment available at CHEMTEX is enclosed.

A. ***Analytical Balances***: All analytical balances are routinely calibrated using standard weights traceable to National Institute of Standards and Technology (NIST) of 100 mg and 10 mg before each use. The instrument "zero" is checked every day before use and before every set of samples. The balances are also calibrated any time the instruments are moved and such changes are recorded in the instrument log. The balances are located in rooms free of drafts of air and thoroughfare. Indication silica gel desiccant is maintained in

the balance and replaced whenever the color changes. All balances are used gently and maintained meticulously. All these balances are aloso

B.*Atomic Absorption Spectrophotometer*: Metals are analyzed by Flame and Furnace atomic absorption spectrophotometers. Instruments are calibrated daily or before analyses of every set of samples, whichever is more often.

C. *Conductivity Meter*: Conductivity meter is calibrated at the beginning and the end of every analysis. A standard potassium chloride solution (0.01N) is used for calibration and cell constant (cell constant will be measured once in a year). Records are maintained in a separated instrument calibration log book, a copy of which is enclosed.

D. Deionized Water Unit: The purity of deionized water used in the laboratory is an important variable in almost all analyses and it is imperative that it be monitored. CHEMTEX uses a commercial ion-exchange resin column unit. The conductivity of deionized water is monitored daily. If it exceeds 2 umhos/cm, it is considered unsuitable for use and the ion-exchange resin column is replaced. A record of the conductivity and the functioning of the indicator light is maintained and the resin is replaced when required.

E. Gas Chromatographs: Monthly calibration of the gas chromatographs are made to check instrument sensitivity. A SP1000 column is used to monitor the sensitivity of the instrument using 8.67 ppm and 17.34 ppm toluene in carbon disulfide. The instrument is considered operational when the response factor is within the previously established control limits for that set of conditions. Each instrument is calibrated with a minimum of five concentrations to determine instrument sensitivity and the linearity of GC response to each parameter. Prior to analysis, the instrument is calibrated with three concentrations to verify sensitivity.

The gas chromatographs used in CHEMTEX are equipped with automatic samplers to minimize volummetric errors in injections. However, duplicate injections are performed for at least one in twenty samples and peak areas are checked to determine if they are within a 5% difference. This serves as an indication of the reproducibility of the instrument's performance.

F. High Performance Liquid Chromatography: Calibration of HPLC is performed using a C-18 column/UV detector for Liquid Chromatography and an anion exchange column/conductivity detector for Ion Chromatography. CHEMTEX routinely conducts analyses of pesticides by LC, in which tebuthiuron is used for monthly calibrations. The calibration procedure is similar to that used for GC.

G. GC/MS Calibration: It is necessary to establish that a given GC/MS meets the standard mass spectral criteria prior to initiating data collection. The GC/MS system is tuned using p-bromofluorobenzene (pBFB) for volatile Organic analysis and decafluorotriphenylphosphine (DFTPP) for semivolatile analysis. The system is tuned if the spectral profile meets the abundance criteria for the selected ions. Calibration is performed under the same set of conditions used for sample analysis and is verified every twelve hours. The details of the procedures are as per the EPA protocol for Contract Laboratory Programs.

H. pH Meters: pH meters are calibrated every day using standard buffers. The buffers used for calibration during sample analysis are of the range close to the sample pH. The electrode is always immersed in the standard buffer solution and is carefully cleaned with deionized water before each transfer. At least three or more standard buffers are used to calibrate the instrument and a record of it is maintained.

I. Spectrophotometers: All colorimetric analyses conducted by spectrophotometers are performed after an initial five point calibration of a given compound for a set of conditions. Subsequent analyses are performed by one or more standard solutions prepared in concentrations in the range of the sample concentration. Instrument sensitivity is checked

every week using two concentrations of potassium chromate solutions of 0.4 mg/l and 0.2 mg/l at wavelengths in both visible and UV ranges.

J. Ovens: The temperatures of the ovens are monitored daily by placing thermometers inside the oven and recording the readings. Thermometers traceable to NIST are used. Log books are maintained separately for each oven.

K. Refrigerators: The refrigerator temperature is recorded by placing the thermometer in mineral oil, which continuously remains in the refrigerator. Temperatures are recorded daily in the assigned log book.

L. Total Organic Carbon Analyzer: The total organic carbon analyzer is calibrated before every set of samples using a standard concentration of 30 ppm carbon.

7. ANALYTICAL PROCEDURES

The analytical methods employed by CHEMTEX for the analysis of Environmental samples are from the following EPA Manuals:

a. Methods for Chemical Analysis of Water and Waste water. EPA 600/4-79-020. (1983.)

b. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods SW-846, (1986)

c. Guidelines Establishing Test Procedures for the Analysis of Pollutants, 40 CFR, Part 136 (As of July 1992)

d. USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Multimedia, Multi Concentration, EPA 7/88, SOW.

e. USEPA Contract Laboratory Program Statement of Work for Organic Analysis, Multimedia, Multi Concentration, EPA 2/88, SOW.

f. Standard Methods for the Examination of Water and Waste water - American Public Health Association, 17th Edition, 1990.

Tables 7.1 to 7.3 present a list of methods employed by CHEMTEX for Inorganic and Organic parameters respectively. Final report issued by CHEMTEX includes a reference to the exact method used in the analysis. Any deviation from the published method must be approved by both the Laboratory Director and the QA/QC Coordinator and are stated in the final report with all reasons for the deviation. CHEMTEX is willing to use other methods if requested or approved by the client.

TABLE 7.1
ANALYTICAL METHODS FOR METAL ANALYSIS

Parameter	Method Reference	Method Description
Sample Preparation (Bulk)	3005A, 3050A, 3010A, 3020A(2)	Acid Digestion
Aluminum (Al)	202.1(1)/7020(2) 202.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Antimony (Sb)	204.1(1)/7040(2) 204.2(1)/7041(2)	AA - Direct Aspiration AA - Graphite Furnace
Arsenic (As)	206.2(1)/7060A(2)	AA - Graphite Furnace
Barium (Ba)	208.1(1)/7080A(2) 208.2(1)/7081(2)	AA - Direct Aspiration AA - Graphite Furnace
Beryllium (Be)	210.1(1)/7090(2) 210.2(1)/7091(2)	AA - Direct Aspiration AA - Graphite Furnace
Boron (B)	212.3(1)	Colorimetric
Cadmium (Cd)	213.1(1)/7130(2) 213.2(1)/7131A(2)	AA - Direct Aspiration AA - Graphite Furnace
Calcium (Ca)	215.1(1)/7140(2)	AA - Direct Aspiration
Chromium (Cr)	218.1(1)/7190(2) 218.2(1)/7191(2)	AA - Direct Aspiration AA - Graphite Furnace
Chromium VI (CrVI)	218.5(1)/7196A(2) 218.4(1)/7197(2)	Spectrophotometry Chelation Extraction AA - Direct Aspiration
Cobalt (Co)	219.1(1)/7200(2) 219.2(1)/7201(2)	AA - Direct Aspiration AA - Graphite Furnace
Copper (Cu)	220.1(1)/7210(2) 220.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Iron (Fe)	236.1(1)/7380(2) 236.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Lead (Pb)	239.1(1)/7420(2) 239.2(1)/7421(2)	AA - Direct Aspiration AA - Graphite Furnace

TABLE 7.1(cont...)
ANALYTICAL METHODS FOR METAL ANALYSIS

Parameter	Method Reference	Method Description
Lithium (Li)	303-A(3)	AA - Direct Aspiration
Magnesium (Mg)	242.1(1)/7450(2)	AA - Direct Aspiration
Manganese (Mn)	243.1(1)/7460(2) 243.2(1)/7461(2)	AA - Direct Aspiration AA - Graphite Furnace
Mercury (Hg)	245.1, 245.5(1) 7470A/7471A(2)	Cold Vapor Technique
Molybdenum (Mo)	246.1(1)/7480(2) 246.2(1)/7481(2)	AA - Direct Aspiration AA - Graphite Furnace
Nickel (Ni)	249.1(1)/7520(2) 249.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Potassium (K)	258.1(1)/7610(2)	AA - Direct Aspiration
Selenium (Se)	270.2(1)/7740/7141A(2)	AA - Graphite Furnace
Silicon (Si)	4500, 4500B (3)	AA - Direct Aspiration
Silver (Ag)	272.1(1)/7760A(2) 272.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Sodium (Na)	273.1(1)/7770(2)	Spectrophotometry AA - Direct Aspiration
Strontium (Sr)	219.1(1)/7200(2)	AA - Direct Aspiration
Thallium (Tl)	279.1(1)/7840(2) 279.2(1)/7841(2)	AA - Direct Aspiration AA - Graphite Furnace
Tin (Sn)	282.1(1)/7870(2) 282.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Titanium (Ti)	283.1(1) 283.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Uranium (U308)	908.1(4)	Fluorometric

TABLE 7.1(cont...)
ANALYTICAL METHODS FOR METAL ANALYSIS

Parameter	Method Reference	Method Description
Vanadium (V)	286.1(1)/7910(2) 286.2(1)/7911(2)	AA - Direct Aspiration AA - Graphite Furnace
Zinc (Zn)	289.1(1)/7950(2) 289.2(1)/7951(2)	AA - Direct Aspiration AA - Graphite Furnace
Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Li, Mn, Mg, Mo, Ni, P, Se, Ag, Na, Sr, Tl, V, Zn	200.7/200.9(1) 6010A(2)	ICP-AES

Table 7.2
ORGANIC ANALYTICAL METHODS

Parameter	Method Reference	Method Description
Purgeable Halocarbons	601(5)/8010A(2)	GC
Purgeable Aromatics	602(5)/8020A(2)	GC
Acrolein/Acrylonitrile	603(5)/8030A(2)	GC
Phenols	304(5)/8040A(2)	GC
Benzidines	605(5)	GC
Phthalate Esters	606(5)/8060(2)	GC
Nitrosamines	607(5)	GC
Pesticides/PCBs	608(5)/8080/8081(2)	GC
Nitroaromatics	609(5)/8090(2)	GC
Polynuclear Aromatics	610(1)/8100/8270B(2)	GC,GC/MS
Haleothers	611(1)	GC
Chlorinated Hydrocarbons	612(1)/8120/8121(2)	GC
Dioxin	613(1)/8280(2)	GC/MS
Volatiles	624(1)/8260A(2)	GC/MS
Semi-Volatiles	625(1)/8270B(2)	GC/MS
Pesticides	608(1)/8080/8081(2)	GC
BTX/BTEX	602,624(1) 8020A,8240A(2)	GC & GC/MS
Trihalomethanes	601(1)/8010/8060A(2)	GC, GC/MS
EPA VOCs	EPA 524.2	GC/MS

TABLE 7.3 INORGANIC ANALYTICAL METHODS

Parameter	Method Reference	Method Description
Acidity	305.1 (1), 2310 (3)	Titrimetric
Alkalinity	310.1 (1)/232 (3)	Titrimetric
Coliform, Total	9222B(6)	Membrane Filter Technique
Coliform, Fecal	9222D(6)	Membrane Filter Technique
Asbestos Fibers	100.1(7)	PCM
BOD 5-day	405.1 (1)	5 days at 20°C
Bromide	320.1 (1)	Titrimetric
COD	410.1/410.4 (1)	Colorimetric/Titrimetric
Chloride	325.3(1)/9252(2)	Titrimetric,Mercuric Nitrate
Chlorine, Residual	330.3(1)	Titrimetric
Color	110.2(1)	Colorimetric
Conductivity	120.1(1)/9050(2)	Probe
Cyanide, Total	335.3(1)/9010(2)	Distillation, Colorimetric
Cyanide, ATC	335.3(1)/9010(2)	Chlorination, Distillation, Colorimetric
Fluoride, ISE	340.2(1)/300.0(1)	Potentiometric
Hardness	130.2(1)	Titrimetric
Iodide	345.1(1)	Titrimetric
Nitrogen Ammonia	350.3(1)	Potentiometric, ISE
N-Ammonia, Dist.	350.2(1)	Colorimetric
Nitrogen, TKN	351.3(1)	Titrimetric
Nitrogen - Nitrate	352.1/300.0(1)/9200(2)	Colorimetric, Brucine
N-Nitrate + Nitrite	353.3(1)	Colorimetric, Cadmium Reduction
Nitrogen - Nitrite	354.1(1)	Spectrophotometric

TABLE 7.3 (cont...)

Parameter	Method Reference	Method Description
Odor	140.1(1)	Threshold Odor (Series)
Total Organic Carbon	415.1(1)/9060(2)	Combustion
Total Organic Halides	9020(2)	Carbon adsorption, Microcoulometric titration
Dissolved Oxygen	360.1	Membrane Electrode
Oil & Grease	413.1(1)/9070-9071(2)	Gravimetric, Funnel Extraction
pH	150.1(1)/9040,9045(2)	Electrometric
Phenols (4AAP)	420.1(1)/9065(2)	Distillation, Spectrophotometric
Phosphorus, ortho-	365.2-365.3(1)	Colorimetric
Phosphorus, total	365.2-365.3(1)	Colorimetric
Solids, Total	160.3(1)	Gravimetric, dried @ 103° - 105° C
Solids, dissolved	160.1(1)	Gravimetric, dried @ 180°C
Solids, suspended	160.2(1)	Gravimetric, dried @ 103° - 105° C
Solids, volatile	160.4(1)	*Gravimetric, ignition @ 550°C*
Solids, settleable	160.5(1)	Volummetric, Imhoff Cone
Sulfate	300.0/375.4(1)/9038(2)	Turbidimetric
Sulfide	376.2(1)/9030(2)	*Colorimetric, methylene blue*
Sulfite	377.1(1)	Titrimetric
Surfactants	425.1(1)	Colorimetric
Turbidity	180.1(1)	Nephelometric
Gross Alpha/Beta	900.0(4)	
Radium 226	903.1(4)	
Radium 228	904.0(4)	

TABLE 7.3 (cont...)

Parameter	Method Reference	Method Description
Total Radium	900.1(4)	
Ignitability	1010(2)	Penske-Marten's Closed Cup Method
Corrosivity	1110(2)	Electrometric
Reactivity - Cyanide - Sulfide	8.3(2)	As Cyanide and Sulfide
TCLP	1311(2) 1312(2)	

References:

(1) EPA-600/4-79-020, Methods for the Analysis of Water and Waste water, March 1983.

(2) EPA-SW-846, *Test Methods for Evaluating Solid Waste,* Third Edition, November 1986.

(3) Standard Methods for the Examination of Water and Waste water, 18th Ed, 1992.

(4) EPA-600/4-80-032, Prescribed Procedures for Measurement of Radioactivity in Drinking Water, August, 1980.

(5) Federal Register, Friday, October 26, 1984 (40 CFR Part 136).

(6) EPA-600/8-78-017, Microbiological Methods for monitoring the Environment, December 1978.

(7) EPA-600/R-94-173, Technical Notes on Drinking water methods.

8. INTERNAL QUALITY CONTROL CHECKS

Each and every analysis at CHEMTEX are analyzed in the following sequence and meet the acceptance criteria as per respective section:

1. ICAL: Initial Calibration (as per method/CHEMTEX SOP)

2. ICB: Initial Calibration Blank (Reagent Blank)

3. ICV: Initial Calibration Verification (from a second source)

4. M.B: Method Blank (should be processed like a sample along with the samples)

5. LCS: Laboratory Control Spike (should be processed like a sample along with the samples)

6. ICS: Interference Check Sample (For ICP only)

7. Samples (1 to 20)

8. 10% of Sample duplicates (minimum of one per set)

9. M.S: Matrix Spike (minimum of one per set)

10. MSD: Matrix Spike Duplicate (minimum of one per set)

11. LCSD: Laboratory Control Spike Duplicate (When MS and MSD are not present)

12. ICS: Interference Check Sample (For ICP only)

13. CCV: Continuous Calibration Verification

14. CCB: Continuous Calibration Blank (Reagent Blank).

A. Metal Analyses

Quality Assurance audits and their frequencies are summarized in Table 8.1, and are described below. Acceptable control limits are listed in Table 8.2.

A.1. Blanks:

a) ***Method Blanks***: Method blanks are carried through the sample preparation at a frequency of one blank per ten samples per matrix or one blank per matrix per preparation date, whichever is more frequent. Tables 8.1 and 8.2 summarize frequency and control limits for these audits.

b.) ***Calibration Blanks***: These blanks consist of deionized water. Initial calibration blank is analyzed after the instrument is calibrated and follow the Initial Calibration Verification standard. Continuing calibration blanks are analyzed for each ten sample analyses and after the last sample analysis. In addition, each continuing calibration blank is analyzed immediately following a continuing calibration verification standard.

A.2. Calibration Standards:

Instruments will be calibrated daily and each time the instrument is set up. The number of calibration standards required for metal analysis is as follows:

Flame AA Analyses - One blank and five standards
Furnace AA Analyses - One blank and five standards
Cold Vapor AA Analyses - One blanks and five standards

A non-digested external reference standard (EPA Certified Commercial Available) are used for Initial Calibration Verification. The concentration of the Initial Calibration Verification is the middle of the calibration range. Continuing Calibration Verification standards are also analyzed after a few

samples have been analyzed and after the last sample is analyzed. A mid-range standard is chosen for this purpose.

A.3. Spikes:

Matrix spikes: One sample is spiked at the frequency of one per ten samples per matrix or one sample per matrix per preparation date, whichever is more frequent. Tables 8.1 and 8.2 describe the frequency and control limits of matrix spikes.
An analytical spike is performed when a matrix spike is out of the acceptable limits. This is to determine if the spike recovery is being affected by the sample matrix.

A.4. Duplicates:

Duplicate analysis is performed on at least one per ten samples per matrix, or one sample per matrix per preparation date, whichever is more frequent. Analytical results of sample duplicates are used to assess precision. Table 8.2 illustrates the precision control limits.

A.5. Laboratory Control Standard:

This consists of a digested external standard; it is analyzed at a frequency of one per sample batch prepared. This kind of blank spike is used as the accuracy audit. Please see Table 8.2 for accuracy control limits.

TABLE 8.1

Quality Control Audits and Frequencies for Metal Analysis

Audit	Frequency
Method Blank (Process)	One per batch
Initial Calibration Verification (ICV) instrument calibration	Run immediately following
Initial Calibration Blank (ICB)	Run immediately following each ICV.
Continuing Calibration Verification (CCV) analyzed and after last sample analyzed	One after every ten samples
Continuing Calibration Blank (CCB) analyzed (analyzed immediately following CCV)	One after every ten samples
Matrix Spike (Accuracy Audit) preparation date	One per ten samples per matrix or one per matrix per sample
Matrix Spike Recovery/Sample Duplicate (Precision Audit) preparation date	One per ten samples per matrix or one per matrix per sample
Laboratory Control Sample	One per sample batch prepared and analyzed

TABLE 8.2

Quality Assurance Criteria for Metal Analysis

Audit*	Element	Control Limit+
Method Blank	All	≤ MDL
Matrix Spike Recovery	All	75-125% *
Sample Duplicate	All	≤ 20% RPD
Initial Calibration Verification	All	90-110% *
Continuing Calibration Verification	All	90-110% *
Laboratory Control Sample	All	80-120% *
Completeness	All above audits	≥ 90%

* The control limits for these audits may be established by the company that prepared the samples. The control limits sent with the samples are the true limits for those specific samples.

\+ Control limits listed are only guides. When statistical control limits have been tabulated and established on the analytes, the control limits calculated are the effective control limits.

MDL - Method Detection Limit (As per 40 CFR, Part 136, Appendix C)
RPD - Relative Percent Difference

B. Organic Analysis

Quality control audits and their frequencies are listed in Tables 8.3 through 8.6 for different kinds of organic analysis.

B.1. Blank Samples:

These samples are analyzed to assess for possible contamination from the laboratory in order that corrective actions may be taken as necessary. Tables 8.7 to 8.10 for acceptable criteria and control limits for blank samples.

a.) ***Method Blanks***: Method blanks are prepared in the laboratory and are handled in the exact manner as actual samples. These determine the presence of possible laboratory contamination.

b.) ***Solvent Blanks***: Solvent blanks are prepared in the laboratory and are analyzed to assess the background of the reagents/solvents used in the analysis.

B.2. Surrogate Spikes:

Surrogate spikes are used as specified by the appropriate method. For volatile organic compounds, all surrogate spikes must be within the control limits as established by the procedure. Any sample with volatile organic compounds out of control must be re-analyzed and the result flagged.

B.3. Internal Standards:

All samples and audits are spiked with the internal standard just prior to the analysis.

B.4. Calibration Standards:

CHEMTEX follows all acceptable criteria, as specified in the appropriate procedure (See Table 7.2) concerning: the number of calibration standards; tune criteria; calibration check compounds (CCCs); and system performance check compounds (SPCCs).

B.5. Matrix Spike/Matrix Spike Duplicate:

Two aliquots of a sample are spiked with the matrix spike compounds. The percent recovery of these compounds will be used to assess accuracy and precision. Refer to Tables 8.3 through 8.10 for control limits and frequency requirements for these audits.

TABLE 8.3

Quality Control Audits and Frequencies for Purgeable Aromatics by GC(PID) (EPA Method 602/8020A)

Audit	Frequency
Method Blank (Process)	One per 10 samples
Continuing Calibration Standard	One per 10 samples
Surrogate Standard	Added to each sample, blank, and standard.
Matrix Spike (MS)*	One set per 10 samples per matrix (Accuracy Audit) or one set per matrix per preparation date, whichever is more frequent
Matrix Spike Duplicate (MSD)*	One set per 10 samples per matrix (Precision Audit) or one set per matrix per preparation date, whichever is more frequent
Laboratory Control Sample	This sample is only to be run if the MS or MSD is out of limit.

* MS and MSD are a set of audits to be performed on the same sample.

TABLE 8.4

Quality Control Audits and Frequencies for Organochlorine Pesticides/PCBs by GC(ECD) (EPA Method 608/8080/8081)

Audit	Frequency
Method Blank (Process)	One per 20 samples per matrix or one per extraction date, whichever is more frequent.
Continuing Calibration Check (Individual/Evaluation Standard Mixes)	One per 10 samples
Surrogate Standard	Added to each sample, blank, and standard.
Matrix Spike (MS)*	One set per 20 samples per matrix (Accuracy Audit) or one set per matrix per preparation date, whichever is more frequent
Matrix Spike Duplicate (MSD)*	One set per 20 samples per matrix (Precision Audit) or one set per matrix per preparation date, whichever is more frequent
External Standard	Run after each calibration curve
Laboratory Control Sample	One set per 20 samples per matrix or one set per matrix per preparation date, whichever is more frequent. This sample is only to be run if the MS or MSD is out of limit.

* MS and MSD are a set of audits to be performed on the same sample.

TABLE 8.5

Quality Control Audits and Frequencies for Purgeable Organics by GC/MS (EPA Methods 624 & 8260A)

Audit	Frequency
GC/MS Tune at the beginning of the 12 hours	Once every 12 hours of analysis,
Method Blank (Process)	One per 12 hours of analysis
Continuing Calibration Standard	One per 12 hours of analysis
Surrogate Standard	Added to each sample, blank, and standard.
Matrix Spike (MS)*	One set per 10 samples per matrix (Accuracy Audit) or one set per matrix per preparation date, whichever is more frequent
Matrix Spike Duplicate (MSD)*	One set per 10 samples per matrix (Precision Audit) or one set per matrix per preparation date, whichever is more frequent
External Standard	One per set of analysis
Laboratory Control Sample	One set per 20 samples per matrix or one set per matrix per preparation date, whichever is more frequent. This sample is only to be run if the MS or MSD is out of limit.

* MS and MSD are a set of audits to be performed on the same sample.

TABLE 8.6

Quality Control Audits and Frequencies
Semivolatile Organics by GC/MS (EPA Method 625/8270B)

Audit	Frequency
GC/MS Tune	Once every 12 hours of analysis, at the beginning of the 12 hours
Method Blank (Process)	One per 20 samples per matrix or one per extraction date,
whichever is more frequent.	
Continuing Calibration Standard	Once per 12 hours of analysis
Surrogate Standard	Added to each sample, blank, and standard.
Matrix Spike (MS)* (Accuracy Audit)	One set per 10 samples per matrix or one set per matrix per preparation date, whichever is more frequent
Matrix Spike Duplicate (MSD)* (Accuracy Audit)	One set per 10 samples per matrix or one set per matrix per
set per matrix per preparation date, whichever is more frequent	
External Standard	One per set of analysis
Laboratory Control Sample	One set per 20 samples per matrix or one set per matrix per preparation date, whichever is more frequent. This sample is only to be run if the MS or MSD is out of limit.

* MS and MSD are a set of audits to be performed on the same sample.

TABLE 8.7

Quality Assurance Criteria for Purgeable Aromatics by GC/PID (EPA Method 602/8020A)

Audit	Parameter	Control Limit
Method Blank (Process)	All method analytes	≤ MDL
Continuing Calibration Standard	All method analytes	RF ≤ 15% difference from initial calibration
Matrix Spike (MS) (Accuracy Audit)	Benzene Ethylbenzene Toluene Xylenes, Total	39-150% Recovery 32-160% Recovery 46-148% Recovery 32-160% Recovery
Matrix Spike Duplicate (MSD) (Precision Audit)	Matrix Spike Compounds	≤ 25% RPD
Completeness	All above audits	≥ 90%

* From SW - 846 Method 8020A.

MDL: Method Detection Limit (40 CFR Part 136 Appendix C)
RPD - Relative Percent Difference
RF - Response Factor

TABLE 8.8

Quality Assurance Criteria for Organochlorine Pesticides/PCBs by GC(ECD) (EPA Method 608/8080/8081)

Audit	Parameter	Control Limit
Method Blank (Process)	All method analytes	≤ MDL
Solvent Blank	All method analytes	≤ MDL
Continuing Calibration Standard	All method analytes	RF ≤ 25% difference from initial calibration
Surrogate Standard Compound	Dibutylchlorendate (DBC)	28-169% Recovery**
Matrix Spike (MS) (% Recoveries) (Accuracy Audit)	Aldrin	42-122% Recovery*
	g-BHC (Lindane)	32-127% Recovery*
	4,4'-DDT	25-160% Recovery*
	Dieldrin	36-146% Recovery*
	Endrin	30-147% Recovery*
	Heptachlor	34-111% Recovery*
	PCB-1016	30-114% Recovery*
	PCB-1260	30-127% Recovery*
Matrix Spike Duplicate (MSD)(Precision Audit)	Matrix Spike Compounds	≤ 25% RPD
Laboratory Control Sample	Matrix Spike Compounds	Matrix spike control limits
External Standard	All method analytes	RF ≤ 25%
Completeness	All above audits	≥ 90%

* From 40 CFR Part 136, Appendix A, Method 608
** Limits based on in-house statistical evaluation
MDL: Method Detection Limit (40 CFR Part 136 Appendix C)
RPD - Relative Percent Difference
RF - Response Factor

TABLE 8.9

Quality Assurance Criteria EPA Method 624/8260A
Purgeable Organics by GC/MS

Audit	Parameter	Control Limit*	
Bromofluorobenzene Check (GC/MS Tune)	BFB	Must pass EPA criteria	
Method Blank	Methylene Chloride	≤ 5 X MDL	
	All other method analytes	≤ MDL	
Continuing Calibration Check Standard	CCCs	RF ≤ 25% difference from initial calibration	
System Performance Check Compounds	SPCCs	Minimum of 0.300 (0.250 for Bromoform)	
Matrix Spike (MS) (Accuracy Audit)	Benzene	34-151% Recovery	
	Chlorobenzene	37-160% Recovery	
	1,1- Dichloroethane	D-234% Recovery	
	Toluene	47-150% Recovery	
	Trichloroethane	71-157% Recovery	
Matrix Spike Duplicate (MSD)(Precision Audit)	Matrix Spike Compounds	≤ 25% RPD	
		Water	Soil
**Surrogate Recoveries	1,2-Dichloroethane-d_4	76-114%	81-117%
	Toluene-d_8	88-110%	74-121%
	4-Bromofluorobenzene	86-115%	70-121%

* From 40 CFR Part 136, Appendix A, Method 624
SW-846, Method 8260A states the same limits
** From SW-846 Method 8260A

MDL: Method Detection Limit
RPD - Relative Percent Difference
RF - Response Factor

TABLE 8.9 (cont...)

Quality Assurance Criteria

EPA Method 624/8260A
Purgeable Organics by GC/MS

Audit	Parameter	Control Limit*
Laboratory Control Standard	All method analytes	RF $\leq$ 25%
Completeness	All above audits	$\geq$ 90%

* From 40 CFR Part 136, Appendix A, Method 624
SW-846, Method 8260A states the same limits
** From SW-846 Method 8260A

MDL: Method Detection Limit
RPD - Relative Percent Difference
RF - Response Factor

TABLE 8.10

Quality Assurance Criteria for Semivolatile Organics by GC/MS (EPA Methods 625 & 8270B)

Audit	Parameter	Control Limit*
Decafluorotriphenyl-phosphine (GC/MS Tune)	DFTPP	Must pass EPA criteria
Method Blank	Phthalates	≤ 5 X MDL
	All other method analytes	≤ MDL
Continuing Calibration Check Standard	CCCs	RF ≤ 25% difference from initial calibration
System Performance Check Compounds	SPCCs	Minimum RF of 0.050
Matrix Spike (MS) (Accuracy Audit)	Acenaphthene	46-118% Recovery
	1,4-Dichlorobenzene	36-125% Recovery
	2,4-Dinitrotoluene	24-120% Recovery
	N-Nitrosodi-n-propylamine	41-116% Recovery
	Pyrene	27-127% Recovery
	1,2,4-Trichlorobenzene	39-142% Recovery
	4-Chloro-3-methylphenol	23-140% Recovery
	2-Chlorophenol	27-123% Recovery
	4-Nitrophenol	10-80% Recovery
	Pentachlorophenol	9-103% Recovery
	Phenol	12-110% Recovery

* From 40 CFR Part 136, Appendix A, Method 625
SW-846, Method 8270B states the same limits

MDL: Method Detection Limit
RPD - Relative Percent Difference
RF - Response Factor

TABLE 8.10
(cont...)

Audit	Parameter	Control Limit*	
Matrix Spike Duplicate (MSD)(Precision Audit)	Matrix Spike Compounds	≤ 25% RPD	
		Water	Soil
Surrogate Recoveries	Nitrobenzene-d_5	35-114%	23-120%
	2-Fluorobiphenyl	43-116%	30-115%
	Terphenyl-d_{14}	33-141%	18-137%
	Phenol-d_6	10-110%	24-113%
	2-Fluorophenol	21-1100%	25-121%
	2,4,6-Tribromophenol	10-123%	19-122%
External Standard	All method analytes	≤ 25% difference from initial calibration	
Laboratory Control Sample	Matrix Spike Compounds	Matrix Spike Limits	
Completeness	All above audits	≥ 90%	

* From 40 CFR Part 136, Appendix A, Method 625
SW-846, Method 8270B states the same limits

MDL: Method Detection Limit
RPD - Relative Percent Difference
RF - Response Factor

C. Conventional Pollutant Analyses

Method specific criteria for the use and frequency of blank analyses, calibration standards, calibration check analyses, and surrogate/matrix spikes to monitor method performance are strictly incorporated at CHEMTEX in conventional pollutant analyses and are summarized in Tables 8.11 and 8.12.

When a calibration curve is to be prepared, one blank and at least three calibration standards must be used. The acceptable correlation factor is 0.995, and should conform to the calibration curve.

TABLE 8.11

Quality Control Audits and Frequencies for Conventional Pollutants

Audit*	Frequency
Calibration Blank	After calibration standards and every ten samples
Method Blank (Process)	One per batch per matrix type
Initial Calibration Verification (ICV) calibrated; and analyzed immediately following instrument calibration	One each time instrument is
Initial Calibration Bland (ICB) calibrated; and analyzed immediately following ICV.	One each time instrument is
Continuing Calibration Verification (CCV) analyzed and after last sample analyzed	One after every ten samples
Continuing Calibration Blank (CCB) analyzed (analyzed immediately following CCV)	One after every ten samples
Matrix Spike (Accuracy Audit)	One per ten samples per matrix or one per matrix per sample
preparation batch, whichever is more frequent	
Sample Duplicate (Precision Audit)	One per ten samples per matrix or one per matrix per sample
preparation batch, whichever is more frequent	
Laboratory Control Sample	One per sample batch prepared and analyzed

* If applicable

TABLE 8.12

Quality Assurance Criteria for Conventional Pollutants

Audit*	Control Limit+
Calibration Blank	≤ MDL
Method Blank	≤ MDL
Initial Calibration Verification Standard	90-110% **
Continuing Calibration Verification Standard	90-110% **
Matrix Spike Recovery	80-120%
Sample Duplicate	≤ 20% RPD
Laboratory Control Sample (LCS)	80-120% **
Completeness	≥ 90% of above audits

* If applicable

** The control limits for these audits may be established by the company that prepared the samples. The control limits sent with the samples are the true limits for those specific samples.

\+ Control limits listed are only guides. When statistical control limits have been tabulated and established on the analytes, the control limits calculated are the effective control limits.

MDL - Method Detection Limit
RPD - Relative Percent Difference

9. DATA REDUCTION, VALIDATION, AND REPORTING

A. Data Reduction:

All test data associated with each analysis is immediately recorded in the respective analysis log book assigned for each parameter including the results of quality control samples. Notebook entries, or any other general laboratory records, are in ink only. Any log book or notebook entries that are corrected are made by writing a one-line strikeout. All corrections are signed and dated by the person making the change. All calculations will be checked independently by two analysts before reporting.

B. Data Validation:

Data validation is the process of examining data and accepting or rejecting it based on pre-defined criteria. **CHEMTEX** exercises the following criteria to validate laboratory data:

1) Use of approved analytical procedures
2) Use of properly operating and calibrated instrumentation
3) Precision and accuracy comparable to that achieved in similar analytical programs.

Persons validating the data will have sufficient knowledge to identify questionable values/data. The second analyst familiar with analysis and QA/QC Coordinator will examine sample result for accuracy. Data is also reviewed for outliner values like large differences between samples or incompatibility of results between parameters. The data after reduction is verified by a second analyst before preparing a report and finally reviewed by the QA/QC Coordinator and laboratory director before reporting it to the client. Any activity which is not performed in accordance with the laboratory

or SOP, is considered as a deviation from the quality control activity. However, due to matrix interferences MS or MSD recoveries are accepted though they are not in the acceptable limits as per the prescribed method. In such events, the client will be notified in writing and a corrective action is documented; indicates the condition from the QA/QC deviations. Similar instances will be acceptable in the case of the extract is diluted to an extent, where surrogates are not able to detect by the instrument. In such cases LCS and duplicate LCS is considered in the place of MS and MSD.

C. Data Reporting and Storage:

Results will be reported to the client after all the quality control parameters are met. Additional data required by the customer, such as operating conditions, QA/QC data, method blanks, and minimum detection limits will be supplied. All copies of the reports, along with the chain of custody and all the corresponding raw data including chromatograms are filed and retained for a period of at least ten years. These retained data packages are accessible to the laboratory director and office manager only. All electronic data that is acquired by the analytical instrument and data entry such as spread sheet and analytical reports will be stores in the magnetic tapes; (backups will be performed every month). The back-up tapes are kept under the custody of the Director and it is not accessable to any other laboratory personal. If needed the stored data will be retrieved by the laboratory director's authorization.

D. Data Confidentiality:

CHEMTEX will ensure the confidentiality of all information pertaining to client samples by maintaining secured storage, tracking all relevant information within the laboratory. There will be no reproduction of client information without prior approval of the client.

10. SYSTEM AND PERFORMANCE AUDITS

The system audit is a systematic check of qualitative nature consisting of an on-site review of a laboratory's quality assurance systems and physical facilities. Internal audits are performed at **CHEMTEX** on a regular basis by QA/QC coordinator, Supervisor and the laboratory director. These audits are scheduled at least once in a year or earlier as the case of any discrepancy in the area of analysis, where the quality system is adversely affected. In such cases CHEMTEX will take corrective action immediately and notify to the client(s), in writting whose work is affected.

Internal audits will also be conducted by an outside audit professional. Internal audit will emphasize the data quality and determine:

1. Procedures described in the quality system.
   - personnel, facilities and equipment
   - chain of custody procedures
   - instrument calibration and maintenance
   - QA/QC procedures

2. Objectives in the QAPP are being achieved
3. Designated duties are satisfactorily discharged
4. Opportunities for improvement

   Internal audits are not only targeted on technical activities but also on activities, which supports the technical activities such as purchasing and

document control. The results of the audit findings to the personnel responsible in the area of analysis.

External audits are performed on a regular basis by state and federal regulatory agencies such as TNRCC, EPA and commercial clients. Performance audits provide a systematic check of laboratory operations and measurements. Following the audit findings, the CHEMTEX management including the president, laboratory director will review the deficiencies found during the audit for suitability and effectiveness in satisfying these requirements to improve the quality system in relation to:

- Matters from previous review
- Reports from the external audit assessments
- Report from audit from clients
- Results of internal audits including corrective actions implemented.
- Results of PE participation
- In house quality checks
- Details of complaints from clients
- Staff training
- Future plans and projections for new work, new staff and new equipment.

All corrective actions arise from the internal, external audits and management review finding will be implemented within the time scale.

CHEMTEX routinely participates in laboratory performance evaluations for the US EPA water pollution studies. **CHEMTEX** also participates in the interlaboratory check programs. All analysts regularly participate in analyzing test samples provided by AIHA, NIST's NVLAP, and

the US EPA performance evaluation samples. Each analyst will analyze the sample separately for the parameter he/she is assigned to, and maintain a record of his/her results for future reference. In addition, intralaboratory performances samples are analyzed for several analytes.

11. PREVENTIVE MAINTENANCE

Preventive maintenance procedures such as lubrication, source cleaning and the frequency of such maintenance, are performed according to the procedures mentioned in the manufactures instrument operating and maintenance manual. All repair work is recorded in an instrument maintenance log with the date, nature of problem , action taken and the name of the service person. **CHEMTEX** also maintains adequate supplies of spare parts such as GC columns, syringes, septa, injection port liners, and electronic parts so they are available when needed. In the case of equipment malfunction which cannot be solved within one or two working days, analysis will be carried out using back up instruments. If such back up instrumentation is not available, arrangements will be made to have the instrument repaired immediately. Laboratory maintenance schedule of common preventive tasks for key instruments are as follows:

GC/MS

Task	Frequency
Replace pump oil	Quarterly
Change septa	As needed
Change gas line	As needed
Dryers	As needed
Clean source	As needed
Change injection port lines	As needed
Change traps	As needed
Change column	As needed
Change turbo pump oil	As needed
Change card case filter	Quarterly
Change dunk drive filter	Quarterly
Replace electron multiplier	As needed
Clean source	As needed

GC

Change septa	As needed
Change injection port liners	As needed
Change column	As needed

Check gas cylinders	Daily
Leak check	As needed
Change gas line dryers	As needed

PURGE & TRAP DEVICE

Replace trap	As needed
Decontaminate system	Daily
leak check system	Daily

AA FLAME & FURNACE

Check energy of Deuterium background collector	Daily
Note AA lamp Intensity	Daily
Check gas and water lines for leaks	As needed
Check Graphite tube condition	Daily
Clean quartz windows	As needed
Clean electrodes on furnace	As needed
Change graphite contact rings electrodes	As needed

GENERAL LABORATORY AREA:

Clean laboratory	Daily
Calibrate Automatic pipettes	Monthly
Replace worn parts on automatic pipettes	As needed

Record oven/refrigerator thermometer	Daily
Record of DI water conductivity	Daily
Calibrate balances/pH meters	Daily
Check supply of consumable items	On regular basis

12. SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

Data quality is assessed based on five main characteristics of the data which are:

Precision

Accuracy

Completeness

Representativeness

Comparability

Each of these characteristics is discussed below.

A. Precision

Precision is the degree of agreement between repeated measurements of the same parameter under prescribed and similar conditions. Analytical precision is monitored using results from duplicate analyses. Relative Percent Difference (RPD) is used as the measure of precision between matrix spike duplicates. The formula utilized to calculate RPD is as follows:

Relative Percent Difference (RPD)

$$\text{RPD} = \frac{(\text{MS} - \text{MSD})}{\text{Mean of MS} + \text{MSD}} \times 100$$

where **MS = Percent recovery for Matrix Spike**
MSD = Percent recovery for Matrix Spike Duplicate

B. Accuracy

Accuracy is a measure of the degree of difference between the analytically obtained value and the known or actual value for a sample. **CHEMTEX** assesses accuracy by determining the percent recover (%R) for the analytes contained by the designated quality control samples. Acceptance criteria for spiked samples processed by the laboratory are mentioned in Tables 8.1 to 8.12. Acceptance criteria for other specific methods may be found in the analytical Standard Operating Procedures. Data obtained for all laboratory spikes evaluated monthly by the QA/QC Coordinator for developing trends.

$$\textbf{Percent Recovery} = \frac{\textbf{Total Analyte Value-Sample value}}{\textbf{Spiked Value}} \times 100$$

C. Completeness

Completeness is a measure of the valid data obtained from an analysis express as the percentage of the total data that should have been obtained.

$$\textbf{\% Completeness} = \frac{\textbf{Amount of Valid Data Obtained}}{\textbf{Total Amount of Valid Data Expected}} \times 100$$

CHEMTEX's objective for completeness is to be able to provide analytical data for 100% of samples received intact and have sufficient sample volume for conducting reanalysis if initial analysis does not meet QC acceptance criteria.

D. Representativeness

Representativeness of the analytical data is primarily a function of the sampling procedures and techniques employed in the field. As such, the sampling plan must be designed to provide representative samples to the laboratory. Once received at the laboratory, samples are homogenized as much as possible to yield representative data on the sample submitted for analysis.

E. Comparability

CHEMTEX's data is fully comparable with data from other laboratories. This is accomplished through use of the following practices:

* Demonstrate traceability of standards to NIST or EPA sources
* Use of Standard and Approved Methodogies
* Standardized units of measure
* Standardized QA Acceptance criteria
* Participation in the interlaboratory studies to demonstrate laboratory performance

13. STATISTICAL FORMULAE AND DEFINITIONS

A. Definitions

For the Precision Audits, X = RPD for each individual compound.

For the Accuracy Audits, X = % Recovery for Each individual compound.

$X_1, X_2, X_3, X_4, \ldots, X_n$ (n>20) represent the first n time-ordered determinations.

$\bar{X}$ = average = $(1/n)(X_1 + X_2 + \ldots X_n)$

Standard Deviation (SD) of X = $\overline{(1}/n-1)\ (Xi - X_2)$

B. Statistical Parameter Evaluation

Parameter	Symbol	Formula
Upper Control Limit	UCL	$\bar{X} + 3SD$
Lower Control Limit	LCL	$\bar{X} - 3SD$
Upper Warning Limit	UWL	$\bar{X} + 2SD$
Lower Warning Limit	LWL	$\bar{X} - 2SD$

C. Statistical Control Limits

Statistical control limits are used to assess QC efforts over a period of time. The lab will establish limits for precision and accuracy. Depending on the analytic, different formats of statistical control may be used. These can include control charts, tabulations, or computerized tracking. A minimum of 20 points will be obtained prior to the initial attempt to establish the statistical control limits. Until 20 points are attained and calculated, the recoveries specified in Tables 8.1 through 8.10 are used as the control limits.

14. CORRECTIVE ACTION

An important part of any quality assurance program is a well designed effective policy for correcting quality programs. One of the most effective means of preventing errors in data generation is to respond immediately to erroneous data. The cause will be immediately investigated, which could be due to any one of the aspects mentioned in this manual. Application of immediate corrective action at this point will reduce or prevent generation of unreliable data. The details of corrective action taken along with the evidence of restoration of results to normal are recorded in corrective action form.

In the event of a defective analysis where a corrective action was taken; analysis that are generated to the clients, whose work might have been affected, will be notified immediately in writing followed by an amended report as expeditionally as possible.

On the first recognition of an outlier, the analyst will ensure that the remainder of the sample is preserved. If the cause of the outlier is not solved with corrective action taken by the analyst, the problems are notified to the QA/QC coordinator. Any major operational changes or initiation of any changes, are made only after the approval by laboratory director.

CORRECTIVE ACTION REPORT

To: Laboratory Director
QA/QC Coordinator

Date:_____

From: Analyst in Charge

Analysis: _____

True Value: _____ Reported Value: _____

Control Limits: _____Duplicate Results: _____

Method Reference: _____Instrument ID# and Type: _____

Method Blank: _____

Comments of Analyst:

Comments of QA/QC Coordinator:

Comments of Laboratory Director:

Corrective Action Taken:_____
_____
_____

15. COMPLAINTS

All the complaints received from the clients and other parties through telephone, fax, oral or written are recorded in a complaint log along with the analytical report by the secretary/office manager and passed on to the laboratory supervisor. These complaints are immediately directed to the QA/QC co-ordinator and concerned analyst(s) for resolution.

QA/QC coordinator will check the data in question. If necessary he or she will authorize for reanalysis. If any variation in results from the earlier analysis, an amended report will be generated and sent to the client. The client will also will be informed about the causes for the defective measurement of the analysis. All these complaints, as well as the corrective actions taken on these instances are discussed in the technical meetings as well as in the general meetings. If necessary an internal audit will be conducted in the area of the analysis by the laboratory director in order to eliminate the questionable quality of the data in future.

Appendix A

LIST OF MAJOR ANALYTICAL EQUIPMENT

Serial #	Name of the Instrument	Make/Model	Detector/ System	Instrument I.D.
1	GC/Mass Spectrophotometer - Purge & Trap Autosampler - Concentrator	HP 5890 ALS 2000 LSC 2016	HP MSD 5970	GCMS01
2	GC/Mass Spectrophotometer - Autosampler	HP 5890 HP 7673	HP MSD 5970	GCMS02
3	GC/Mass Spectrophotometer - Purge & Trap System	HP 5890, Series II OI Analytical	HP MSD 5970	GCMS03
4	GC/Mass Spectrophotometer - Autosampler	HP 5890, Series II HP 7673	HP MSD 5970	GCMS04
5	GC/Mass Spectrophotometer - Autosampler	HP 5890, Series II HP 7673	HP MSD 5972	GCMS05
6	GC/Mass Spectrophotometer - VOC Autosampler - Cryogenic Concentrator	HP 5890, Series II Nutech 3600 Nutech 3550A Series	HP MSD 5972	GCMS06
7	Gas Chromatograph - Autosampler	HP 5890 HP 7673	FID	GC01
8	Gas Chromatograph - Autosampler	HP 5890 HP 7673	FID	GC01
9	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID	GC02
10	Gas Chromatograph - Autosampler	HP 5890 HP 7673	NPD	GC02
11	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FPD	GC03
12	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID	GC04
13	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID	GC04
14	Gas Chromatograph - Purge & Trap Autosampler - Concentrator	HP 5890, Series II ALS 2000 LSC 2016	PID	GC05

Serial #	Name of the Instrument	Make/Model	Detector/ System	Instrument I.D.
15	Gas Chromatograph - Purge & Trap Autosampler - Concentrator	HP 5890, Series II ALS 2000 LSC 2016	PID	GC05
16	Gas Chromatograph	HP 5890, Series II	FID	GC06
17	Gas Chromatograph	HP 5890, Series II	FPD	GC06
18	Gas Chromatograph	HACH	TCD	GC07
19	Gas Chromatograph - Autosampler	HP 5890 HP 7673	ECD	GC08
20	Gas Chromatograph - Autosampler	HP 5890 HP 7673	ECD	GC08
21	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673	ECD	GC09
22	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673	ECD	GC10
23	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	ECD	GC10
24	Gas Chromatograph	HP 5890, Series II	ECD	GC11
25	Gas Chromatograph	HP 5880	TCD	GC12
26	Gas Chromatograph	HP 5880	FID	GC12
27	Gas Chromatograph	HP 5880	FID	GC12
28	Inductively Coupled Plasma Spectrophotometer	Perkin Elmer	AES	ICP01
29	Inductively Coupled Plasma Spectrophotometer	Leeman Labs	AES	ICP02
30	Atomic Absorption (AA) Spectrophotometer	Varian 400 Zeeman	Furnace	AA01
31	A A Spectrophotometer	Varian 400 Zeeman	Flame	AA02
32	Mercury Analyzer	Buck Scientific	Cold Vapor Technique	AA03

Serial #	Name of the Instrument	Make/Model	Detector/ System	Instrument I.D.
33	A A Spectrophotometer	Perkin Elmer 560	Flame	AA04
34	High Performance Liquid Chromatograph (HPLC)	DIONEX, VDM-2	UV/VIS	HPLC01
35	H P L C - Autosampler	DIONEX, VDM-2 DIONEX, ASM-2	UV/VIS	HPLC02
36	Ion Chromatograph	DIONEX, CDM-2	Conductivity	IC01
37	Ion Chromatograph - Autosampler	DIONEX, CDM-2 DIONEX, ASM-2	Conductivity	IC02
38	Ion Chromatograph - Autosampler	DIONEX, CDM-3 DIONEX, ASM-2	Amperometric	IC02
39	Ion Chromatograph - Autosampler	DIONEX, ADM-2 DIONEX, ASM-2	Conductivity	IC02
40	X-Ray Diffraction	Diano series 9000	X-Ray	XRD01
41	Transmission Electron Microscope	JEOL JEM 100 CX11		TEX01
42	Total Organic Carbon Analyzer	Beckman		TOC01
43	Total Organic Halide Analyzer	Dohrmann		TOX01
44	Total Organic Halide Analyzer	Dohrmann		TOX02
45	Infrared Spectrophotometer	Buck Scientific		IR01
46	Microscope	Nikon, Labophot		ASB01
47	Microscope	Nikon, Labophot		ASB02
48	Phase Contrast Microscope	Nikon, Labophot		PCM01
49	Phase Contrast Microscope	Nikon, Labophot		PCM02
50	Phase Contrast Microscope	Nikon, Labophot		PCM03
51	Stereo Microscope	Nikon, SMZ-1		FC01
52	Stereo Microscope	Nikon, SMZ-1		FC02
53	Stereo Microscope	Nikon, SMZ-1		FC03

Serial #	Name of the Instrument	Make/Model	Detector/ System	Instrument I.D.
54	Stereo Microscope	Nikon, SMZ-1		FC04
55	Polarized Light Microscope	Nikon, Labophot		PLM01
56	Polarized Light Microscope	Nikon, Labophot		PLM02
57	Polarized Light Microscope	Nikon, Labophot		PLM03
58	Polarized Light Microscope	Nikon, Labophot		PLM04

Qualifications of the Key personnel at CHEMTEX

Dr. C.N. Reddy, M.S., Ph.D., CIH, ASP, Director.

Professional Qualification: March 86 - Present, Responsible for day to day operation of the laboratory, providing the facilities for all the laboratories under the Chemtex and in-charge of confidentiality, security and integrity of the laboratories and as well as the analytical data.

November 80 - March 86: Supervisor, Kemron Laboratory.
Certified Industrial Hygienist 1993.
Associate Safety Professional 1993.

Affiliations: American Chemical Society.
American Society of Agronomy.
American Society of Soil Science.
American Industrial Hygiene Association.
American Society of Safety Engineers.

Dr. S.R. Kor, M.S., Ph.D., Supervisor

Professional Qualifications: Jan 95 - Present: Supervisor of the laboratory, responsible for the day to day laboratory operations.
Jan 1994 - Jan 95, QA/QC coordinator.
November 1993 - Jan 94: Responsible for the analysis of metals by using AA (Flame and Furnace) and ICP at CHEMTEX.
November 1990 - December 1992, Chief Environmental Chemist, Environmental Control Division, Ministry of Health, Govt of Jamaica, West Indies.

Affiliations: Gulf Coast Deep South Section and Coastal bend of American Industrial Hygiene Association.

Dr. Ramesh K. Cherivirala, M.S., Ph.D., QA/QC Coordinator.

Professional Qualifications: June 1995 - Present, Responsible for the day to day QA/QC operations of the laboratory and data validation, reduction and reporting of the analytical results. Training of the personnel in organic division of the laboratory.

April 1992 - June 95, Responsible for the analysis of Organic pollutants in different matrices, such as Soil, Water, Waste Water, Sludge and Industrial Hygiene Samples by GC, HPLC, IC and IR spectrophotometer at CHEMTEX.

Affiliations: American Chemical Society.
Gulf Coast Deep South Section of American Industrial Hygiene Association.

Mr. Prasad K Lavu, M.S., Biologist/Microscopist.

Professional Qualifications: October 1991 - Present, Responsible for the analysis of various Classic Wet Chemical parameters, microbiological analysis, asbestos analysis and fiber counting.

Dr. V.N.R.Mukku, M.S., Ph.D., Physicist/Chemist.

Professional Qualifications: Jan 1992-Present: Responsible for the analysis of Semi-Volatile analysis using GC/MS and responsible for the analyses of Pesticides, Herbicides and PCB's using GC/ECD.

Dr. Sriramoji Manohar, M.S., Ph.D., Senior Chemist.

Professional Qualifications: January 1994 - Present, Responsible for the analysis of metals by AA (Flame and Furnace) and ICP.

Affiliations: American Chemical Society.

Dr. Mulam, M.S., Ph.D., Organic Chemist

Professional Qualifications: June 1994 - Present, Organic Chemist, Responsible for the analysis of Volatile organics present in multimedia samples by GC/MS.

February 1992 - May 1994, Research Associate at Tini Pharma Ltd, India.

Dr. S.R. Gosala, M.S. Ph.D., Supervisor, Corpus Christi Facility

Professional Qualifications: June 95 - present: Responsible for the analysis of Volatile Aromatic Hydrocarbons using Gas Chromatography and Total Petroleum Hydrocarbons.
1993 - May 95, Research Fellow, Japanese University, Photocatalysts. Purification of drinking water using semiconductor materials on presence of sun light.
1991 - 93, Research Associate, IIT, Bombay Photoelectro Chemistry.

Dr. H.R. Goolla, M.S. Ph.D., Organic Chemist

Professional Qualifications: May 1995-Present: Working with IC and Gas chromotographs for multimedia environmental and industrial hygiene samples.

June 1986 - May 1995: Worked on development of a process in synthesis of automerlvi drugs used during chromotoghraphy to treat cancer patients as young scientists fellow in school of Chemistry. Used different spectral and separation techniques like NMR, MASS, Chromatography and HPLC.

Dr. R.P. Kankati, M.S., Ph.D., Organic Chemist.

Professional Qualifications: May 1995-Present: Responsible for the analysis of purgeable aromatic hydrocarbons using Gas Chromatography and Semi-Volatile analysis using GC/MS.
1993 - 1995, As a post-doctorine research scientist at "Institute of Chemistry" National Autonomous University of Mexico, Mexico, D.F.
1992 - 1993, Research Associate at Dept. of Chemistry Osmania University, Hyderabad, India.

Affiliations: American Chemical Society.

Dr. M.R. Polala, MS., Ph.D., Biologist/Microscopist.

Professional Qualifications: Jan 1996 - Present: Responsible for the analysis of asbestos and fiber counting and microbiological analysis.
May 1992- 96: Post-doctoral fellow, S.K.University, India, Worked on acute toxicicity tests like LC_{50}, safe level concentrations of pesticides, metals are evaluated with reference to aquatic organisms. The toxic impact of pollutants on biochemical and physiological changes in animals are noticed.

Dr.K.C.K.Reddy, M.S., Ph.D., Environmental Soil Chemist

Professional Qualifications: May 1996 - Present: Responsible for the analysis of wet chemical parameters, metals, radio chemical, and silica.
Sept 1976 - May 96: Worked as a senior scientist and project co-ordinator in Indian Council of Agricultural University, Hyderabad, India. Performed research in the field of soil testing and plant nutrition in relation to major secondary and micro-nutrients leading to optimization and prevention of pollution of the agricultural sites. Coordinated multilocation research projects on soil testing and soil health care.

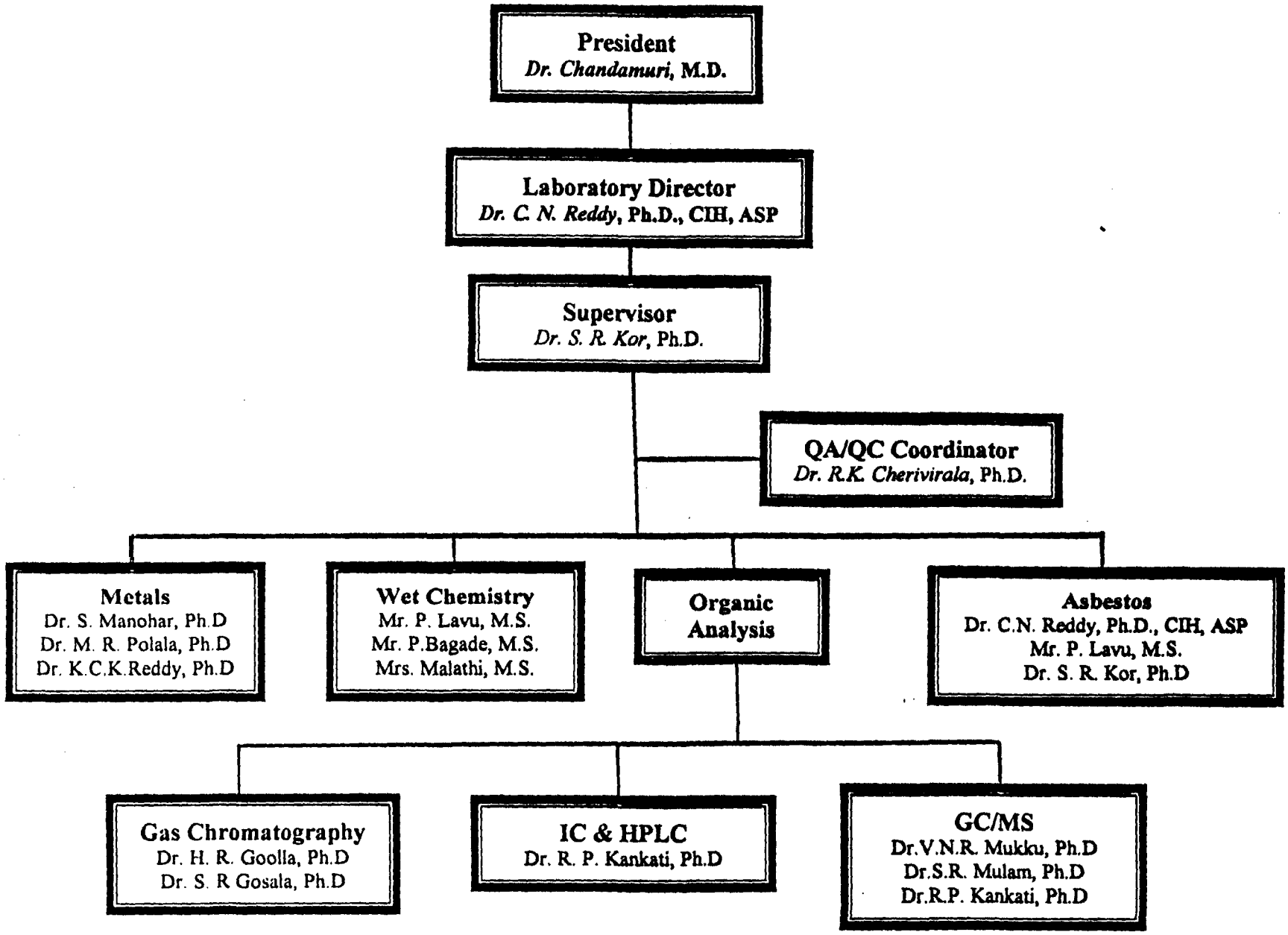
Mr.Prashant Bagade., M.S., Ph.D Student., Biologist/Chemist

Professional Qualifications: July 1996 - Present: Responsible for the analysis of Microbiological organisms and asbestos.

Affiliations: Member of American Society of Agronomy.

Mrs. Malathi Palem, M.S., Chemist.

Professional Qualifications: May 1996 - Present: Responsible for the analysis of wet chemical parameters.


President
Dr. Chandamuri, M.D.
Laboratory Director
Dr. C. N. Reddy, Ph.D., CIH, ASP
Supervisor
Dr. S. R. Kor, Ph.D.
QA/QC Coordinator
Dr. R.K. Cherivirala, Ph.D.
Metals
Dr. S. Manohar, Ph.D
Dr. M. R. Polala, Ph.D
Dr. K.C.K.Reddy, Ph.D
Wet Chemistry
Mr. P. Lavu, M.S.
Mr. P.Bagade, M.S.
Mrs. Malathi, M.S.
Organic Analysis
Asbestos
Dr. C.N. Reddy, Ph.D., CIH, ASP
Mr. P. Lavu, M.S.
Dr. S. R. Kor, Ph.D
Gas Chromatography
Dr. H. R. Goolla, Ph.D
Dr. S. R Gosala, Ph.D
IC & HPLC
Dr. R. P. Kankati, Ph.D
GC/MS
Dr.V.N.R. Mukku, Ph.D
Dr.S.R. Mulam, Ph.D
Dr.R.P. Kankati, Ph.D

Accreditations/Certifications

The American Industrial Hygiene Association

is proud to acknowledge that

Chemtex Environmental and Industrial Hygiene

Port Arthur, TX

Laboratory ID# 10696

has fulfilled the requirements for Industrial Hygiene Laboratory Accreditation and has earned distinguished recognition as an

AIHA Accredited Laboratory

Originally Accredited July 1, 1990, current certificate effective July 1, 1993 until July 1, 1996, subject to continued compliance with AIHA accreditation criteria.

President
American Industrial Hygiene Association

December 1, 1994
Date Prepared

Mark A. Puskar
Chairman
Laboratory Accreditation Committee

423
Certificate Number

AIHA
The Essential Source

January 31, 1997

Dr. C. N. Reddy, CIH, ASP, Director
CHEMTEX Environmental & Industrial
Hygiene Services
3082 25th Street
Port Arthur TX 77642

LAB ID #10696

Dear Dr. Reddy:

This letter is in response to your request for an extension to your current AIHA accreditation which expired on July 1, 1996. The Chair of the Industrial Hygiene Laboratory Accreditation Committee has approved your second extension of three (3) months to your accreditation that will expire on May 1, 1997. By that time the process of reaccreditation should be complete and a new certificate in your laboratory. In the meantime your laboratory remains accredited in the AIHA Industrial Hygiene Laboratory Accreditation Program.

If I can assist you in the future, please write or call.

Sincerely,

Charlotte L. Miller
Manager, Laboratory Accreditation Administration

CLM

cc: K. Bacon

American Industrial Hygiene Association
2700 Prosperity Ave., Suite 250, Fairfax, VA 22031
(703) 849-8888 (703) 207-3561 fax
InfoFax Service Line (703) 641-INFO or Internet: infonet@aiha.org

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

ISO/IEC GUIDE 25:1990
ISO 9002:1987

Certificate of Accreditation

DEPARTMENT OF COMMERCE ★ UNITED STATES OF AMERICA ★

CHEMTEX ENVIRONMENTAL LABORATORY, INC.
PORT ARTHUR, TX

is recognized under the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. Accreditation is awarded for specific services, listed on the Scope of Accreditation for:

BULK ASBESTOS FIBER ANALYSIS

March 31, 1997

Effective through

For the National Institute of Standards and Technology

NVLAP Lab Code: 200025-0

NVLAP-01C (11-95)

TEXAS
DEPARTMENT OF HEALTH

BE IT KNOWN THAT

CHEMTEX ENVIRONMENTAL LABORATORY, INC.

is Licensed and authorized to perform as an

ASBESTOS LABORATORY

PLM-PCM (Port Arthur)

in the State of Texas within the purview of Texas Civil Statutes, Article 4477-3a, as amended, so long as this License is not suspended or revoked and is renewed according to the rules adopted by the Texas Board of Health.

30-0180

License Number

03/04/96

Issue Date

03/03/97

Expiration Date

This certificate is void after expiration date without a current renewal identification card displayed here.

Todd F. Wingler, P.E.
Chief, Asbestos Programs Branch
Occupational Safety and Health Division

David R. Smith, M.D.
Commissioner of Health

VOID IF ALTERED NON-TRANSFERABLE

17406

Statement of Qualifications

CHEMTEX

Environmental & Industrial Hygiene Services

3082 25th Street Port Arthur Texas 77642
(409) 983-4575; FAX (409) 982-1522

Statement of Qualifications

10 Years of

C *Competence*
H *Honesty*
E *Erudition*
M *Motivation*
T *Talent*
E *Expertise*
X *Xperience*

Facilities are also available at:
16550 Highland Road, Baton Rouge, LA 70810 Ph: (504) 752-5100; FAX: (504) 753-1782
1825 N.Padre Island Dr., Corpus Christi, TX 78408 Ph: (512) 299-9900; FAX: (512) 299-1155
194 N. Cities Service Hwy., Sulphur, LA 70663; Ph: (318) 625-8898; FAX: (318) 625-5582

Contents

1. Forethought
2. Introduction
3. General Laboratory Operations
4. Experience
5. Capabilities
   a). Environmental
   b). Industrial Hygiene
6. Facilities
7. Accreditations & Affiliations
8. Instrumentation
9. Methodology
10. Qualifications & Experience of the key personnel
11. Synopsis of Quality Assurance Program Plan

FORETHOUGHT

Forethought

CHEMTEX Environmental & Industrial Hygiene Services is herewith presenting the Statement of Qualifications with an intention of providing the information to project its capabilities, experience and competency to aware the world of environmental community to show that CHEMTEX is one of the best of its kind in its territory in serving the needs of the nation. In this tiny manual CHEMTEX summarizes it's General Operations, Quality Assurance Program Plan, Experience, Qualifications of the personnel and analytical capabilities. It also describes the facilities, methodology and instrumentation, which are using for its operation. In short, it tries to give a precise idea about the structure and the strategy of CHEMTEX.

Dr. C. N. Reddy, Ph.D., CIH, ASP
Director

INTRODUCTION

Introduction

CHEMTEX Environmental Laboratory was established in 1986 at Port Arthur to provide analyses of environmental and industrial hygiene samples to Industries, Cities, Municipalities, Public, State and Federal Government agencies. CHEMTEX extends its services to consulting firms by providing analyses of drinking water, waste water, hazardous waste, air, emissions, indoor air quality, asbestos and industrial hygiene samples.

CHEMTEX expanded its arms to Baton Rouge, Louisiana, Sulphur, Louisiana, Corpus Christi, Texas clients with their warm welcome and by keeping in a mind to provide better services with its extensive experience in analyzing environmental and industrial hygiene samples to meet the growing needs of the modern industry. CHEMTEX Laboratories are capable of providing a complete spectrum of multi media Environmental and Industrial Hygiene samples.

CHEMTEX made a "Commitment to generate precise and accuarate data that is satisfactory and dependable, which addresses the clients concern in the area of accountability, documentation, security and analytical performance of the samples suuplied" with the concern of the environment of the nation and health of the humane. CHEMTEX takes pride in attaining its commitment by generating *precise and accurate* data with its state-of-the-art instrumentation. *Analytical performance* of highly educated, experienced and skilled individuals of the CHEMTEX add up to the satisfaction of the clients concern of the *accountability, dependability and documentation.* Having a Certified Industrial Hygienist, dynamic and talented personality as a leader, CHEMTEX undoubtedly shows the highest professional ethics in the security of the data, besides the quality, reasonable cost and required turnaround time for the sample supplied.

CHEMTEX personnel are also dedicated to the fulfillment of its commitment. CHEMTEX operates under a great deal of enthusiasm and dedication. Its team is well aware of the importance of the accurate data and the implications of providing the faulty interpretations, approximate and incorrect results. It is also aware of their responsibility for providing reliable and accurate analytical data at their best professional competence. CHEMTEX not only provide the data, it also provides valid records and maintains adequate documentation to support the result. Apart of

perfoming a wide variety of analyses, its team maintains memberships and participates in a variety of technical and professional organizations as a part of improving technology, methadology and to stay abreast of the latest changes in the modern world.

CHEMTEX's Quality Assurance Program Plan (QAPP) monitors all the aspects to maintain the required quality from the sample reciept through the analysis to the data reduction and reporting. It reflects the commitment of CHEMTEX to describe, about it, in one sentence. Successful participation in Environmental Protection Agency's (EPA) Water Pollution and Water Supply studies, AIHA's Proficiency Analytical Testing program, National Institute of Standards and technology's (NIST) National Voluntary Laboratory Accreditation Program (NVLAP), client's DMR study and spiked samples of the clients show the CHEMTEX's competence in generating accurate precise and reliable analytical data.

CHEMTEX's reputation for client satisfaction reflects in their continuous business and their growing relationship. CHEMTEX is fully accredited by American Industrial Hygiene Association (AIHA) and is maintaing the accreditation since 1990. CHEMTEX is completed all the requirments for the accredation of NIST's NVLAP and waiting for the certificate.

GENERAL LABORATORY OPERATIONS

General Operations

CHEMTEX provides Chain of Custody (COC) forms to all the clients. The COC consists of all the information regarding the sample supplied, such as Sample Identification, Name of the Sampler, Data Sampled, Sample Matrix, Name of the Client, Name of the Project, Name of the Project Manager, Date shipped, Date and time received, Signature of the Sample custodian, Address, Phone and Fax number of the Client and CHEMTEX. Samples will be logged by the sample custodian after examining their condition and the information comes along. A copy of the sample receipt will be given or faxed to the client. If there is any discrepancy in the sample and the information supplied, concerned client and the supervisor if informed. Each sample will be assigned by a unique seven digit number, for example P5100001, which is used throughout the laboratory for the reference and the analysis. With the use of this CHEMTEX Number, CHEMTEX can trace any sample at any given time for further investigation. As soon as the samples are logged in, COC will be filed near the Sample log book. The sample custodian will inform the supervisor and the analyst(s), if there is any special turn around time and any time bound analysis. The sample log book and COC's are in accessible to all analysts. Analyst(s) will analyze the samples with in the prescribed holding time and with in turn around time by following the prescribed method and the Quality Control criteria. After the analyses, the report will be reviewed by the QA/QC Coordinator and the Supervisor of the Laboratory. In case of any irregularity, report is directed back the analyst for rectification, otherwise, it is passed on for typing to the secretary. After typing, the report comes back to the analyst for proofread and then it travels to the supervisor and there to the Director/in-charge of the Laboratory to finalization. Apart from the analytical data, and address of the Client, the final report consists of the Date Received, Date Analyzed, Date Sampled, Date Reported, Name of the Sampler, Name of the Project, Name of the Project Manager, Methods used for the analyses, Name of the Analyst, and Signatures of the Supervisor and Director/in-charge of the laboratory. Regulatory levels, Detection Limits, Quality Control Data like duplicates, blanks, spikes and surrogate recoveries are also given in the final report. Report will be faxed to the client and the hard copy including with the original chain of custody will be mailed. By means of raw data and software analytical data will be saved at least for three years.

EXPERIENCE

Experience

CHEMTEX employs Chemists, Biologists and technicians, who are experts in their respective fields. Most of the employees hold doctoral degrees in different fields of Chemistry. CHEMTEX operates systematically under the leadership of a Certified Industrial Hygienist. Qualifications, Educational background and professional experience of the key personnel are given in this SOQ. CHEMTEX started its work with wet Chemical Analysis in 1986. Later, it gradually expanded its sphere of work to Industrial Hygiene, Organic and metal analyses. CHEMTEX nearly has a decade of experience in doing the wide variety of analyses of different matrices to meet the needs of Clients. Besides the needs of the nation, CHEMTEX has served and is serving at least 500 Clients at all time. CHEMTEX worked with the clients in different environmental and industrial hygiene projects.

Examples of Projects Handled

1. NPDES Sampling and analysis, Port Neches, Texas.
2. Solid Waste Sampling/Hazardous Waste Sampling and Monitoring.
3. Asbestos Bulk Sampling/Air Monitoring and Analyses.
4. Sludge, Sewage, and Waste Water Analyses.
5. City Effluent, Influent, and Sludge Characterization.
6. Sand Blasting Grit, Waste Oil Characterization.
7. Benzene Survey, Lead Survey, and Hazardous Waste Characterization.
8. Ground Water Monitoring, Effluent Analyses, and Hazardous Waste Characterization.
9. Underground Storage Tank Testing Ground Water, Soil, and Sludge Analyses.
10. Stack Sampling Analyses, Incinerator Burn Analyses, and Ambient Air Monitoring Analyses.
11. Asbestos Bulk Analyses, Fiber Counting Analyses, and Industrial Hygiene Services.
12. Underground Gas and Diesel Tanks, Leak Testing, Soil Characterization, and Ground Water Analyses.
13. Industrial Hygiene Services, and Environmental Testing.
14. Laboratory Services and Consultation.
15. Soil Sampling, Hazardous Waste Characterization, Ground Water Testing, and Analyses.
16. Asbestos Analyses and Industrial Hygiene Services.
17. Asbestos Analyses, Industrial Hygiene Services, and Environmental Services.
18. NPDES Permit Analyses.
19. Oil Field Soil Contamination Survey, Sampling and Analyses.
20. Ground Water Monitoring and Analyses for Pesticide-Tebuthiuron.

21. Steel Product Testing.

22. Glycol Product Testing, Asbestos Sampling and Analyses.

23. Asbestos Testing, NPDES Discharge Analyses.

24. Plant Survey for Drinking Water Contamination and Analyses.

25. NPDES Discharge Analyses for Carbofuron and Carsulfan.

26. Hazardous Waste Characterization, and Product Testing.

27. Hazardous Waste Characterization, Soil and Water Sampling and Analyses for EPA Priority Pollutants.

28. NPDES Permit Analyses, Asbestos Sampling and Analyses, and Hazardous Waste Characterization.

29. Hazardous Waste Characterization, and Industrial Hygiene Services.

30. Industrial Hygiene Services.

31. EPA Storm Water Sampling.

32. Lead Analysis, U.S. Army Corps of Engineers, Granite City.

33. Hazardous Waste Characterization from Superfund Sites JBT/JCS.

34. NPDES Permit analyses for several pollutants including Dioxin & Furans.

35. NPDES Permit analyses for several pollutants including Dioxin & Furans.

36. Bioremediation & Petrochemical degradation Study, Fina Chemical.

37. Lead Monitoring in Drinking Water from school Districts.

38. Ground Water Contamination Exploration at Morton International site, Weeks Island, Louisiana.

CAPABILITIES

Analytical Capabilities

CHEMTEX is capable of doing any type of analysis at any given matrix at any given time. CHEMTEX does not perceive capability as only adhering to regulatory agencies and producing numbers as such it exhibits its capability in terms of producing accurate and reliable data by virtue of its resources and highly qualified personnel. CHEMTEX is not only capable of producing the accurate and reliable data by following the regulatory agencies' methods, but it also proudly claims that it can develop a method for a given analyte on its own. CHEMTEX works like an industry to meet the necessities of the day to day environmental pollution crisis and thereby the global ecology. CHEMTEX does the following analyses regularly as per the requirements of the Clients.

ANALYTICAL METHODS FOR METAL ANALYSIS

Parameter	Method Reference	Method Description
Sample Preparation (Bulk)	3005, 3050, 3010, 3020(2)	Acid Digestion
Aluminum (Al)	202.1(1)/7020(2) 202.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Antimony (Sb)	204.1(1)/7020(2) 204.2(1)/7041(2)	AA - Direct Aspiration AA - Graphite Furnace
Arsenic (As)	206.2(1)/7060(2)	AA - Graphite Furnace
Barium (Ba)	208.1(1)/7080(2) 208.2(1)/7081(2)	AA - Direct Aspiration AA - Graphite Furnace
Beryllium (Be)	210.1(1)/7090(2) 210.2(1)/7091(2)	AA - Direct Aspiration AA - Graphite Furnace
Boron (B)	212.3(1)	Colorimetric
Cadmium (Cd)	213.1(1)/7130(2) 213.2(1)/7131(2)	AA - Direct Aspiration AA - Graphite Furnace
Calcium (Ca)	215.1(1)/7140(2)	AA - Direct Aspiration
Chromium (Cr)	218.1(1)/7190(2) 218.2(1)/7191(2)	AA - Direct Aspiration AA - Graphite Furnace
Chromium VI (CrVI)	218.5(1)/7196(2) 218.4(1)/7197(2)	Spectrophotometry Chelation Extraction AA - Direct Aspiration
Cobalt (Co)	219.1(1)/7200(2) 219.2(1)/7201(2)	AA - Direct Aspiration AA - Graphite Furnace
Copper (Cu)	220.1(1)/7210(2) 220.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Iron (Fe)	236.1(1)/7380(2) 236.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Lead (Pb)	239.1(1)/7240(2) 239.2(1)/7241(2)	AA - Direct Aspiration AA - Graphite Furnace

ANALYTICAL METHODS FOR METAL ANALYSIS

Parameter	Method Reference	Method Description
Lithium (Li)	303-A(3)	AA - Direct Aspiration
Magnesium (Mg)	242.1(1)/7450(2)	AA - Direct Aspiration
Manganese (Mn)	243.1(1)/7460(2) 243.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Mercury (Hg)	245.1, 245.5(1) 7470-7471(2)	Cold Vapor Technique
Molybdenum (Mo)	246.1(1)/7480(2) 246.2(1)/7481(2)	AA - Direct Aspiration AA - Graphite Furnace
Nickel (Ni)	249.1(1)/7520(2) 249.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Potassium (K)	258.1(1)/7610(2)	AA - Direct Aspiration
Selenium (Se)	270.2(1)/7740(2)	AA - Graphite Furnace
Silicon (Si)	4500, 4500B (3)	AA - Direct Aspiration
Silver (Ag)	272.1(1)/7760(2) 272.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Sodium (Na)	273.1(1)/7770(2)	Spectrophotometry AA - Direct Aspiration
Strontium (Sr)	219.1(1)/7200(2)	AA - Direct Aspiration
Thallium (Tl)	220.1(1)/7210(2) 220.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Tin (Sn)	236.1(1)/7380(2) 236.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Titanium (Ti)	283.1(1) 283.2(1)	AA - Direct Aspiration AA - Graphite Furnace
Uranium (U308)	908.1(4)	Fluorometric

ANALYTICAL METHODS FOR METAL ANALYSIS

Parameter	Method Reference	Method Description
Vanadium (V)	286.1(1)/7910(2) 286.2(1)/7911(2)	AA - Direct Aspiration AA - Graphite Furnace
Zinc (Zn)	289.1(1)/7950(2) 289.2(1)	AA - Direct Aspiration AA - Graphite Furnace

ORGANIC ANALYTICAL METHODS

Parameter	Method Reference	Method Description
Purgeable Halocarbons	601(5)/8010(2)	GC
Purgeable Aromatics	602(5)/8020(2)	GC
Acrolein/Acrylonitrile	603(5)/8030(2)	GC
Phenols	304(5)/8040(2)	GC
Benzidines	605(5)	GC
Phthalate Esters	606(5)/8060(2)	GC
Nitrosamines	607(5)	GC
Pesticides/PCBs	608(5)/8080(2)	GC
Nitroaromatics	609(5)/8090(2)	GC
Polynuclear Aromatics	610(1)/8100(2)	GC
Haloethers	611(1)	GC
Chlorinated Hydrocarbons	612(1)/8120(2)	GC
Dioxin	613(1)/8280(2)	GC/MS
Volatiles	624(1)/8240(2)	GC/MS
Semi-Volatiles	625(1)/8270(2)	GC/MS
Pesticides	608(1)/8080(2)	GC
BTX/BTEX	602,624(1)/8020,8240(2)	GC & GC/MS
Trihalomethanes	601(1)/8010	GC
EPA VOCs	EPA 524	GC/MS

CHEMTEX

INORGANIC ANALYTICAL METHODS (WET CHEMISTRY)

Parameter	Method Reference	Method Description
Acidity	305.1 (1), 2310 (3)	Titrimetric
Alkalinity	310.1 (1)/232 (3)	Titrimetric
Coliform, Total	(6)	Membrane Filter Technique
Coliform, Fecal	(6)	Membrane Filter Technique
Std. Plate Count	(6)	Platecount
BOD 5-day	405.1 (1)	5 days at 20°C
Bromide	320.1 (1)	Titrimetric
COD	410.1-410.4 (1)	Colorimetric/Titrimetric
Chloride	325.3(1)/9252(2)	Titrimetric,Mercuric Nitrate
Chlorine, Residual	3303(1)	Titrimetric
Color	110.2(1)	Colorimetric
Conductivity	120.1(1)/9050(2)	Probe
Cyanide, Total	335.3(1)/9010(2)	Distillation, Colorimetric
Cyanide, ATC	335.3(1)/9010(2)	Chlorination, Distillation, Colorimetric
Fluoride, ISE	340.2(1)	Potentiometric
Hardness	130.2(1)	Titrimetric
Iodide	345.1(1)	Titrimetric
Nitrogen Ammonia	350.3(1)	Potentiometric, ISE
N-Ammonia, Dist.	350.2(1)	Colorimetric
Nitrogen, TKN	351.3(1)	Titrimetric
Nitrogen - Nitrate	352.1(1)/9200(2)	Colorimetric, Brucine
N-Nitrate + Nitrite	353.3(1)	Colorimetric, Cadmium Reduction
Nitrogen - Nitrite	354.1(1)	Spectrophotometric

Parameter	Method Reference	Method Description
Odor	140.1(1)	Threshold Odor (Series)
Total Organic Carbon	415.1(1)/9060(2)	Oxidation
Total Organic Halides	9020(2)	Carbon adsorption, Microcolorimetric titration
Dissolved Oxygen	360.1	Membrane Electrode
Oil & Grease	413.1(1)/9070-9071(2)	Gravimetric, Funnel Extraction
pH	150.1(1)/9040,9045(2)	Electrometric
Phenols (4AAP)	420.1(1)/9065(2)	Distillation, Spectrophotometric
Phosphorus, ortho-	365.2-365.3(1)	Colorimetric
Phosphorus, total	365.2-365.3(1)	Colorimetric
Solids, Total	160.3(1)	Gravimetric, dried @ 103°-105° C
Solids, dissolved	160.1(1)	Gravimetric, dried @ 180°C
Solids, suspended	160.2(1)	Gravimetric, dried @ 103°-105° C
Solids, volatile	160.4(1)	Gravimetric, ignition @ 550°C
Solids, settleable	160.5(1)	Volumetric, Imhoff Cone
Sulfate	375.4(1)/9038(2)	Turbidimetric
Sulfide	376.2(1)/9030(2)	Colorimetric, methylene blue
Sulfite	377.1(1)	Titrimetric
Surfactants	425.1(1)	Colorimetric
Turbidity	180.1(1)	Nephelometric
Gross Alpha/Beta	900.0(4)	
Radium 226	903.1(4)	
Radium 228	904.0(4)	

Parameter	Method Reference	Method Description
Total Radium	900.1(4)	
Ignitability	1010(2)	Penske-Marten's Closed Cup Method
Corrosivity	1110(2)	Electrometric
Reactivity - Cyanide - Sulfide	8.3(2)	As Cyanide and Sulfide
TCLP	1311(2) 1312(2)	

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Acetaldehyde	NIOSH 2538	GC/FID	XAD-2	20	10
	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
Acetic Acid	NIOSH 1603	GC/FID	Charcoal	50	24
	OSHA ID 118	IC	Impinger	1000	120
Acetone	OSHA 69	GC/FID	Anasorb	50	3
	NIOSH 1300	GC/FID	Charcoal	10	3
	OSHA 7	GC/FID	Charcoal	50	3
Acetonitrile	NIOSH 1606	GC/FID	Charcoal	20	10
Acids (Inorganic)	NIOSH 7903	IC	Washed Silicagel	200	48
Hydrogen Bromide	NIOSH 7903	IC	Washed Silicagel	200	48
Hydrogen Chloride	NIOSH 7903	IC	Washed Silicagel	200	48
Hydrogen Fluoride	NIOSH 7903	IC	Washed Silicagel	200	48
Nitric Acid	NIOSH 7903	IC	Washed Silicagel	200	48
Phosphoric Acid	NIOSH 7903	IC	Washed Silicagel	200	48
Sulfuric Acid	NIOSH 7903	IC	Washed Silicagel	200	48
Acrolein	NIOSH 2501	GC/NPD	XAD-2	100	48
	NIOSH 2539	GC/FID	XAD-2	10	5
	OSHA 52	GC/NPD	XAD-2	100	48
Acrylamide	OSHA 21	GC/NPD	Silicagel	1000	120
Acrylic Acid	OSHA 28	HPLC/UV	XAD-8	100	120
	NON 10	GC/FID	Silicagel	100	48
Acrylonitrile	NIOSH 1604	GC/FID	Charcoal	20	10
	OSHA 37	GC/NPD	Charcoal	200	20
Alcohols-I (Scan)	NIOSH 1400	GC/FID	Charcoal	---	---
Ethanol	NIOSH 1400	GC/FID	Charcoal	50	1
2-Propanol	NIOSH 1400	GC/FID	Charcoal	10-200	3
t-Butyl alcohol	NIOSH 1400	GC/FID	Charcoal	10-200	10
Alcohols-II (Scan)	NIOSH 1401	GC/FID	Charcoal	---	---
n-Butyl alcohol	NIOSH 1401	GC/FID	Charcoal	10-20	1-10
sec-Butyl alcohol	NIOSH 1401	GC/FID	Charcoal	10-20	1-10

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Aluminum	NIOSH 7013	AA-F	MCE Filter	1000	360
	NIOSH 7300	ICP-AES	MCE Filter	1000	90
	OSHA ID 121	AA	MCE Filter	1000	960
Amines (Aliphatic)	NIOSH 2010	GC/FID	Silicagel	10-1000	3-30
Diethylamine	NIOSH 2010	GC/FID	Silicagel	10-1000	3-30
Dimethylamine	NIOSH 2010	GC/FID	Silicagel	10-1000	3-30
Amines (Aromatic)	NIOSH 2002	GC/FID	Silicagel	---	---
Aniline	NIOSH 2002	GC/FID	Silicagel	20-200	5-30
o-Toluidine	NIOSH 2002	GC/FID	Silicagel	20-1000	10-150
2,4-Xylidine	NIOSH 2002	GC/FID	Silicagel	20-200	3-30
N,N-Dimethyl-p-toluidine	NIOSH 2002	GC/FID	Silicagel	20-1000	---
N,N-Dimethylaniline	NIOSH 2002	GC/FID	Silicagel	20-1000	3-30
Aminoethanol Comp-I	NIOSH 2007	GC/FID	Treated Silicagel	10-200	4-24
2-Aminoethanol	NIOSH 2007	GC/FID	Treated Silicagel	10-200	4-24
2-Dibutyl aminoethanol	NIOSH 2007	GC/FID	Treated Silicagel	10-200	4-24
2-Diethyl aminoethanol	NIOSH 2007	GC/FID	Treated Silicagel	10-200	4-24
Aminoethanol Comp-II	NIOSH 3509	GC/FID	Treated Silicagel	500-1000	5-300
2-Aminoethanol	NIOSH 3509	GC/FID	Treated Silicagel	500-1000	5-300
Diethanolamine	NIOSH 3509	GC/FID	Treated Silicagel	500-1000	5-300
Triethanolamine	NIOSH 3509	GC/FID	Treated Silicagel	500-1000	5-300
2-Amino pyridine	NIOSH 4(S158)	GC/FID	Tenax	100	12
Ammonia	NIOSH 6015	V.A.S	Treated Silicagel	150	72
	OSHA ID 188	IC	Carbon Beads	200	3
Ammonium chloride	OSHA ID 188	GR, IC	MCE Filter	2000	960
Ammonium nitrate	OSHA CIM	GR	MCE Filter	2000	960
Ammonium sulfamate	OSHA ID 188	GR	MCE Filter	2000	960
n-Amyl acetate	OSHA 07	GC/FID	Charcoal	20-50	10
sec-Amyl acetate	OSHA 07	GC/FID	Charcoal	20-50	10
Aniline	NIOSH 2002	GC/FID	Silicagel	20-200	5-30

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
iso-Butyl alcohol	NIOSH 1401	GC/FID	Charcoal	10-20	1-10
1-Propanol	NIOSH 1401	GC/FID	Charcoal	10-20	1-10
Alcohols-III (Scan)	NIOSH 1402	GC/FID	Charcoal	10-20	1-10
Allyl alcohol	NIOSH 1402	GC/FID	Charcoal	10-20	1-10
Diacetone alcohol	NIOSH 1402	GC/FID	Charcoal	10-20	1-10
Cyclohexanol	NIOSH 1402	GC/FID	Charcoal	10-20	1-10
iso-Amyl alcohol	NIOSH 1402	GC/FID	Charcoal	10-20	1-10
Methyl isobutyl carbinol	NIOSH 1402	GC/FID	Charcoal	10-20	1-10
Alcohols-IV (Scan)	NIOSH 1403	GC/FID	Charcoal	---	---
Methoxy ethanol	NIOSH 1403	GC/FID	Charcoal	10-50	1-10
2-Ethoxy ethanol	NIOSH 1403	GC/FID	Charcoal	10-50	1-6
2-Butoxy ethanol	NIOSH 1403	GC/FID	Charcoal	10-50	1-10
Aldehydes (Screening)	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
Acetaldehyde	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
Acrolein	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
Butyraldehyde	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
Crotonaldehyde	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
Formaldehyde	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
Furfural	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
Heptanal	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
iso-Butyraldehyde	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
iso-Valeraldehyde	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
Propionaldehyde	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
Valeraldehyde	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
Aldrin	NIOSH 5502	GC/ELCD	GFF/Impinger	500	240
	OSHA CIM	GC/ECD	GFF/Impinger	1000	240
Alkaline Dusts	NIOSH 7401	Titrimetric	PTFE Filter	2000	1000
Allyl alcohol	NIOSH 1402	GC/FID	Charcoal	10-20	1-10
Allyl chloride	NIOSH 1000	GC/FID	Charcoal	1000	100
	OSHA 07	GC/FID	Charcoal	1000	100

Analyses of Industrial Hygiene samples

Chemical Substance	Method #	Analytical Technique	Sampling Media	Volume ml/min	Total Vol (l)
Anisidine	NIOSH 2514	HPLC/UV	XAD-2	200	96
Anthophylite Fibers	NIOSH 7400	PCM	MCE Filter	2000	960
Anthracene	OSHA 58	GR, HPLC/UV	GFF	2000	960
Antimony	OSHA ID 121	AA	MCE Filter	2000	960
	OSHA ID 125	ICP-AES	MCE Filter	2000	960
Arsenic	NIOSH 7900	AA	MCE Filter	2000	960
	NIOSH 7300	ICP-AES	MCE Filter	2000	960
	OSHA ID 105	AA-GF	MCE Filter	2000	960
Arsenic trioxide	NIOSH 7901	AA-GF	MCE Filter	2000	960
Arsine	NIOSH 6001	AA-GF	Charcoal	20	30
Asbestos	OSHA ID 160	PCM	MCE Filter	2000	960
Asbestos Fibers	NIOSH 7400	PCM	MCE Filter	2000	960
	NIOSH 7402	TEM	MCE Filter	2000	960
Asphalt Fumes	OSHA 58	GR, HPLC	GFF	2000	960
Barium Chloride	NIOSH 7056	AA	MCE Filter	2000	960
Barium	OSHA ID 121	AA	MCE Filter	2000	960
	NIOSH 7056	AA	MCE Filter	2000	960
Barium Sulfate	OSHA ID 121	GR	MCE Filter	2000	960
Benz(a)anthracene	NIOSH 5506	HPLC/UV	PTFE Filter	2000	960
	NIOSH 5515	GC/FID	PTFE Filter	2000	960
Benz(a)anthrone	NIOSH 5506	HPLC/UV	PTFE Filter	2000	960
Benz(a,h)anthracene	NIOSH 5506	HPLC/UV	PTFE Filter	2000	960
Benz(c)acridine	NIOSH 5515	GC/FID	PTFE Filter	2000	960
	NIOSH 5506	HPLC/UV	PTFE Filter	2000	960
Benzene	NIOSH 3700	GC/PID	T-Bag	---	---
	OSHA 12	GC/FID	Charcoal	20	10
	NIOSH 1501	GC/FID	Charcoal	20-50	10
Benzidine	NIOSH 5509	HPLC/UV	GFF	200	96
	OSHA 65	GC/ECD	Treated GFF	1000	96
Benzo(a,h,i)perylene	NIOSH 5515	GC/FID	PTFE Filter	2000	960
Benzo(a)pyrene	NIOSH 5515	GC/FID	PTFE Filter	2000	960

Analyses of Industrial Hygiene samples

Chemical Substance	Method #	Analytical Technique	Sampling Media	Volume ml/min	Total Vol.(l)
Benzo alpha pyrene	OSHA 58	HPLC/UV	PTFE Filter	2000	960
Benzo(b)fluoranthene	NIOSH 5506	HPLC/UV	PTFE Filter	2000	960
Benzo(e)pyrene	NIOSH 5506	HPLC/UV	PTFE Filter	2000	960
Benzo(g,h,i)perylene	NIOSH 5506	HPLC/UV	PTFE Filter	2000	960
	NIOSH 5515	GC/FID	PTFE Filter	2000	960
Benzo(j)fluoranthene	NIOSH 5515	GC/FID	PTFE Filter	2000	960
	NIOSH 5506	HPLC/UV	PTFE Filter	2000	960
Benzo(k)fluoranthene	NIOSH 5515	GC/FID	PTFE Filter	2000	960
	NIOSH 5506	HPLC/UV	PTFE Filter	2000	960
Benzyl chloride	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1003	GC/FID	Charcoal	20-50	10
Beryllium	OSHA ID 125	ICP	MCE Filter	2000	960
	NIOSH 7102	AA-GF	MCE Filter	2000	960
	NIOSH 7300	ICP-AES	MCE Filter	2000	960
Bibenzyl	NIOSH 5515	GC/FID	PTFE Filter	2000	960
Biphenyl	NIOSH 2530	GC/FID	Tenax Tube	20-50	10
Bismuth telluride	OSHA ID 121	GR, AA	PVC Filter	2000	960
Bromine	NIOSH 6011	IC	SM Filter	1000	240
	OSHA ID 108	IC	Impinger	500	120
Bromo ethane	NIOSH 1011	GC/FID	Charcoal	20-50	4
Bromoform	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1003	GC/FID	Charcoal	20-50	10
Bromo trifler methane	NIOSH 1017	GC/FID	Charcoal	20	0.3
1,3-Butadiene	NIOSH 1024	GC/FID	Charcoal	50	3
	OSHA 56	GC/FID	Charcoal	20-50	10
1-Butanethiol	NIOSH 2525	GC/FPD	Chromosorb	50	1
	NIOSH 2542	GC/FPD	Treated GFF	100	48
2-Butanone	OSHA 16	GC/FID	Silicagel	100	3
	OSHA 84	GC/FID	Anasorb	50	3
	NIOSH 2500	GC/FID	Anasorb	20-50	10
2-Butoxy ethanol	NIOSH 1403	GC/FID	Charcoal	10-50	1-10

Analyses of Industrial Hygiene samples

Chemical Substance	Method #	Analytical Technique	Sampling Media	Volume ml/min	Total Vol (l)
2-Butoxy ethanol	OSHA 83	GC/FID	Charcoal	100	48
n-Butyl acetate	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1450	GC/FID	Charcoal	20-50	10
sec-Butyl acetate	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1450	GC/FID	Charcoal	20-50	10
tert-Butyl acetate	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1450	GC/FID	Charcoal	20-50	10
n-Butyl alcohol	NIOSH 1401	GC/FID	Charcoal	10-20	1-10
	OSHA 07	GC/FID	Charcoal	20-50	10
sec-Butyl alcohol	NIOSH 1401	GC/FID	Charcoal	10-20	1-10
	OSHA 07	GC/FID	Charcoal	20-50	10
tert-Butyl alcohol	NIOSH 1402	GC/FID	Charcoal	10-20	1-10
	OSHA 07	GC/FID	Charcoal	20-50	10
n-Butyl amine	NIOSH 2012	GC/FID	Treated SGT	1000	15
Butyl cellosolve acetate	OSHA 83	GC/FID	Charcoal	100	48
p-tert-Butyl toluene	OSHA 07	GC/FID	Charcoal	20-50	10
Butyraldehyde	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
Cadmium	OSHA ID 189	AA	MCE Filter	2000	960
	NIOSH 7048	AA-F	MCE Filter	1000	480
	NIOSH 7300	ICP-AES	MCE Filter	1000	90
Calcium	NIOSH 7020	AA-F	MCE Filter	1000	240
	NIOSH 7300	ICP-AES	MCE Filter	1000	180
Camphor	NIOSH 1301	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20-50	10
Carbon black	NIOSH 5000	GR	PVC Filter (low ash)	1500	360
	OSHA ID 196	GR	PVC Filter	1500	360
Carbon dioxide	NIOSH 6603	GC/TCD	T-Bag	---	---
	OSHA ID 172	GC/TCD	T-Bag	---	---
Carbon disulfide	NIOSH 1600	GC/FPD	Charcoal	20-50	10
Carbontetrachloride	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1003	GC/FID	Charcoal	20-50	10

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Chlordane	NIOSH 5510	GC/ECD	Chromosorb	1000	150
	OSHA 67	GC/ECD	XAD-2	1000	480
Chlorine	NIOSH 6011	IC	SM Filter	1000	90
	OSHA ID 101	S I E	Impinger	1000	240
Chlorine dioxide	OSHA ID 202	IC	Impinger	500	120
Chlorobenzene	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1003	GC/FID	Charcoal	20-50	10
Chlorobromomethane	NIOSH 1003	GC/FID	Charcoal	20-50	10
Chloroethane	NIOSH 2519	GC/FID	Charcoal	50	3
2-Chloro ethanol	NIOSH 2513	GC/FID	Charcoal	20-50	10
bis-Chloro methyl ether	NIOSH 1(213)	GC/MS	Chromosorb	20-50	10
	OSHA 10	GC/ECD	Impinger	500	50
Chloromethyl methyl ether	OSHA 10	GC/ECD	Impinger	500	50
	NIOSH 1(220)	GC/ECD	Impinger	500	60
Chlorodiphenyl	NIOSH 5503	GC/ECD	GFF	60	30
Chloroform	NIOSH 1003	GC/FID	Charcoal	20-50	10
	OSHA 05	GC/FID	Charcoal	200	10
p-Chlorophenol	NIOSH 2014	HPLC/UV	Silicagel	50	24
beta-Chloroprene	NIOSH 1002	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20-50	10
Chloropyrifos	OSHA 62	GC/FPD	XAD-2	1000	480
	NIOSH 5600	GC/FPD	XAD-2	1000	240
Chromic acid	NIOSH 7600	V.A.S.	PVC Filter (low ash)	1000	240
	NIOSH 7604	IC	PVC Filter	1000	240
Chromium acetate	OSHA ID 121	AA	MCE Filter	2000	960
Chromium carbonate	OSHA ID 121	AA	MCE Filter	2000	960
Chromium	NIOSH 7024	AA-Furnace	MCE Filter	1000	480
	NIOSH 7300	ICP-AES	MCE Filter	1000	480
	OSHA ID 121	AA	MCE Filter	2000	960
Chromium, Hexavalent	NIOSH 7600	V.A.S.	PVC Filter	1000	240
	NIOSH 7604	IC	PVC Filter	1000	240

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Chromium, Hexavalent	OSHA ID 215	IC	PVC Filter	2000	960
Chrysene	OSHA 58	GR, HPLC	PTFE Filter	2000	960
	NIOSH 5515	GC/FID	PTFE Filter	2000	960
	NIOSH 5506	HPLC	PTFE Filter	2000	960
Chrysotile, Fibers	NIOSH 7400	PCM	MCE Filter	2000	960
Coaltar napthas	NIOSH 1550	GC/FID	Charcoal	20	3
Coal tar pitch volatiles	OSHA 58	GR, HPLC	PTFE Filter	2000	960
Cobalt	NIOSH 7027	AA-Furnace	MCE Filter	2000	960
	NIOSH 7300	ICP-AES	MCE Filter	1000	480
	OSHA ID 121	AA	MCE Filter	2000	960
Coke (oven emissions)	OSHA 58	GR, HPLC	PTFE Filter	2000	960
Copper	NIOSH 7029	AA-Furnace	MCE Filter	1000	480
	NIOSH 7300	ICP-AES	MCE Filter	1000	480
	OSHA ID 121	AA	MCE Filter	2000	960
Cresols (total)	NIOSH 2546	GC/FID	XAD-7	100	24
	OSHA 32	HPLC/UV	XAD-7	100	24
Crocidolite	NIOSH 7400	PCM	MCE Filter	2000	960
Crotonaldehyde	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
	OSHA 81	HPLC/UV	GFF	100	6
Cumene Hydroperoxide	OSHA CIM	GC/FID	Impinger	1000	120
Cyanide	OSHA ID 120	S I E	MCE Filter	1000	120
	NIOSH 7940	S I E	MCE Filter	1000	120
Cyclohexane	NIOSH 1500	GC/FID	Charcoal	20	3.5
	OSHA 07	GC/FID	Charcoal	20-50	10
Cyclohexanol	NIOSH 1402	GC/FID	Charcoal	10-20	1-10
	OSHA 07	GC/FID	Charcoal	20-50	10
Cyclohexanone	OSHA 01	GC/FID	Chromosorb	20-50	10
	NIOSH 1300	GC/FID	Charcoal	20-50	10
Cyclohexene	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1500	GC/FID	Charcoal	20	3.5
Cyclohexylamine	NIOSH 2010	GC/FID	Silicagel	10-1000	3-30

Analyses of Industrial Hygiene samples

Chemical Substance	Method #	Analytical Technique	Sampling Media	Volume ml/min	Total Vol (l)
2,4-D	NIOSH 5001	HPLC/UV	GFF	1000	180
DDT	NIOSH 3(S274)	GC/ECD	GFF	1500	90
Demeton	NIOSH 5514	GC/FPD	MCE Filter	1000	480
Dibutyl phthalate	NIOSH 5020	GC/FID	MCE Filter	1000	180
2,6-Di-tert-butyl-p-cresol	NIOSH 1(226)	GC/FID	Silicagel	200	10
Diacetone alcohol	NIOSH 1401	GC/FID	Charcoal	10-20	1-10
Diazinon	NIOSH 5600	GC/FPD	XAD-2	1000	240
	OSHA 62	GC/FPD	XAD-2	1000	240
Diazomethane	NIOSH 2515	GC/FID	Treated XAD-2	200	10
DBCP	OSHA CIM	GC/ECD	Charcoal	20-50	10
Dibromodifluoromethane	NIOSH 1012	GC/FID	Charcoal	20-50	10
1,2-Dibromoethane	NIOSH 1008	GC/ECD	Charcoal	20-50	10
2-Dibutyl aminoethanol	NIOSH 3509	GC/FID	Treated Silicagel	500-1000	5-300
Dibutyl phosphate	NIOSH 5017	GC/FPD	PTFE Filter	2000	480
Dibutyl pthalate	NIOSH 5020	GC/FID	XAD-2	1000	100
	OSHA 104	GC/FID	XAD-2	1000	100
1,1-Dichloro-1-nitroethane	OSHA 07	GC/FID	Charcoal	20-50	10
m-Dichlorobenzene	OSHA CIM	GC/FID	Charcoal	200	10
o-Dichlorobenzene	OSHA 07	GC/FID	Charcoal	20-50	10
p-Dichlorobenzene	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1003	GC/FID	Charcoal	20-50	10
3,3'-Dichloro benzidine	NIOSH 5509	HPLC/UV	GFF	200	48
Dichloro difluoromethane	NIOSH 1018	GC/FID	Charcoal	20	3
1,1-Dichloroethane	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1003	GC/FID	Charcoal	20-50	10
1,2-Dichloroethane	OSHA 07	GC/FID	Charcoal	20-50	10
Dichloro ethyl ether	NIOSH 1004	GC/FID	Charcoal	20-50	10
1,2-Dichloroethylene	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1003	GC/FID	Charcoal	20-50	10
Dichloro fluoromethane	NIOSH 2516	GC/FID	Charcoal	20-50	10
1,2-Dichloro propane	NIOSH 1013	GC/ELCD	Charcoal	20	3

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Dichloro difluoromethane	NIOSH 1018	GC/FID	Charcoal	20	3
1,1-Dichloro-1-nitroethane	NIOSH 1601	GC/FID	Charcoal	20-50	10
Dieldrin	NIOSH 3(S283)	GC/ECD	GFF	1500	180
Diethanolamine	NIOSH 2007	GC/FID	Treated Silicagel	10-200	4-24
Diethyl amine	NIOSH 2010	GC/FID	Silicagel	10-1000	3-30
	OSHA 41	HPLC	XAD-7	200	10
2-Dietyl aminoethanol	NIOSH 3509	GC/FID	Treated Silicagel	500-1000	5-300
Diethyl ether	NIOSH 1610	GC/FID	Charcoal	20	3
Diethyl pthalate	OSHA 104	GC/FID	XAD-2	1000	100
Diethyl sulfate	OSHA CIM	GC/FID	Silicagel	20-50	10
Difluoro dibromo methane	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1012	GC/FID	Charcoal	50	6
Diisobutyl ketone	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1300	GC/FID	Charcoal	20-50	10
Dimethoxy methane	NIOSH 1611	GC/FID	Charcoal	20	2
	OSHA 07	GC/FID	Charcoal	20-50	10
Dimethyl acetamide	NIOSH 2004	GC/FID	Silicagel	100	48
Dimethyl amine	NIOSH 2010	GC/FID	Silicagel	50	24
	OSHA 34	GC/FID	Silicagel	20	10
2,4-Dimethyl aminobenzene	NIOSH 2002	GC/FID	Silicagel	20-1000	3-24
N,N-Dimethyl aniline	NIOSH 2002	GC/FID	Silicagel	20-1000	3-24
	OSHA 07	GC/FID	Charcoal	20-50	10
N,N-Dimethyl-p-toluidine	NIOSH 2002	GC/FID	Silicagel	20-100	3-24
Dimethyl pthalate	OSHA 104	GC/FID	XAD-2	1000	100
Dimethyl sulfate	OSHA CIM	GC/FID	Porpak Q	100	10
Dimethyl sulfide	OSHACIM	GC/FPD	Charcoal	20	5
N,N-Dimethyl formamide	NIOSH 2004	GC/FID	Silicagel	100	48
	OSHA 66	GC/NPD	Charcoal	20	10
Dinitro benzene	NIOSH 4(S214)	HPLC	MCE Filter	1000	90
Dioxane	NIOSH 1602	GC/FID	Charcoal	20-50	10

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Dioxane	OSHA 07	GC/FID	Charcoal	20-50	10
Diphenyl	NIOSH 2530	GC/FID	Tenax Tube	100	30
Diphenyl amine	OSHA 78	HPLC/UV	Treated GFF	1000	90
Diquat	OSHA CIM	HPLC/UV	GFF	1000	120
Disulfoton	NIOSH 5600	GC/FPD	XAD-2	1000	240
Divinyl Sulfide	OSHA CIM	GC	Charcoal	20	2.5
Divinyl benzene	OSHA 89	GC/FID	Treated CT	50	12
Dust, Respirable nuisance	NIOSH 0600	GR	PVC Filter	2600	390
Dust, Total nuisance	NIOSH 0500	GR	PVC Filter	2600	390
Elements	NIOSH 7300	ICP-AES	MCE Filter	---	---
Aluminum	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-100
Arsenic	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-2000
Beryllium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	1250
Cadmium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	2000
Calcium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-200
Chromium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-1000
Cobalt	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	2000
Copper	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-1000
Iron	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-100
Lead	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	2000
Lithium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	2000
Magnesium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-67
Manganese	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-200
Molybdenum	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-67
Nickel	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-1000
Phosphorous	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	2000
Platinum	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	2000
Selenium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	2000
Silver	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	2000
Sodium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	2000
Tellurium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	2000

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Thallium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	2000
Tin	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-500
Titanium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-100
Tungsten	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-200
Vanadium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-2000
Yttrium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-1000
Zinc	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-200
Zirconium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	5-200
Endrin	NIOSH 5519	GC/ECD	XAD-2	1000	240
Epichlorohydrin	NISOH 1010	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20-50	10
Esters-I	NIOSH 1450	GC/FID	Charcoal	---	---
n-Amyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
sec-Amyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
n-Butyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
sec-Butyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
t-Butyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
2-Ethoxyethyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
Ethyl acrylate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
iso-Amyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
iso-Butyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
Methyl iso-amyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
n-Propyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
Ethoxy ethanol	NIOSH 1403	GC/FID	Charcoal	10-50	1-10
	OSHA 79	GC/FID	Charcoal	100	48
2-Ethoxyethyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
	OSHA 79	GC/FID	Charcoal	100	48
Ethyl acetate	NIOSH 1457	GC/FID	Charcoal	100	48
	OSHA 07	GC/FID	Charcoal	20-50	10
Ethyl acrylate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
	OSHA 92	GC/FID	Treated CT	20-50	10

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Ethyl alcohol	NIOSH 1400	GC/FID	Charcoal	10-50	1-10
	OSHA 07	GC/FID	Charcoal	20-50	10
	OSHA 100	GC/FID	Anasorb	50	12
Ethyl amine	NIOSH 3(S144)	GC/FID	Silicagel	100	30
Ethyl amyl ketone	OSHA 07	GC/FID	Charcoal	20-50	10
Ethyl benzene	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1501	GC/FID	Charcoal	20-50	10
Ethyl bromide	NIOSH 1011	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20-50	10
Ethyl butyl ketone	OSHA 07	GC/FID	Charcoal	20-50	10
	NIOSH 1301	GC/FID	Charcoal	200	24
Ethyl cellosolve	NIOSH 1403	GC/FID	Charcoal	10-50	1-10
Ethyl chloride	NIOSH 2519	GC/FID	Charcoal	50	3
	OSHA 07	GC/FID	Charcoal	20-50	10
Ethyl ether	NIOSH 1610	GC/FID	Charcoal	50	3
	OSHA 07	GC/FID	Charcoal	20-50	10
Ethyl formate	NIOSH 1452	GC/FID	Charcoal	20	10
	OSHA 07	GC/FID	Charcoal	20-50	10
2-Ethyl hexanol	OSHA CIM	GC/FID	Charcoal	200	48
Ethyl mercaptan	NIOSH 2542	GC/FPD	Treated GFF	200	12
Ethyl methacrylate	OSHA CIM	GC/FID	Charcoal	200	48
Ethylene chlorohydrine	NIOSH 2513	GC/FID	Charcoal	200	48
Ethylene dibromide	NIOSH 1008	GC/ECD	Charcoal	20-50	10
	OSHA 02	GC/ECD	Charcoal	20-50	10
Ethylene dichloride	NIOSH 1003	GC/ECD	Charcoal	20	5
	OSHA 03	GC/ECD	Charcoal	20-50	10
Ethylene glycol	OSHA CIM	GC/FID	Silicagel	20-50	10
Ethylene glycol mono hexyl ether	OSHA CIM	GC/FID	Charcoal	200	10
Ethylene oxide	NIOSH 1614	GC/ECD	Treated CT	100	24
	OSHA 50.00	GC/ECD	Treated CT	100	24
Ethylvinyl benzene	OSHA 89	GC/FID	Treated CT	50	12

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Fluoranthene	NIOSH 5506	HPLC/UV	PTFE Filter	2000	960
	NIOSH 5515	GC/FID	PTFE Filter	2000	960
Fluorides	NIOSH 7906	IC	MCE Filter	1000	480
	NIOSH 7902	S I E	Treated MCEF	1000	480
	OSHA ID 110	S I E	Treated MCEF	1500	90
Fluorotrichloromethane	NIOSH 1006	GC/FID	Charcoal	20	5
Formaldehyde	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
	NIOSH 3500	V.A.S	PTFE Filter	200	96
	NISOH 2541	GC/FID	XAD-2	100	24
	OSHA 52	GC/NPD	XAD-2	100	24
Formic acid	NISOH 2011	IC	Treated SGT	200	24
Furfural	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
	NIOSH 2529	GC/FID or MS	XAD-2	20	5
	OSHA 72	GC/FID	Charcoal	1000	180
Furfuryl alcohol	NISOH 2505	GC/FID	Porpak Q	20	5
Gasoline	OSHA CIM	GC/FID	Charcoal	20-50	10
Glass, Fibrous (Asbestos)	NIOSH 7400	PCM	MCE Filter	2000	960
Glycerine, mist	NIOSH 0600	GR	PVC Filter	2600	390
Heptachlor	NIOSH 5(S287)	GC/ECD	Chromosorb	100	48
Heptanal	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
n-Heptane	NIOSH 1500	GC/FID	Charcoal	20	4
	OSHA 07	GC/FID	Charcoal	20-50	10
1-Heptene	OSHA 07	GC/FID	Charcoal	20-50	10
Hexachloro-1,3-cyclopentadiene	NIOSH 2518	GC/ECD	Porpak T	50	24
Hexachlorobenzene	OSHA CIM	GC/ECD	GFF	2000	480
Hexachlorobutadiene	NIOSH 2543	GC/ECD	Charcoal	100	48
Hexachloroethane	NIOSH 1003	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20-50	10
Hexachloronapthalene	NIOSH 2(S100)	GC/ECD	MCE Filter	1000	30
1,6-Hexamethylene diisocyanate (HDI)	OSHA 42	HPLC/UV	Treated GFF	1000	15
	NIOSH 5521	HPLC/UV	Impinger	1000	480

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Hexamethylenetetramine	NISOH 4(263)	Colorimetric	MCE Filter	1000	15
	OSHA CIM	GC/NPD	MCE Filter	1000	15
Hexanal	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
n-Hexane	OSHA 07	GC/FID	Charcoal	20	4
	NIOSH 1500	GC/FID	Charcoal	20	4
2-Hexanone	NIOSH 1300	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20-50	10
Hexone	NIOSH 1300	GC/FID	Charcoal	20-50	10
sec-Hexyl acetate	OSHA 07	GC/FID	Charcoal	20-50	10
Hydrobromic acid	NIOSH 7903	IC	Washed Silicagel	200	48
Hydrocarbons, Aromatic	NIOSH 1501	GC/FID	Charcoal	---	---
Benzene	NIOSH 1501	GC/FID	Charcoal	< 200	2-30
p-tert-Butyl toluene	NIOSH 1501	GC/FID	Charcoal	< 200	10-29
Cumene	NIOSH 1501	GC/FID	Charcoal	< 200	10-30
Ethyl benzene	NIOSH 1501	GC/FID	Charcoal	< 200	10-24
α-Methylstyrene	NIOSH 1501	GC/FID	Charcoal	< 200	3-30
Napthalene	NIOSH 1501	GC/FID	Charcoal	< 1000	200
Styrene	NIOSH 1501	GC/FID	Charcoal	< 1000	5-14
Toluene	NIOSH 1501	GC/FID	Charcoal	< 200	2-8
Vinyltoluene	NIOSH 1501	GC/FID	Charcoal	< 200	10-24
Xylene	NIOSH 1501	GC/FID	Charcoal	< 200	12-23
Hydrocarbons	NIOSH 1500	GC/FID	Charcoal	---	---
Benzene	NIOSH 1500	GC/FID	Charcoal	< 200	2-30
Cyclohexane	NIOSH 1500	GC/FID	Charcoal	< 200	2.5-5
Cyclohexene	NIOSH 1500	GC/FID	Charcoal	< 200	5-7
n-Heptane	NIOSH 1500	GC/FID	Charcoal	< 200	4
n-Hexane	NIOSH 1500	GC/FID	Charcoal	< 200	4
Methylcyclohexane	NIOSH 1500	GC/FID	Charcoal	< 200	4
n-Octane	NIOSH 1500	GC/FID	Charcoal	< 200	4
n-Pentane	NIOSH 1500	GC/FID	Charcoal	< 50.00	2
Toluene	NIOSH 1500	GC/FID	Charcoal	< 200	2-8

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Hydrocarbons, halogenated	NIOSH 1003	GC/FID	Charcoal	10-200	50
Benzyl chloride	NIOSH 1003	GC/FID	Charcoal	10-200	70
Bromoform	NIOSH 1003	GC/FID	Charcoal	10-200	150
Carbon tetrachloride	NIOSH 1003	GC/FID	Charcoal	10-200	40
Chlorobenzene	NIOSH 1003	GC/FID	Charcoal	10-200	8
Chlorobromomethane	NIOSH 1003	GC/FID	Charcoal	10-200	50
Chloroform	NIOSH 1003	GC/FID	Charcoal	10-200	60
o-Dichlorobenzene	NIOSH 1003	GC/FID	Charcoal	10-200	10
p-Dichlorobenzene	NIOSH 1003	GC/FID	Charcoal	10-200	15
1,1-Dichloroethane	NIOSH 1003	GC/FID	Charcoal	10-200	5
1,2-Dichloroethylene	NIOSH 1003	GC/FID	Charcoal	10-200	5
Ethylene dichloride	NIOSH 1003	GC/FID	Charcoal	10-200	50
Hexachloroethane	NIOSH 1003	GC/FID	Charcoal	10-200	70
Methylchloroform	NIOSH 1003	GC/FID	Charcoal	10-200	8
Tetrachloroethylene	NIOSH 1003	GC/FID	Charcoal	10-200	40
1,1,2-Trichloroethane	NIOSH 1003	GC/FID	Charcoal	10-200	60
1,2,3-Trichloropropane	NIOSH 1003	GC/FID	Charcoal	10-200	60
Hydrogen bromide	NIOSH 7903	IC	Washed Silicagel	200	48
Hydrogen chloride	NIOSH 7903	IC	Washed Silicagel	200	48
Hydrogen cyanide	NIOSH 6010	V.A.S	Sodalime Tube	200	5
	OSHA ID 120	S I E	MCE Filter	1000	15
	NIOSH 7904	S I E	Treated SGT	1000	15
Hydrogen fluoride	NIOSH 7903	IC	Washed Silicagel	200	48
	OSHA ID 110	S I E	Treated MCE Filter	1500	90
	NIOSH 7906	IC	Treated MCE Filter	1500	90
Hydrogen sulfide	NIOSH 6013	IC	Treated CT	100	24
Hydroquinone	NIOSH 5004	HPLC/UV	MCE Filter	2000	30
2-Imidazolidinethione	NIOSH 5011	V.A.S.	PVC Filter	1000	480
Indene	OSHA CIM	GC/FID	Chromosorb	20-50	10
Iodine	NIOSH 6005	IC	Treated Charcoal	1000	15
	OSHA 212	IC	Treated CT or AT	500	2.5

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Iodoform	OSHA CIM	GC/ECD	GFF	100	10
Iron	NIOSH 7300	ICP-AES	MCE Filter	1-4L	5-100
	OSHA ID 121	AA	MCE Filter	2000	960
	OSHA ID 125	ICP	MCE Filter	2000	960
iso-Amyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
	OSHA 07	GC/FID	Charcoal	20-50	10
iso-Amyl alcohol	NIOSH 1401	GC/FID	Charcoal	10-20	1-10
iso-Butyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
	OSHA 07	GC/FID	Charcoal	20-50	10
iso-Butyl alcohol	NIOSH 1401	GC/FID	Charcoal	10-20	1-10
	OSHA 07	GC/FID	Charcoal	20-50	10
iso-Butyraldehyde	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
Isocyanates	NIOSH 5521	HPLC/UV	Impinger	1000	500
TDI	NIOSH 5521	HPLC/UV	Impinger	1000	500
MDI	NIOSH 5521	HPLC/UV	Impinger	1000	500
HDI	NIOSH 5521	HPLC/UV	Impinger	1000	500
Isophorone	NIOSH 2508	GC/ID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20-50	10
iso-Propylacetate	NIOSH 1454	GC/FID	Charcoal	50	10
iso-Propyl alcohol	NIOSH 1401	GC/FID	Charcoal	10-20	1-10
	OSHA 07	GC/FID	Charcoal	20-50	10
iso-Propylamine	NIOSH 2010	GC/FID	Silicagel	10-1000	3-30
iso-Propyl cellosolve	OSHA CIM	GC/FID	Charcoal	100	10
iso-Propyl ether	NIOSH 1618	GC/FID	Charcoal	20	3
	OSHA 07	GC/FID	Charcoal	20-50	10
iso-Valeraldehyde	NIOSH 2539	GC/FID or MS	XAD-2	10-50	5
Kerosene	NIOSH 1550	GC/FID	Charcoal	20-50	10
Ketene	NIOSH 2(S92)	Colorimetric	Impinger/Charcoal	1000	50
Ketones I	NIOSH 1300	GC/FID	Charcoal	---	----
Acetone	NIOSH 1300	GC/FID	Charcoal	10-200	0.5-1
Cyclohexanone	NIOSH 1300	GC/FID	Charcoal	10-200	3-10

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Diisobutyl ketone	NIOSH 1300	GC/FID	Charcoal	10-200	3-10
2-Hexanone	NIOSH 1300	GC/FID	Charcoal	10-200	3-10
Methyl isobutyl ketone	NIOSH 1300	GC/FID	Charcoal	10-200	3-10
2-Pentanone	NIOSH 1300	GC/FID	Charcoal	10-200	3-10
Ketones II	NIOSH 1301	GC/FID	Charcoal	----	----
Camphor	NIOSH 1301	GC/FID	Charcoal	10-200	1-25
Mesityl oxide	NIOSH 1301	GC/FID	Charcoal	10-200	1-25
5-Methyl-3-heptanone	NIOSH 1301	GC/FID	Charcoal	10-200	1-25
Methyl-(n-amyl)-ketone	NIOSH 1301	GC/FID	Charcoal	10-200	1-25
Ethyl butyl ketone	NIOSH 1301	GC/FID	Charcoal	10-200	1-25
Lead	NIOSH 7082	AA	MCE Filter	1500	720
	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	2000
	NIOSH 7015	AA-GF	MCE Filter	1500	720
	OSHA ID 121	AA	MCE Filter	2000	960
	OSHA ID 125	ICP	MCE Filter	2000	960
Lindane	NIOSH 5502	GC/ELCD	GFF/Iminger/CT	1000	240
	OSHA CIM	GC/ECD	GFF/Iminger/CT	1000	240
Lithium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	2000
	OSHA CIM	AA	MCE Filter	2000	960
Magnesium	NIOSH 7300	ICP-AES	MCE Filter	1-4 L	2000
	OSHA ID 121	AA	MCE Filter	2000	960
Malathion	OSHA 62	GC/FPD	XAD-2/GFF	1000	60
	NIOSH 5012	GC/FPD	GFF	1000	120
	NIOSH 5600	GC/FPD	XAD-2	1000	60
Maleic anhydride	NIOSH 3512	HPLC/UV	Impinger	1000	360
	OSHA 25	HPLC/UV	XAD-2	100	20
	OSHA 86	HPLC/UV	GFF	500	60
Manganese	NIOSH 7300	ICP-AES	MCE Filter	2000	960
	OSHA ID 121	AA	MCE Filter	2000	960
	OSHA ID 125	ICP	MCE Filter	2000	960
MDI	NIOSH 5521	HPLC/UV	Impinger	1000	500

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
	OSHA 47	HPLC/UV	Treated GFF	1000	10
Mercaptans	NIOSH 2542	GC/FPD	Treated GFF	----	----
Methyl mercaptan	NIOSH 2542	GC/FPD	Treated GFF	200	12
Ethyl mercaptan	NIOSH 2542	GC/FPD	Treated GFF	200	12
n-Butyl mercaptan	NIOSH 2542	GC/FPD	Treated GFF	100	48
Mercury	NIOSH 6009	AA	HT/MCE Filter	2000	48
	OSHA ID 145	AA	MCE Filter	2000	48
	OSHA ID 140	AA	HT/MCE Filter	100	48
Mesityl oxide	NIOSH 1301	GC/FID	Charcoal	10-200	1-25
	OSHA 07	GC/FID	Charcoal	20-50	10
Methanol	NIOSH 2000	GC/FID	Silicagel	20	5
	OSHA 91	GC/FID	Anasorb	50	10
2-Methoxy-1-propanol	OSHA 99	GC/FID	Charcoal	100	10
2-Methoxy-1-propyl acetate	OSHA 99	GC/FID	Charcoal	100	10
2-Methoxy-2-propanol	OSHA 99	GC/FID	Charcoal	100	10
2-Methoxy-2-propyl acetate	OSHA 99	GC/FID	Charcoal	100	10
Methoxychlor	NIOSH 4(S371)	GC/ECD	GFF	1000	90
Methyl acetate	NIOSH 1458	GC/FID	Charcoal	20	5
	OSHA 07	GC/FID	Charcoal	20	5
Methyl acrylate	NIOSH 1459	GC/FID	Charcoal	20	5
	OSHA 92	GC/FID	Anasorb	20	10
Methyl amine	NIOSH 4(277)	GC/FID	Silicagel	200	96
	NIOSH 6(S148)	IC	Silicagel	50	48
	OSHA 40	HPLC/UV	XAD-7	20	10
Methyl bromide	OSHA CIM	GC/FID	Charcoal	50	10
Methyl cellosolve	NIOSH 1403	GC/FID	Charcoal	10-20	1-10
	OSHA 79	GC/FID	Charcoal	100	48
Methyl chloride	NIOSH 1001	GC/FID	Charcoal	20	10
Methyl chloroform	OSHA 14	GC/FID	Charcoal	20	5
	OSHA 14	GC/FID	Charcoal	20	5

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Methyl cyclohexane	NIOSH 1500	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20	5
Methyl cyclohexanol	NIOSH 1404	GC/FID	Charcoal	20	5
Methyl cyclohexanone	NIOSH 2521	GC/FID	Porpak Q	50	5
Methyl ethyl ketone peroxide	NIOSH 3508	Colorimetric	Impinger	1000	480
	OSHA 77	HPLC/UV	XAD-4	1000	100
Methyl iodide	NIOSH 1014	GC/FID	Charcoal	20-50	10
Methyl isoamyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
Methyl isobutyl carbinol	NIOSH 1402	GC/FID	Charcoal	10-20	1-10
	OSHA 07	GC/FID	Charcoal	20-50	10
Methyl parathion	NIOSH 5600	GC/FPD	XAD-2	1000	240
2-Methyl pentane	OSHA CIM	GC/FID	Charcoal	20-50	10
3-Methyl pentane	OSHA CIM	GC/FID	Charcoal	20-50	10
α-Methyl styrene	NIOSH 1501	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20-50	10
5-Methyl-3-heptanone	NIOSH 1301	GC/FID	Charcoal	10-200	1-25
Methyl-t-butyl ether	NIOSH 1615	GC/FID	Charcoal	200	96
MDI	NIOSH 5521	HPLC/UV	Impinger	1000	500
Methylene chloride	NIOSH 1005	GC/FID	Charcoal	20	2
	OSHA 59	GC/FID	Charcoal	50	10
	OSHA 80	GC/FID	Anasorb	50	3
4,4'-Methylene dianiline (MDA)	NIOSH 5029	GC/FID	Treated GFF	1000	480
	OSHA 57	GC/FID	Treated GFF	1000	90
Mineral spirits (Naphthas)	NIOSH 1550	GC/FID	Charcoal	20	3
Molybdenum	NIOSH 7300	ICP-AES	MCE Filter	2000	960
	OSHA ID 121	AA	MCE Filter	2000	960
	OSHA ID 125	ICP	MCE Filter	2000	960
Monomethyl aniline	NIOSH 3511	GC/FID	Impinger	1000	100
Morpholine	NIOSH 3(S150)	GC/FID	Silicagel	40	20
Napthalene	NIOSH 1501	GC/FID	Charcoal	20-50	10
	OSHA 35	GC/FID	Charcoal	20-50	10

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Naphthas	NIOSH 1550	GC/FID	Charcoal	10-200	2-20
Petroleum ether	NIOSH 1550	GC/FID	Charcoal	10-200	2-20
Rubber solvent	NIOSH 1550	GC/FID	Charcoal	10-200	2-20
Petroleum naphtha	NIOSH 1550	GC/FID	Charcoal	10-200	2-20
VM&P naphtha	NIOSH 1550	GC/FID	Charcoal	10-200	2-20
Minereal spirits	NIOSH 1550	GC/FID	Charcoal	10-200	2-20
Stoddard solvents	NIOSH 1550	GC/FID	Charcoal	10-200	2-20
Kerosene	NIOSH 1550	GC/FID	Charcoal	10-200	2-20
Coal tar naphtha	NIOSH 1550	GC/FID	Charcoal	10-200	2-20
Nickel	NIOSH 7300	ICP-AES	MCE Filter	2000	960
	OSHA ID 121	AA	MCE Filter	2000	960
	OSHA ID 125	ICP	MCE Filter	2000	960
Nitric acid	NIOSH 7903	IC	Washed Silicagel	200	48
Nitric oxide	OSHA 182	IC	MS Tube	200	5
Nitrobenzene	NIOSH 2005	GC/FID	Silicagel	1000	150
p-Nitrochlorobenzene	NIOSH 2005	GC/FID	Silicagel	1000	150
Nitroethane	NIOSH 2526	GC/FID	XAD-2	20	5
Nitrogen dioxide	OSHA 182	IC	MS Tube	200	5
1-Nitropropane	OSHA 46	GC/FID	XAD-2	100	5
2-Nitropropane	OSHA 46	GC/FID	XAD-2	100	5
	NIOSH 2528	GC/FID	Chromosorb	20	2
Nonane	OSHA CIM	GC/FID	Charcoal	50	3
n-Octane	NIOSH 1500	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20-50	10
Oil mist (mineral)	NIOSH 5026	IR	MCE Filter	1000	480
Oxalic acid	OSHA CIM	IC	MCE Filter	2000	960
Paraquat	NIOSH 5003	HPLC/UV	GFF	1000	480
Parathion	NIOSH 5012	GC/FPD	GFF	1000	480
	OSHA 62	GC/FPD	Charcoal	1000	480
Particulates, Total	NIOSH 0500	GR	PVC Filter	2000	120
PCB's	NIOSH 5503	GC/ECD	GFF/Florisil Tube	60-150	30

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Pentachloroethane	NIOSH 2517	GC/ECD	Porpak R	20	10
Pentachlorophenol	NIOSH 5512	HPLC/UV	MCEF/Impinger	1000	480
n-Pentane	NIOSH 1500	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20-50	10
2-Pentanone	NIOSH 1300	GC/FID	Charcoal	10-200	3-10
	OSHA 07	GC/FID	Charcoal	20-50	10
1-Pentene	OSHA CIM	GC/FID	Charcoal	20-50	10
2-Pentyl acetate	NIOSH 1450	GC/FID	Charcoal	10-200	1-10
Perchloroethylene	NIOSH 1003	GC/FID	Charcoal	20-50	10
Petroleum distillates	NIOSH 1550	GC/FID	Charcoal	20-50	10
	OSHA 48	GC/FID	Charcoal	20-50	10
Petroleum ether	NIOSH 1550	GC/FID	Charcoal	20-50	10
Petroleum naphtha	NIOSH 1550	GC/FID	Charcoal	20-50	10
Phenanthrene	OSHA 58	HPLC/UV	GFF	2000	960
Phenol	NIOSH 2546	GC/FID	XAD-7	100	24
Phenyl ether	NIOSH 1617	GC/FID	Charcoal	100	48
	OSHA 07	GC/FID	Charcoal	20-50	10
Phenyl ether - biphenyl	NIOSH 2013	GC/FID	Silicagel	50	24
Phenyl glycidyl ether	NIOSH 1619	GC/FID	Charcoal	20-50	10
Phosphoric acid	NIOSH 7903	IC	Washed Silicagel	200	48
	OSHA ID 111	IC	MCE Filter	2000	960
Phosphorous	NIOSH 7300	ICP-AES	MCE Filter	2000	960
Phosphorous pentoxide	OSHA ID 111	IC	MCE Filter	2000	960
Phthalic anhydride	NIOSH 3(S179)	HPLC	MCE Filter	1000	100
	OSHA 90	HPLC/UV	MCE Filter	1000	75
Picric acid	NIOSH 4(S228)	HPLC/UV	MCE Filter	1500	180
Platinum	NIOSH 7300	ICP-AES	MCE Filter	2000	960
PNA's	NIOSH 5506	HPLC/UV	PTFE Filter/XAD-2	2000	240
	NIOSH 5515	GC/FID	PTFE Filter/XAD-2	2000	240
	OSHA 58	GR, HPLC/UV	GFF	2000	960
Polychlorobiphenyls	NIOSH 5503	GC/ECD	GFF/Florisil Tube	60-150	30

Analyses of Industrial Hygiene samples

Chemical Substance	Method #	Analytical Technique	Sampling Media	Volume ml/min	Total Vol (l)
Potassium	OSHA ID 121	AA	MCE Filter	2000	960
Potassium hydroxide	NIOSH 7401	Titrimetric	PTFE Filter	2000	960
Propionaldehyde	NIOSH 2539	GC/FID, GC/MS	XAD-2		
n-Propyl acetate	OSHA 07	GC-ID	Charcoal	20-50	10
Propyl alcohol	OSHA 07	GC-FID	Charcoal	20-50	10
n-Propyl alcohol	NIOSH 1401	GC-FID	Charcoal	20-50	10
n-Propyl nitrate	NIOSH 3(S227)	GC-FID	Charcoal	100	48
Propylene oxide	NIOSH 1612	GC-FID	Charcoal	20	5
Pyrene	OSHA 58	HPLC-UV	GFF	2000	960
	NIOSH 5506	HPLC-UV	PTFE Filter	2000	480
Pyridine	NIOSH 1613	GC-FID	Charcoal	100	48
	OSHA 07	GC-FID	Charcoal	100	48
Quinone	NIOSH 4(S181)	HPLC	XAD-2	50	12
Resorcinol	OSHA CIM	HPLC-UV	XAD-7	100	24
Rhodium	NIOSH 3(S188)	AA	MCE	1500	720
	OSHA CIM	AA-GF	MCE	2000	960
Rubber Solvent	NIOSH 1550	GC-FID	Charcoal	20-50	10
Selenium	NIOSH 7300	ICP-AES	MCE	2000	960
Silica,, Amorphous	NIOSH 7501	X DIF	PVC/MCE	2500	390
Silica, Crystalline	NIOSH 7601	VAS	PVC/MCE	2600	624
	NIOSH 7602	IR	PVC/MCE	2600	624
	NIOSH 7500	X DIF	PVC/MCE	2600	624
Silicon tetrahydride	OSHA CIM	AA-GF	Impinger	1000	480
Silver	NIOSH 7300	ICP-AES	MCE	2000	960
	OSHA ID 121	AA	MCE Filter	2000	960
	OSHA ID 206	ICP	MCE Filter	2000	960
Sodium azide	OSHA ID 211	IC	PVCF/Silicagel	1000	10
Sodium bisulfite	OSHA ID 121	IC	MCE Filter	2000	960
Sodium fluoride	NIOSH 7902	S I E	MCE Filter	1000	480
Sodium hydroxide	OSHA ID 121	AA	MCE Filter	2000	960
	NIOSH 7401	Titrimetric	PTFE Filter	1500	360

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Stoddard solvent	NIOSH 1550	GC/FID	Charcoal	10-200	2-20
	OSHA 48	GC/FID	Charcoal	200	12
Strontium	OSHA CIM	AA	MCE Filter	1000	480
Styrene	NIOSH 1501	GC/FID	Charcoal	< 1000	5-14
	OSHA 9	GC/FID	Charcoal	20-50	10
	OSHA 89	GC/FID	Charcoal	50	12
Sulfur dioxide	NIOSH 6004	IC	Treated GFF	1000	180
	OSHA ID 200	IC	Anasorb/PTFEF	100	12
Sulfuric acid	NIOSH 7903	IC	Washed Silicagel	200	48
	OSHA ID 113	IC	MCE Filter	2000	960
2,4,5-T (2,4-D)	NIOSH 5001	HPLC/UV	GFF	1000	180
TDI	NIOSH 5521	HPLC/UV	Impinger	1000	500
Tellurium	NIOSH 7300	ICP-AES	MCE Filter	2000	960
	OSHA ID 121	AA	MCE Filter	2000	960
Tebufos	NIOSH 5600	GC/FPD	XAD-2/Quartz	1000	240
o-Terphenyl	NIOSH 5021	GC/FID	PTFE Filter	2000	30
Terpineol	OSHA CIM	GC/FID	Charcoal	200	10
1,1,2,2-Tetrabromoethane	NIOSH 2003	GC/FID	Silicagel	200	96
1,1,2,2-Tetrachloro-1,2-difluoroethane	NIOSH 1016	GC/FID	Charcoal	20	2
	OSHA 07	GC/FID	Charcoal	50	2
1,1,1,2-Tetrachloro-2,2-difluoroethane	NIOSH 1016	GC/FID	Charcoal	20	2
	OSHA 07	GC/FID	Charcoal	50	2
1,2,4,5-Tetrachlorobenzene	NIOSH 5517	GC/ECD	XAD-2/ PTFE Filter	25	12
2,3,7,8-TCDD	----	GC/ECD	Impinger	1000	30
2,3,7,8-TCDF	----	GC/ECD	Impinger	1000	30
1,1,2,2-Tetrachloroethane	NIOSH 1019	GC/FID	Pet. Charcoal	50	24
	OSHA 07	GC/FID	Pet. Charcoal	200	30
Tetrachloroethylene	NIOSH 1003	GC/FID	Charcoal	20	3
	OSHA 07	GC/FID	Charcoal	50	24
Tetrachloronaphthalene	NIOSH 2(S130)	GC/ECD	GFF/Impinger	1000	60
	OSHA CIM	GC/FID	XAD-2/GFF	1000	90

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
Tetrachlorophenol	OSHA 45	HPLC/UV	XAD-7	200	48
Tetraethyl lead	NIOSH 2533	GC/PID	Silicagel	1000	120
	OSHA CIM	AA	Charcoal	1000	480
Tetrahydrofuran	NIOSH 1609	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20-50	10
Tetramethyl lead	NIOSH 2534	GC/PID	Silicagel	200	96
	OSHA CIM	AA	Charcoal	1000	480
Tetramethyl succinonitrile	NIOSH 3(S155)	GC/FID	Charcoal	100	50
	OSHA 07	GC/FID	Charcoal	20	10
Tetrasodium pyrophosphate	OSHA ID 111	GR, IC	PVE Filter	2000	960
	OSHA ID 121	GR, AA	PVE Filter	2000	960
Thallium	NIOSH 7300	ICP-AES	MCE	2000	960
	OSHA ID 121	AA	MCE Filter	2000	960
Tin	NIOSH 7300	ICP-AES	MCE	2000	960
	OSHA ID 121	AA	MCE Filter	2000	960
	OSHA ID 206	ICP	MCE Filter	2000	960
Tin Oxide	OSHA ID 121	AA	MCE Filter	2000	960
Titanium Dioxide	NIOSH 3(S385)	AA	MCE Filter	1500	140
Titanium	NIOSH 7300	ICP-AES	MCE	2000	960
Toluene	NIOSH 1501	GC/FID	Charcoal	20-50	10
Toluene-2,4-diisocyanate	NIOSH 5521	HPLC/UV	Impinger	1000	500
	OSHA 42	HPLC/UV	Treated GFF	1000	500
	NIOSH 2535	HPLC/UV	Treated GFF	200	96
Toluene-2,6-diisocyanate	NIOSH 5521	HPLC/UV	Impinger	1000	500
	OSHA 42	HPLC/UV	Treated GFF	1000	500
2,4-Toluenediamine	NIOSH 5516	HPLC/UV	Impinger	1000	480
	OSHA 65	GC/ECD	Treated GFF	1000	100
2,6-Toluenediamine	NIOSH 5516	HPLC/UV	Impinger	1000	480
	OSHA 65	GC/ECD	Treated GFF	1000	100
p-Toluenesulfonic acid	OSHA CIM	HPLC/UV	Impinger	1000	120
m-Toluidine	OSHA 73	GC/ECD	Treated GFF	1000	90

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
o-Toluidine	OSHA 73	GC/ECD	Treated GFF	1000	90
	NIOSH 2002	GC/FID	Silicagel	100	50
p-Toluidine	OSHA 73	GC/ECD	Treated GFF	1000	90
Tributyl phosphate	NIOSH 5034	GC/FPD	MCE Filter	1500	90
1,1,2-Trichloro-1,2,2-trifluoroethane	NIOSH 1020	GC/FID	Charcoal	20	3
Trichloroacetic acid	OSHA CIM	HPLC/UV	Silicagel	20-50	10
1,2,3-Trichlorobenzene	OSHA CIM	GC/ECD	XAD-2/PTFEF	50	12
1,2,4-Trichlorobenzene	NIOSH 5517	GC/ECD	XAD-2/PTFEF	50	12
1,1,2-Trichloroethane	NIOSH 1003	GC/FID	Charcoal	20-50	10
	OSHA 11	GC/FID	Charcoal	20-50	10
1,1,1-Trichloroethane	NIOSH 1003	GC/FID	Charcoal	20-50	10
Trichloroethylene	NIOSH 1022	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20-50	10
Trichlorofluoromethane	NIOSH 1006	GC/FID	Charcoal	20	5
Trichloronaphthalene	NIOSH 2(S128)	GC/ELCD	Impinger/GFF	1000	100
	OSHA CIM	GC/ECD	XAD-2/GFF	1000	90
1,2,3-Trichloropropane	NIOSH 1003	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20-50	10
2,3,6-Trichlorotoluene	OSHA CIM	GC/FID	Charcoal	20-50	10
Triethanolamine	NIOSH 3509	IC	Impinger	1000	240
Triethylamine	NIOSH 2010	GC/FID	Charcoal	50	24
Triethylene tetramine	NIOSH 2540	HPLC/UV	XAD-2	100	10
	OSHA 60	HPLC/UV	XAD-2	100	10
Trifluorobromomethane	NIOSH 1017	GC/FID	Charcoal	20	1
	OSHA 07	GC/FID	Charcoal	20	1
Triphenyl phosphate	NIOSH 5038	GC/FPD	MCE Filter	1000	240
Tungsten	NIOSH 7300	ICP-AES	MCE	2000	960
	NIOSH 7074	AA	MCE Filter	1000	480
	OSHA ID 213	ICP	MCE Filter	2000	960
Turpentine	NIOSH 1551	GC/FID	Charcoal	20-50	10
Valeraldehyde	NIOSH 2536	GC/FID	XAD-2	20	10

Analyses of Industrial Hygiene samples

Chemical Substance	*Method #*	*Analytical Technique*	*Sampling Media*	*Volume ml/min*	*Total Vol (l)*
	OSHA 85	HPLC/UV	GFF	50	3
	NIOSH 2539	GC/FID or MS	XAD-2	20	5
Vanadium	NIOSH 7300	ICP-AES	MCE	2000	960
Vanadium oxides	NIOSH 7504	X DIF	PVC Filter	2600	960
Vanadium pentoxide	OSHA ID 185	X DIF	PVC Filter	2000	960
Vinyl acetate	NIOSH 1453	GC/FID	Chromosorb	50	24
	OSHA 51	GC/FID	Chromosorb	100	24
Vinyl bromide	NIOSH 1009	GC/FID	Charcoal	20-50	10
	OSHA 08	GC/FID	Charcoal	20	5
Vinyl chloride	NIOSH 1007	GC/FID	Charcoal	50	3
	OSHA 07	GC/FID	Charcoal	20	5
Vinyl toluene	NIOSH 1501	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20	5
Vinylidine chloride	NIOSH 1015	GC/FID	Charcoal	20	5
	OSHA 19	GC/FID	Charcoal	100	3
VM & P Naphtha	OSHA 48	GC/FID	Charcoal	20	3
	NIOSH 1550	GC/FID	Charcoal	20-50	10
Welding fumes	OSHA ID 125	ICP	MCE Filter	2000	960
Xylenes	NIOSH 1501	GC/FID	Charcoal	20-50	10
	OSHA 07	GC/FID	Charcoal	20	5
2,4-Xylidine	NIOSH 2002	GC/FID	Silicagel	20-50	10
Zinc	OSHA ID 121	AA	MCE Filter	2000	960
	OSHA ID 125	ICP	MCE Filter	2000	960
	NIOSH 7300	ICP-AES	MCE	2000	960
	NIOSH 7030	AA	MCE Filter	1000	180
Zinc oxide	NIOSH 7502	X DIF	MCE Filter	1000	240
Zirconium	NIOSH 7300	ICP-AES	MCE	2000	960
	OSHA ID 121	AA	MCE Filter	2000	960

FACILITIES

Facilities

CHEMTEX occupies a vast area of 12,000 square feet at Port Arthur for its operation. It is located in the vicinity of highway 69 and is very much convenient for the clients to reach. CHEMTEX owns all the literature pertaining to the analyses including manuals, test methods of the regulated agencies and journals.

CHEMTEX laboratory at Port Arthur expanded its facility four years ago with modern ventilation systems and well-designed physical facilities in order to avoid cross contamination of the samples and to create its employees fair working conditions to produce accurate, reliable and precise results. CHEMTEX is sectioned into Organic-I (GC, HPLC, IR), Organic-II (GC/MS), Wet Chemical, Asbestos and Fiber Counting, Sample preparation, Extractions and Office. The enclosed layout chart shows 27 zones, in which 1,2 & 6 are meant for office, reception and sample receipt. Wet Chemical analyses and metal analyses are performed at 3 & 4, zones 19 & 20 are designed for GC, HPLC and IR analyses. Zones 24 are provided for Volatile and Semi-volatile analyses by GC/MS. Other major areas are X-ray diffraction (11), Transmission Electron Microscope (12), Asbestos bulk analyses (26), Fiber Counting (27) and Sample preparation areas (21&25). Lay out chart also shows the locations of the rest rooms, refrigerators, drinking water coolers, Gas Cylinders and safety equipment.

ACCREDITATIONS & AFFILIATIONS

The American Industrial Hygiene Association

is proud to acknowledge that

Chemtex Environmental and Industrial Hygiene

Port Arthur, TX

Laboratory ID# 10696

has fulfilled the requirements for Industrial Hygiene Laboratory Accreditation and has earned distinguished recognition as an

AIHA Accredited Laboratory

Originally Accredited July 1, 1990, current certificate effective July 1, 1993 until July 1, 1996, subject to continued compliance with AIHA accreditation criteria.

President
American Industrial Hygiene Association

December 1, 1994
Date Prepared

Mark A. Puskar

Chairman
Laboratory Accreditation Committee

423
Certificate Number

TEXAS
DEPARTMENT OF HEALTH

BE IT KNOWN THAT

CHEMTEX ENVIRONMENTAL LABORATORY, INC.

is Licensed and authorized to perform as an

ASBESTOS LABORATORY

PLM-PCM (Port Arthur)

in the State of Texas within the purview of Texas Civil Statutes, Article 4477-3a, as amended, so long as this License is not suspended or revoked and is renewed according to the rules adopted by the Texas Board of Health.

30-0180

License Number

03/04/96

Issue Date

03/03/97

Expiration Date

This certificate is void after expiration date without a current renewal identification card displayed here.

Todd F. Wingler, P.E.
Chief, Asbestos Programs Branch
Occupational Safety and Health Division

David R. Smith, M.D.
Commissioner of Health

VOID IF ALTERED NON-TRANSFERABLE

17406

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

ISO/IEC GUIDE 25:1990
ISO 9002:1987

Certificate of Accreditation

DEPARTMENT OF COMMERCE ★ UNITED STATES OF AMERICA ★

CHEMTEX ENVIRONMENTAL LABORATORY, INC.
PORT ARTHUR, TX

is recognized under the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. Accreditation is awarded for specific services, listed on the Scope of Accreditation for:

BULK ASBESTOS FIBER ANALYSIS

March 31, 1997

Effective through

For the National Institute of Standards and Technology
NVLAP Lab Code: 200025-0

AP 01C (11-95)

TEXAS
DEPARTMENT OF HEALTH

BE IT KNOWN THAT

CHEMTEX ENVIRONMENTAL LABORATORY, INC.

is Licensed and authorized to perform as an

ASBESTOS LABORATORY

PCM ONLY (Corpus Christi)

in the State of Texas within the purview of Texas Civil Statutes, Article 4477-3a, as amended, so long as this License is not suspended or revoked and is renewed according to the rules adopted by the Texas Board of Health.

30-0179
License Number

03/04/96
Issue Date

03/03/97
Expiration Date

This certificate is void after expiration date without a current renewal identification card displayed here.

Todd F. Wingler, P.E.
Chief, Asbestos Programs Branch
Occupational Safety and Health Division

David R. Smith, M.D.
Commissioner of Health

VOID IF ALTERED NON-TRANSFERABLE

17424

INSTRUMENTATION

Analytical Equipment

CHEMTEX is equipped with the wide variety of instruments ranging from analytical balances to mass spectrophotometers, which is the most important requirement in maintaining the quality of the data. CHEMTEX invests significant amount for the equipment to generate highest quality results in order to meet its commitment. CHEMTEX maintains its instruments in a good condition at all times. CHEMTEX keenly observes the development of research and technology and updates its facilities accordingly. CHEMTEX receives a lot of advertising brochures, announcements and catalogs of newly available equipment.

CHEMTEX laboratories are equipped with four GC/MS spectrophotometers, in which half of the instruments are dedicated to Volatile Organic Analyses and the rest of them is used for semi-volatile Organic analyses. It possesses five Gas Chromatographs with dual Flame Ionization Detectors, dual auto samplers and injectors for Industrial Hygiene testing. Four other Gas Chromatographs with dual Injectors and auto samplers have Electron Capture, Nitrogen Phosphorus and flame Photometric detectors. Two Gas Chromatographs are exclusively used for the analyses of EPA Method 8020 and EPA Method 602 with Photo Ionization Detectors. Other major equipments are High Performance Liquid Chromatography with Ultra Violet, Visible, and Conductivity detectors, three Atomic Absorption Spectrophotometers for the metal analyses, four tekmar purge and trap devices, TEM and X-ray Diffraction instrument. A detailed list of the equipment, that is used at CHEMTEX will be followed by this page, which gives model and manufacturer and number of instruments.

LIST OF MAJOR ANALYTICAL EQUIPMENT

Serial #	Name of the Instrument	Make/Model	Detector/System
1	GC/Mass Spectrophotometer - Purge & Trap Autosampler - Concentrator	HP 5890 ALS 2000 LSC 2016	HP MSD 5970
2	GC/Mass Spectrophotometer - Autosampler	HP 5890 HP 7673	HP MSD 5970
3	GC/Mass Spectrophotometer - Purge & Trap System	HP 5890, Series II OI Analytical	HP MSD 5970
4	GC/Mass Spectrophotometer - Autosampler	HP 5890, Series II HP 7673	HP MSD 5970
5	GC/Mass Spectrophotometer - Autosampler	Perkin Elmer GC 1020	MSD QMS 910
6	GC/Mass Spectrophotometer - VOC Autosampler - Cryogenic Concentrator	HP 5890, Series II Nutech 3600 Nutech 3550A Series	HP MSD 5972
7	Gas Chromatograph - Autosampler	HP 5890 HP 7673	FID
8	Gas Chromatograph - Autosampler	HP 5890 HP 7673	FID
9	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID
10	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID
11	Gas Chromatograph - Autosampler	HP 5890 HP 7673	FID
12	Gas Chromatograph - Autosampler	HP 5890 HP 7673	FID
13	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID
14	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID

Serial #	Name of the Instrument	Make/Model	Detector/System
15	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673	FID
16	Gas Chromatograph - Autosampler	HP 5890 HP 7673	FID
17	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673	FPD
18	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID
19	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	FID
20	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673	NPD
21	Gas Chromatograph - Purge & Trap Autosampler - Concentrator	HP 5890, Series II ALS 2000 LSC 2016	PID
22	Gas Chromatograph - Purge & Trap Autosampler - Concentrator	HP 5890, Series II ALS 2000 LSC 2016	PID
23	Gas Chromatograph - Autosampler	HP 5890, Series HP 7673	ECD
24	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673	ECD
25	Gas Chromatograph - Autosampler	HP 5890, Series II HP 7673A	ECD
26	Gas Chromatograph	HP 5880	TCD
27	Gas Chromatograph	HP 5880	FID
28	Gas Chromatograph	HP 5880	FID
29	Gas Chromatograph	HACH	TCD
30	Gas Chromatograph	SRI Instruments	ECD
31	Gas Chromatograph	SRI Instruments	FID
32	Gas Chromatograph	SRI Instruments	FID

Serial #	Name of the Instrument	Make/Model	Detector/System
33	Gas Chromatograph - Autosampler	SRI Instruments	PID
34	Gas Chromatograph - Autosampler	SRI Instruments	ECD
35	Inductively Coupled Plasma Spectrophotometer	Leeman Labs	AES
36	Inductively Coupled Plasma Spectrophotometer	Perkin Elmer	AES
37	Atomic Absorption Spectrophotometer	Varian 400 Zeeman	Flame
38	Atomic Absorption Spectrophotometer	Varian 400 Zeeman	Furnace
39	Atomic Absorption Spectrophotometer	Perkin Elmer 5100	Flame
40	Atomic Absorption Spectrophotometer	Perkin Elmer 5100	Flame
41	Atomic Absorption Spectrophotometer	Perkin Elmer 5100	Furnace
42	Atomic Absorption Spectrophotometer	Perkin Elmer 5100	Furnace
43	Atomic Absorption Spectrophotometer	Perkin Elmer 5000	Flame
44	Atomic Absorption Spectrophotometer	Perkin Elmer 560	Flame
45	High Performance Liquid Chromatograph	DIONEX, VDM-2	UV/VIS
46	High Performance Liquid Chromatograph - Autosampler	DIONEX, VDM-2 DIONEX, ASM-2	UV/VIS
47	Ion Chromatograph	DIONEX, CDM-2	Conductivity
48	Ion Chromatograph - Autosampler	DIONEX, CDM-2 DIONEX, ASM-2	Conductivity
49	Ion Chromatograph - Autosampler	DIONEX, CDM-3 DIONEX, ASM-2	Amperometric
50	Ion Chromatograph - Autosampler	DIONEX, ADM-2 DIONEX, ASM-2	Conductivity
51	X-Ray Diffraction	Diano series 9000	X-Ray
52	Transmission Electron Microscope	JEOL JEM 100 CX11	
53	Total Organic Carbon Analyzer	Beckman	

Serial #	Name of the Instrument	Make/Model
54	Total Organic Halide Analyzer	Dohrmann
55	Total Organic Halide Analyzer	Dohrmann
56	Infrared Spectrophotometer	Buck Scientific
57	Mercury Analyzer	Buck Scientific
58	Microscope	Nikon, Labophot
59	Microscope	Nikon, Labophot
60	Phase Contrast Microscope	Nikon, Labophot
61	Phase Contrast Microscope	Nikon, Labophot
62	Phase Contrast Microscope	Nikon, Labophot
63	Phase Contrast Microscope	Nikon, Labophot
64	Phase Contrast Microscope	Nikon, Labophot
65	Stereo Microscope	Nikon, SMZ-1
66	Stereo Microscope	Nikon, SMZ-1
67	Stereo Microscope	Nikon, SMZ-1
68	Stereo Microscope	Nikon, SMZ-1
69	Polarized Light Microscope	Nikon, Labophot
70	Polarized Light Microscope	Nikon, Labophot
71	Polarized Light Microscope	Nikon, Labophot
72	Polarized Light Microscope	Nikon, Labophot

METHODOLOGY

Methodology

CHEMTEX strictly follows the rules and regulations of the Federal, State and Local regulatory agencies. CHEMTEX follows the EPA' s SW-846, Water, Waste water and drinking water methods, Standard and ASTM methods for the environmental pollutants present in water, soil and sludges. CHEMTEX follows NIOSH, OSHA and EPA's TO methods for Industrial Hygiene analysis. In the face of availability of various methods, CHEMTEX chooses a proper method that not only generate accurate data but also has minimum interferences and reproducibility of the results. CHEMTEX has developed its own standard operating procedures for each and every analysis on the basis of feasibility of the method to produce accurate results under the laboratory conditions of operation by its intellectual staff. CHEMTEX clearly gives the references of the methods, that are used for the analyses, to its clients. CHEMTEX advises its clients in using the proper media, containers and preservatives to collect the samples.

Qualifications and Experience of the Key Personnel

Dr. C.N. Reddy, M.S., Ph.D., CIH, ASP, Director.

Professional Qualification: March 86 - Present, Responsible for day to day operation of the laboratory, providing the facilities for all the laboratories under the Chemtex and in-charge of confidentiality, security and integrity of the laboratories and as well as the analytical data.

November 80 - March 86: Supervisor, Kemron Laboratory.
Certified Industrial Hygienist 1993.
Associate Safety Professional 1993.

Education: Post Doctoral Fellow: May 78 - November 80, Louisiana State University, Baton Rouge, LA.
Ph.D.: 1978 - Soil Chemistry - Louisiana State University, Baton Rouge, LA.
M.S.: 1973 - Soil Science & Agricultural Chemistry, Indian Agricultural Research Institute, New Delhi, India.

Affiliations: American Chemical Society.
American Society Agronomy.
American Society of Soil Science.
American Industrial Hygiene Association.
American Society of Safety Engineers.

Dr. Ramesh K. Cherivirala, M.S., Ph.D., QA/QC Coordinator.

Professional Qualifications: June 1995 - Present, Responsible for the day to day QA/QC operations of the laboratory and data validation, reduction and reporting of the analytical results. Training of the personnel in organic division of the laboratory.

April 1992 - June 95, Responsible for the analysis of Organic pollutants in different matrices, such as Soil, Water, Waste Water, Sludge and Industrial Hygiene Samples by GC, HPLC, IC and IR spectrophotometer at CHEMTEX.

Education: Ph.D 1991, Organic Chemistry, "Synthesis, Reactivity and Spectral studies of isoxazole derivatives" Osmania University, India.
M.S. 1986, Organic Chemistry, Kakatiya University, India.

Affiliations: American Chemical Society.
Gulf Coast Deep South Section of American Industrial Hygiene Association.

Mr. Prasad K Lavu, M.S., Biologist/Microscopist.

Professional Qualifications: October 1991 - Present, Responsible for the analysis of various Classic Wet Chemical parameters, microbiological analysis, asbestos analysis and fiber counting.

Education: Doctoral Student, 1989-91, University of Southwestern Louisiana, Louisiana.
M.S. 1987, Biology, S.K. University, India.
B.S. 1984, Physical and Chemical Sciences, S.K. University, India.

Dr. V.N.R.Mukku, M.S., Ph.D., Chemist.

Professional Qualifications: Jan 1992-Present: Responsible for the analysis of Semi-Volatile analysis using GC/MS and responsible for the analyses of Pesticides, Herbicides and PCB's using GC/ECD.

Education: 1979, M.S.: Physics, University of Roorkee, India.
1983, Ph.D: Atmospheric Studies, Kashmir University, Srinagar, India.

Dr. Sriramoji Manohar, M.S., Ph.D., Chemist.

Professional Qualifications: January 1994 - Present, Responsible for the analysis of metals by AA (Flame and Furnace) and ICP.

Education: Post-doctoral Fellow: 1992 - January 94, University of Oklahoma, Norman, Oklahoma.
Ph.D.: 1990, Physical Chemistry, Osmania University, India.
M.S.: 1985, Physical Chemistry, Osmania University India.

Affiliations: American Chemical Society.

Dr. Mulam, M.S., Ph.D., Organic Chemist

Professional Qualifications: June 1994 - Present, Organic Chemist, Responsible for the analysis of Volatile organics present in multimedia samples by GC/MS.

February 1992 - May 1994, Research Associate at Tini Pharma Ltd, India.

Education: Ph.D. Sri Venkateswara University, India 1992. "Synthesis, Spectral and Biological Studies of some Organophosphorus Heterocyclic Compounds."

Dr. S.R. Kor, M.S., Ph.D., Supervisor, Baton Rouge Facility.

Professional Qualifications: Jan 1994 - Present, Responsible for the day to day operations of the laboratory.
November 1993 - Jan 94: Responsible for the analysis of metals by using AA (Flame and Furnace) and ICP at CHEMTEX.
November 1990 - December 1992, Chief Environmental Chemist, Environmental Control Division, Ministry of Health, Govt of Jamaica, Govt of Jamaica, West Indies.

Education: Project Assistant: August 1989 - October 1990, S.V. University , India.
Ph.D.: December 1990, Analytical Chemistry, S.V. University, India.
M.S.: August 1986, Environmental Chemistry, S.V. University, India.

Affiliations: Gulf Coast Deep South Section and Coastal bend of American Industrial Hygiene Association.

Dr. S.R. Gosala, M.S. Ph.D., Supervisor, Corpus Christi Facility.

Professional Qualifications: June 95 - present: Responsible for the day to day operations of the laboratory.
1993 - May 95: Research Fellow, Japanese Govt. Monbusho Fellowship, photocatalysts. Purification of drinking water using semiconductor materials on presence of sun light.
1991 - 1993, Research Associate, IIT, Bombay Photoelectro Chemistry.

Education: Ph.D.: 1987 - 1991, Analytical Chemistry, S.V. University, Tirupati, India.

Vishnu Battula, M.S. Chemist.

Professional Qualifications: March 1995 - Present, Responsible for classical Wet Chemical parameters. Also responsible for Asbestos Analysis, Fiber Counting, and Bulk Analysis

1991 - 1992, B.R. Engineering Works. Responsible for monitoring ground water resources; excavation of canals and other irrigation resources.

Education: M.S. Environmental Science and Engineering, University of New Haven, New Haven, CT, 1994.

Dr. H.R. Golla, M.S. Ph.D., Organic Chemist

Professional Qualifications: May 1995-Present: Working with IC and Gas chromotographs for multimedia environmental and industrial hygiene samples.

June 1986 - May 1995: Worked on development of a process in synthesis of antiemetic drugs used during chromotoghraphy to treat cancer patients as young scientists fellow in school of Chemistry. Used different spectral and separation techniques like NMR, MASS, Chromatography and HPLC.

Education: 1983, M.S.: S.K. University Anantapur, India.
1986, Ph.D.: S.K. University Anantapur, India.

Dr. R.P. Kankati, M.S., Ph.D., Organic Chemist.

Professional Qualifications: May 1995-Present: Responsible for the analysis of purgeable aromatic hydrocarbons using Gas Chromatography and Semi-Volatile analysis using GC/MS.
1993 - 1995, As a post-doctorine research scientist at "Institute of Chemistry" National Autonomous University of Mexico, Mexico, D.F.
1992 - 1993, Research Associate at Dept. of Chemistry Osmania University, Hyderabad, India.

Education: 1984, M.S.: Organic Chemistry.
1992, Ph.D: Organic Chemistry. "Synthesis and Physiological Activity of 3-Heteryl and 3, 4 annelated AZA heterocycles derived from 3-amino Coumarins".

Affiliations: American Chemical Society.

Dr. M.R. Polala, MS., Ph.D., Biologist/Microscopist.

Professional Qualifications: Jan 1996 - Present: Responsible for the analysis of asbestos and fiber counting and microbiological analysis.

May 1995 - 96: Post-doctoral fellow, S.K.University, India, Worked on acute toxicicity tests like LC_{50}, safe level concentrations of pesticides, metals are evaluated with reference to aquatic organisms. The toxic impact of pollutants on biochemical and physiological changes in animals are noticed.

Education: 1983, M.S., S.K. University, India.
1986, M.Phil, S.K. University, India.
1991, Ph.D., Environmental Biology, S.K. University, India.

SYNOPSIS OF QUALITY ASSURANCE PROGRAM PLAN

Synopsis of QA/QC Manual

CHEMTEX does have a QA/QC manual by name Quality assurance (QA) Program Plan to govern all aspects of laboratory operation. This manual provides the basis for the establishment and maintenance of the QA program. It is subjected to review at a regular interval. It contains all the information regarding laboratory operation, quality assurance and quality control programs and many more under different headlines. Out lines of the QA/QC manual are given here.

a) *Introduction*: Introductory part of this manual tells about the purpose of having a manual of its kind for the laboratory and explains briefly about the contexts of it.

b) *QA Objectives*: It writes about CHEMTEX'S commitment as to "generate precise, accurate and reliable analytical data with in the context of cost and turnaround time" that addresses the clients concern in the areas of accountability, documentation, confidentiality and defensibility. it tells that CHEMTEX follows the methods of the regulatory agencies for all the analyses performed. It defines the Quality Assurance as, maintaining the protocols of the regulatory agencies for all the operations from sample receipt, through analysis, to data reduction and reporting. The quality of the data is assured by the evaluation, documentation, precision, accuracy and completeness of the analysis. It also tells how the data passed on and monitored for the accuracy and precision from the analyst, through QA/QC Coordinator, to the Director of the laboratory and there by finally to the clients.

c) *Quality Assurance Operations*: It narrates the use of laboratory materials, Organization & Personnel of the laboratory, Facilities and equipment present at CHEMTEX, Analytical methods that follow in performing the analysis, Sample custody

& storage, Quality Control of the analysis and Data handling under the proper subheadlines as below.

i. *Laboratory materials:* Starts with deionized water, which is used for dilutions and ration of reagent solutions etc, is obtained using commercially manufactured ion exchange resin column. Conductivity of DI water is also monitored every day. All the reagents used for the analysis are AR grade or commercially available high purity solvents. All standards are obtained as per the methods from the manufacturers or from EPA and are used only in a specified shelf time.

ii. *Quality Control of Analysis*: Quality control checks are routinely performed during sample analysis, which include method blanks, duplicate analysis, matrix spikes and matrix spike duplicates. On the basis of the protocols of the regulatory agencies and type of analysis, frequencies of these analyses are described in its manual. In addition to the above said analyses, Quality is regularly controlled by analyzing check standards and performance evaluation studies like EPA's WP & WS, NIOSH's PAT, Clients DMR Study and Clients Check samples.

iii *Instrument Calibrations*: QA/QC Manual describes how often the instruments are calibrated, and how the instruments are maintained, which is an important necessity to fulfill its commitment. The requirements for the calibration and quality control criteria for each and every individual instrument are given under the respective names of the instruments.

iv. *Internal Quality Control Checks:* Method blanks, matrix spikes (MS), and its duplicates (MSD), surrogates, duplicate analyses, initial calibration verification (ICV), continuing calibration verification (CCV), continuing calibration blank (CCB) and laboratory control check standards are defined under this category. Frequency and quality control criteria for such analyses are also described.

v. *System Performance Audits*: Internal audits are conducted at CHEMTEX once in three months by the Internal Audit Committee (IAC), which consists of the Director, Supervisor and QA/QC coordinator of the laboratory. IAC will review the following items.

* Organization

* Facilities and Equipment

* Calibration and maintenance of instruments

* Analytical and Quality control procedures

* Review of corrective actions taken

* Data handling

* Documentation of standards preparation, analysis, calibration and surrogate and spike recoveries

* Confidentiality of the analytical data

CHEMTEX invites external audits by different clients, state and federal regulatory such as TWA and EPA. CHEMTEX participates in intra and inter laboratory performance tests on a regular basis. CHEMTEX successfully participates in EPA, WP and WS studies and NIOSH's PAT programs in addition to the clients check samples and DMR study. Results of such analyses and the accreditations and certifications of NVLAP and AIHA are enclosed at the end of this SOQ.

The data generated out of all such audits, performance evaluation tests and corrective actions taken during the day to day operation of the laboratory by the QA/QC coordinator are reviewed by the IAC. IAC will take the corrective actions as necessary. IAC will also discuss with personnel individually and encourages accordingly.

vi. *Confidentiality*: All the analytical data will be stored in a storage room under the supervision of the laboratory director. The data generated at CHEMTEX is strictly confidential and cannot be altered by any person without authorization. CHEMTEX does have a legal contract with its employees in protecting its integrity, security and confidentiality. CHEMTEX ensures the confidentiality of all the information pertaining to the clients, their samples and analytical data.

Handling, generation, reduction, validation, reporting and completeness of the data is also discussed in it's QA/QC manual.

US EPA WP Study Results

Performance Evaluation Report
USEPA Water Pollution Study WP036

Participant ID: TX00946 Type: OTHER Requesting Office: R06

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
TRACE METALS IN MICROGRAMS/LITER					
001-ALUMINUM					
01	3503	3609	3130- 4040	3250- 3920	Accept.
003-BERYLLIUM					
01	50.1	51.1	39.9- 62.9	42.8- 60	Accept.
004-CADMIUM					
01	126	131	113- 148	117- 144	Accept.
005-COBALT					
01	443	433	386- 497	400- 483	Accept.
006-CHROMIUM					
01	241	250	218- 289	227- 280	Accept.
007-COPPER					
01	574	552	515- 618	528- 605	Accept.
008-IRON					
01	810	790	715- 934	742- 906	Accept.
010-MANGANESE					
01	751	750	686- 812	702- 797	Accept.
011-NICKEL					
01	1858	1812	1660- 2030	1710- 1990	Accept.
012-LEAD					
01	352	375	332- 429	344- 417	Accept.
013-SELENIUM					
01	287	310	244- 360	258- 345	Accept.
014-VANADIUM					
01	7052	6662	5980- 7620	6180- 7410	Accept.
015-ZINC					
01	1179	1203	1100- 1370	1140- 1340	Accept.
016-ANTIMONY					
02	861	891	590- 1070	650- 1010	Accept.
017-SILVER					
02	551	573	448- 659	474- 633	Accept.
018-THALLIUM					
02	785	787	630- 908	665- 873	Accept.
074-MOLYBDENUM					
02	456	473	403- 536	420- 519	Accept.
075-STRONTIUM					
02	259	243	206- 277	215- 268	Accept.
076-TITANIUM					
02	172	171	142- 181	147- 176	Accept.
MINERALS IN MILLIGRAMS/LITER (EXCEPT AS NOTED)					
019-PH-UNITS					
02	8.42	8.73	8.54- 9.01	8.6- 8.95	Not Accept.
020-SPEC. COND.(UMHOS/CM AT 25 C)					
01	272.0	269	251- 293	256- 288	Accept.

Performance Evaluation Report
USEPA Water Pollution Study WP036

Participant ID: TX00946 Type: OTHER Requesting Office: R06

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
021-TDS AT 180 C					
01	155.0	148	104- 187	114- 177	Accept.
022-TOTAL HARDNESS(AS CACO3)					
01	51.0	47.4	42.5- 53.7	43.9- 52.3	Accept.
023-CALCIUM					
01	16.5	17.0	14.8- 19.5	15.4- 18.9	Accept.
025-SODIUM					
01	8.21	7.46	6.55- 9.17	6.88- 8.85	Accept.
027-TOTAL ALKALINITY(AS CACO3)					
01	14.7	13.0	9.69- 16.8	10.6- 15.9	Accept.
028-CHLORIDE					
01	36.9	34.8	30.8- 38.4	31.8- 37.4	Accept.
029-FLUORIDE					
01	0.179	0.210	0.153- 0.27	0.168-0.255	Accept.
030-SULFATE					
01	34.5	44.0	36.4- 49.1	37.9- 47.5	Not Accept.
NUTRIENTS IN MILLIGRAMS/LITER					
031-AMMONIA-NITROGEN					
01	10.58	10.0	8.05- 12	8.52- 11.5	Accept.
032-NITRATE-NITROGEN					
01	2.10	2.10	1.73- 2.48	1.82- 2.39	Accept.
033-ORTHOPHOSPHATE					
01	0.89	0.880	0.768- 1.02	0.798-0.988	Accept.
DEMANDS IN MILLIGRAMS/LITER					
036-COD					
01	20.2	20.8	10.7- 32.2	13.5- 29.5	Accept.
037-TOC					
01	7.95	8.20	6.74- 10.5	7.23- 10.1	Accept.
038-5-DAY BOD					
01	13.0	13.0	6.89- 19.2	8.44- 17.7	Accept.
102-CARBONACEOUS BOD					
01	10.7	11.3	5.33- 17.3	6.93- 15.7	Accept.
PCB'S IN MICROGRAMS/LITER					
040-PCB-AROCLOR 1016/1242					
02	3.16	3.85	1.48- 4.82	1.9- 4.4	Accept.
045-PCB-AROCLOR 1254					
01	2.01	1.78	0.627- 2.59	0.875- 2.35	Accept.
PCB'S IN OIL IN MILLIGRAMS/KILOGRAM					
099-PCB IN OIL- 1016/1242					
02	18.13	17.9	1.13- 28.8	4.68- 25.3	Accept.
100-PCB IN OIL- 1254					
01	14.00	15.9	0.227- 28.6	3.9- 24.9	Accept.

Performance Evaluation Report
USEPA Water Pollution Study WP036

Participant ID: TX00946 Type: OTHER Requesting Office: R06

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
PESTICIDES IN MICROGRAMS/LITER					
047-ALDRIN					
01	0.269	0.313	0.0856-0.425	0.129-0.382	Accept.
048-DIELDRIN					
01	1.270	1.24	0.675- 1.68	0.803- 1.55	Accept.
049-DDD					
01	2.560	2.35	1.27- 3.29	1.52- 3.03	Accept.
050-DDE					
01	1.176	1.18	0.605- 1.55	0.725- 1.43	Accept.
051-DDT					
01	1.650	2.05	1.07- 2.68	1.27- 2.48	Accept.
052-HEPTACHLOR					
01	0.346	0.386	0.119-0.525	0.171-0.473	Accept.
053-CHLORDANE					
03	02.50	2.34	1.14- 3.33	1.42- 3.06	Accept.
078-HEPTACHLOR EPOXIDE					
01	0.187	0.222	0.118-0.285	0.139-0.264	Accept.
VOLATILE HALOCARBONS IN MICROGRAMS/LITER					
054-1,2 DICHLOROETHANE					
01	11.8	10.5	8.14- 15.8	9.1- 14.9	Accept.
055-CHLOROFORM					
01	11.5	11.1	8.85- 14.6	9.57- 13.9	Accept.
056-1,1,1 TRICHLOROETHANE					
01	11.9	11.7	8.67- 15.8	9.56- 14.9	Accept.
057-TRICHLOROETHENE					
01	14.2	14.7	10- 19.5	11.2- 18.3	Accept.
058-CARBONTETRACHLORIDE					
01	13.4	13.3	8.7- 20.4	10.2- 18.9	Accept.
059-TETRACHLOROETHENE					
01	14.8	14.5	9.56- 19.2	10.8- 18	Accept.
060-BROMODICHLOROMETHANE					
01	12.7	12.0	8.48- 15.6	9.37- 14.7	Accept.
061-DIBROMOCHLOROMETHANE					
01	12.8	11.7	9.22- 15.9	10- 15	Accept.
062-BROMOFORM					
01	18.7	16.3	11.9- 22.8	13.3- 21.5	Accept.
063-METHYLENE CHLORIDE					
01	13.6	16.4	12.6- 24.4	14.1- 22.9	Ck. for Err.
064-CHLOROBENZENE					
01	13.9	13.6	10.9- 17.6	11.8- 16.8	Accept.
VOLATILE AROMATICS IN MICROGRAMS/LITER					
065-BENZENE					
01	17.5	18.6	14.1- 24.3	15.4- 23	Accept.

Performance Evaluation Report
USEPA Water Pollution Study WP036

Participant ID: TX00946 Type: OTHER Requesting Office: R06

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
066-ETHYLBENZENE					
01	17.3	19.8	13.8- 25.4	15.3- 23.9	Accept.
067-TOLUENE					
01	16.6	17.0	12.4- 22	13.6- 20.8	Accept.
094-1,2-DICHLOROBENZENE					
01	8.97	9.19	6.42- 12.4	7.17- 11.7	Accept.
095-1,4-DICHLOROBENZENE					
01	8.80	7.60	5.23- 10.2	5.87- 9.6	Accept.
096-1,3-DICHLOROBENZENE					
01	7.34	8.40	5.73- 10.9	6.38- 10.3	Accept.
MISCELLANEOUS PARAMETERS					
071-TOTAL CYANIDE(IN MG/L)					
01	1.03	0.921	0.645- 1.18	0.712- 1.11	Accept.
072-NON-FILTERABLE RESIDUE(IN MG/L)					
01	29.8	30.0	20.1- 31.4	21.5- 30	Accept.
073-OIL AND GREASE(IN MG/L)					
01	16.6	19.5	11.9- 23.9	13.4- 22.4	Accept.
097-TOTAL PHENOLICS(IN MG/L)					
01	0.23	0.483	0.27-0.697	0.325-0.642	Not Accept.

********** END OF DATA FOR TX00946 **********
NOTE: FOR LIMITS AND TRUE VALUES, ASSUME THREE SIGNIFICANT DIGITS.
********** END OF REPORT FOR TX00946 **********

* Based on gravimetric calculations, or a reference value when necessary.

Performance Evaluation Report
USEPA Water Pollution Study WP035

Date: 16APR96

Participant ID: TX00089 Type: OTHER Requesting Office: R06

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
TRACE METALS IN MICROGRAMS/LITER					
001-ALUMINUM					
01	323	321	261- 382	276- 367	Accept.
02	1440	1500	1270- 1700	1330- 1640	Accept.
002-ARSENIC					
01	196	193	167- 231	175- 223	Accept.
02	507	571	492- 676	515- 653	Ck. for Err.
003-BERYLLIUM					
01	184	190	165- 209	170- 204	Accept.
02	540	541	480- 597	495- 583	Accept.
004-CADMIUM					
01	52.6	52.6	44.5- 60.7	46.5- 58.7	Accept.
02	407	401	345- 454	359- 440	Accept.
005-COBALT					
01	26.5	28.1	22.9- 32.6	24.1- 31.4	Accept.
02	628	624	557- 686	574- 670	Accept.
006-CHROMIUM					
01	18.5	17.0	13- 20.5	13.9- 19.5	Accept.
02	900	880	767- 985	794- 958	Accept.
007-COPPER					
01	91.0	86.7	75.5- 96.9	78.2- 94.2	Accept.
02	380	370	334- 409	344- 399	Accept.
008-IRON					
01	35.5	30.4	18.8- 42.6	21.8- 39.6	Accept.
02	440	464	441- 519	451- 509	Not Accept.
010-MANGANESE					
01	390	401	369- 441	378- 432	Accept.
02	860	881	833- 968	850- 951	Accept.
011-NICKEL					
01	519	496	453- 560	466- 547	Accept.
02	640	611	557- 698	574- 680	Accept.
012-LEAD					
01	317	297	259- 334	269- 325	Accept.
02	411	399	356- 446	367- 435	Accept.
013-SELENIUM					
01	474	522	402- 615	429- 588	Accept.
02	868	978	754- 1150	804- 1100	Accept.
015-ZINC					
01	74.0	71.9	62.7- 84.9	65.5- 82.2	Accept.
02	1700	1800	1610- 2030	1660- 1980	Accept.
016-ANTIMONY					
03	381	370	240- 450	266- 423	Accept.
04	595	570	369- 692	410- 651	Accept.
017-SILVER					
03	172	180	153- 207	160- 200	Accept.
04	326	340	298- 391	310- 380	Accept.

Participant ID: TX00089 Type: OTHER Requesting Office: R06

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
018-THALLIUM					
03	94.0	83.3	63.4- 99.1	67.9- 94.6	Accept.
04	385	365	301- 425	317- 410	Accept.
MINERALS IN MILLIGRAMS/LITER (EXCEPT AS NOTED)					
019-PH-UNITS					
03	4.31	4.30	4.22- 4.4	4.25- 4.38	Accept.
04	5.52	5.50	5.46- 5.62	5.48- 5.6	Accept.
020-SPEC. COND.(UMHOS/CM AT 25 C)					
01	860	916	830- 983	849- 964	Accept.
02	560	586	536- 627	547- 616	Accept.
021-TDS AT 180 C					
01	1167	553	326- 762	380- 708	Not Accept.
02	329	311	226- 398	248- 377	Accept.
022-TOTAL HARDNESS(AS CACO3)					
01	330.0	330	302- 358	309- 351	Accept.
02	98.0	101	90.8- 110	93.2- 108	Accept.
023-CALCIUM					
01	106	104	92.8- 120	96.2- 116	Accept.
02	6.65	6.39	5.53- 7.54	5.79- 7.29	Accept.
025-SODIUM					
01	15.1	14.2	13.1- 16.2	13.5- 15.8	Accept.
02	55.7	54.3	49.3- 58.9	50.5- 57.7	Accept.
027-TOTAL ALKALINITY(AS CACO3)					
01	39.0	20.0	17.4- 25.1	18.3- 24.1	Not Accept.
02	132.0	72.0	64.8- 78.6	66.5- 76.9	Not Accept.
028-CHLORIDE					
01	246.5	241	224- 259	228- 254	Accept.
02	74.5	72.7	65.1- 79.8	67- 77.9	Accept.
029-FLUORIDE					
01	3.22	3.50	3.09- 3.8	3.18- 3.71	Accept.
02	1.31	1.35	1.16- 1.53	1.21- 1.48	Accept.
030-SULFATE					
01	18.0	18.0	13.8- 22.1	14.8- 21.1	Accept.
02	88.0	86.4	72- 97	75.1- 93.9	Accept.
NUTRIENTS IN MILLIGRAMS/LITER					
031-AMMONIA-NITROGEN					
01	27.5	19.0	15- 22.3	15.9- 21.5	Not Accept.
02	2.4	1.40	1.15- 2.08	1.26- 1.97	Not Accept.
032-NITRATE-NITROGEN					
01	8.19	8.31	6.76- 9.69	7.11- 9.34	Accept.
02	0.383	0.390	0.28-0.495	0.305-0.469	Accept.
033-ORTHOPHOSPHATE					
01	0.068	.0560	0.0333-0.076	0.0384-0.071	Accept.
02	2.70	2.80	2.43- 3.19	2.52- 3.1	Accept.

Participant ID: TX00089 Type: OTHER Requesting Office: R06

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
DEMANDS IN MILLIGRAMS/LITER					
036-COD					
01	180.0	236	189- 259	198- 250	Not Accept.
02	88.0	101	71.2- 120	77.3- 114	Accept.
037-TOC					
01	72.0	93.1	78.5- 108	82.4- 105	Not Accept.
02	35.0	40.1	31.6- 47.4	33.6- 45.3	Accept.
038-5-DAY BOD					
01	114.0	141	64.1- 218	83.3- 199	Accept.
02	55.0	62.5	29.5- 95.5	37.7- 87.3	Accept.
102-CARBONACEOUS BOD					
01	100.0	117	34.3- 199	55.6- 178	Accept.
02	48.0	51.6	20- 83.2	28.2- 75	Accept.
PCB'S IN MICROGRAMS/LITER					
042-PCB-AROCLOR 1232					
01	02.27	2.76	0.709- 4.3	1.17- 3.84	Accept.
044-PCB-AROCLOR 1248					
02	03.39	4.26	1.77- 6.04	2.3- 5.5	Accept.
PCB'S IN OIL IN MILLIGRAMS/KILOGRAM					
099-PCB IN OIL- 1016/1242					
01	044.9	42.3	6.88- 58.9	13.5- 52.3	Accept.
101-PCB IN OIL- 1260					
02	023.6	12.7	3.17- 20.4	5.37- 18.2	Not Accept.
PESTICIDES IN MICROGRAMS/LITER					
047-ALDRIN					
01	02.92	3.11	0.522- 5.23	1.12- 4.64	Accept.
02	0.115	0.243	0.065-0.322	0.0977-0.289	Accept.
048-DIELDRIN					
01	03.96	4.51	2.62- 6.22	3.08- 5.76	Accept.
02	0.950	1.62	0.858- 2.19	1.03- 2.02	Ck. for Err.
049-DDD					
01	05.79	5.67	3.14- 9.33	3.92- 8.55	Accept.
02	01.45	1.94	1.21- 2.64	1.39- 2.46	Accept.
050-DDE					
01	03.71	3.76	2.14- 5.1	2.51- 4.73	Accept.
02	01.27	1.42	0.72- 1.85	0.863- 1.71	Accept.
051-DDT					
01	08.62	6.46	3.79- 9.28	4.48- 8.59	Ck. for Err.
02	02.50	1.76	0.865- 2.33	1.05- 2.14	Not Accept.
052-HEPTACHLOR					
01	02.39	2.85	0.694- 4.14	1.13- 3.71	Accept.
02	0.149	0.278	0.0899-0.374	0.126-0.338	Accept.
053-CHLORDANE					
03	012.4	12.3	4.69- 17.2	6.27- 15.6	Accept.
04	01.25	1.36	0.695- 1.81	0.835- 1.67	Accept.

Participant ID: TX00089 Type: OTHER Requesting Office: R06

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
078-HEPTACHLOR EPOXIDE					
01	01.71	2.20	1.13- 2.53	1.31- 2.35	Accept.
02	0.144	0.284	0.153- 0.37	0.18-0.342	Not Accept.
VOLATILE HALOCARBONS IN MICROGRAMS/LITER					
054-1,2 DICHLOROETHANE					
01	61.4	56.3	39- 79.4	44.1- 74.4	Accept.
02	12.8	12.2	8.5- 17.5	9.63- 16.4	Accept.
055-CHLOROFORM					
01	70.9	64.8	47.6- 83.2	52.1- 78.7	Accept.
02	14.9	14.2	11- 18.4	11.9- 17.4	Accept.
056-1,1,1 TRICHLOROETHANE					
01	69.7	63.7	41- 85.7	46.6- 80.1	Accept.
02	16.5	16.2	10.4- 22.2	11.9- 20.7	Accept.
057-TRICHLOROETHENE					
01	76.2	72.3	45.7- 93	51.6- 87.1	Accept.
02	15.6	16.1	10.7- 20.6	11.9- 19.4	Accept.
058-CARBONTETRACHLORIDE					
01	32.7	29.0	16.5- 45	20- 41.4	Accept.
02	9.7	9.36	5.61- 13.7	6.62- 12.7	Accept.
059-TETRACHLOROETHENE					
01	77.6	73.6	46.5- 96.3	52.7- 90.1	Accept.
02	10.5	10.4	6.04- 14.5	7.1- 13.4	Accept.
060-BROMODICHLOROMETHANE					
01	57.7	55.6	37- 73.1	41.6- 68.6	Accept.
02	14.7	14.6	10.2- 18.4	11.2- 17.3	Accept.
061-DIBROMOCHLOROMETHANE					
01	50.1	48.5	33.1- 63.4	37- 59.6	Accept.
02	14.2	14.6	9.59- 18.9	10.7- 17.7	Accept.
062-BROMOFORM					
01	76.2	68.0	50.4- 95.3	56- 89.7	Accept.
02	12.8	12.6	8.42- 17.3	9.53- 16.2	Accept.
063-METHYLENE CHLORIDE					
01	49.4	46.7	30.3- 64.1	34.6- 59.9	Accept.
02	10.9	10.3	6.63- 14.7	7.65- 13.7	Accept.
064-CHLOROBENZENE					
01	72.6	68.1	46.5- 89	51.8- 83.7	Accept.
02	18.1	17.7	11.7- 24.2	13.2- 22.6	Accept.
VOLATILE AROMATICS IN MICROGRAMS/LITER					
065-BENZENE					
01	058.7	55.9	40.7- 69.9	44.4- 66.2	Accept.
02	010.1	9.30	6.56- 12.3	7.28- 11.6	Accept.
066-ETHYLBENZENE					
01	052.4	56.4	38.7- 73.3	43- 69	Accept.
02	012.0	10.4	7.18- 13.6	7.99- 12.8	Accept.
067-TOLUENE					
01	042.4	44.7	30.9- 57.6	34.3- 54.2	Accept.
02	008.1	7.60	5.29- 9.97	5.88- 9.38	Accept.

Participant ID: TX00089 Type: OTHER Requesting Office: R06

Sample Number	Reported Value	True Value*	Acceptance Limits	Warning Limits	Performance Evaluation
094-1,2-DICHLOROBENZENE					
01	050.5	52.0	40.7- 66.5	44- 63.2	Accept.
02	011.9	11.7	7.82- 16.6	8.92- 15.5	Accept.
095-1,4-DICHLOROBENZENE					
01	047.1	48.3	33.3- 62.2	37- 58.5	Accept.
02	013.0	13.4	9.37- 17.6	10.4- 16.6	Accept.
096-1,3-DICHLOROBENZENE					
01	042.8	42.7	34.4- 53.1	36.7- 50.7	Accept.
02	012.9	12.6	8.8- 16.6	9.79- 15.6	Accept.
MISCELLANEOUS PARAMETERS					
071-TOTAL CYANIDE(IN MG/L)					
01	0.036	.0301	0.0138-0.046	0.0179-0.042	Accept.
02	0.420	0.410	0.297-0.522	0.325-0.493	Accept.
072-NON-FILTERABLE RESIDUE(IN MG/L)					
01	86.0	88.0	61.9- 98.1	66.4- 93.6	Accept.
02	53.5	56.0	42.7- 60.1	44.9- 57.9	Accept.
073-OIL AND GREASE(IN MG/L)					
01	42.0	46.0	29.5- 54.1	32.6- 51	Accept.
02	15.0	18.9	12- 23.2	13.4- 21.8	Accept.
097-TOTAL PHENOLICS(IN MG/L)					
01	2.66	2.71	1.47- 3.96	1.78- 3.64	Accept.
02	1.30	1.19	0.519- 1.87	0.692- 1.7	Accept.

********** END OF DATA FOR TX00089 **********
NOTE: FOR LIMITS AND TRUE VALUES, ASSUME THREE SIGNIFICANT DIGITS.
********** END OF REPORT FOR TX00089 **********

* Based on gravimetric calculations, or a reference value when necessary.

US EPA WS Study Results

PROFICIENCY ANALYTICAL TESTING (PAT) PROGRAM
INDIVIDUAL LABORATORY REPORT FOR ROUND 124
LAB ID=10696 FEBRUARY 23, 1996
CHEMTEX ENV LAB INC, PORT ARTHUR, TX 77642

CONTAMINANT (ABV.)	UNIT	SAMPLE NO.	REPORTED RESULTS	REFERENCE VALUES *	ACCEPTABLE RANGE# LOWER	UPPER	Z & SCORE	LAB @ PERFORMANCE
CADMIUM (CAD)	(MG)	1	0.0052	0.0048	0.0041	0.0055	1.83	A
	(MG)	2	0.0097	0.0096	0.0085	0.0108	0.15	A
	(MG)	3	0.0077	0.0078	0.0070	0.0086	-0.39	A
	(MG)	4	0.0126	0.0127	0.0112	0.0143	-0.26	A
CHROMIUM (CHR)	(MG)	1	0.0528	0.0502	0.0427	0.0577	1.03	A
	(MG)	2	0.1016	0.0993	0.0859	0.1126	0.53	A
	(MG)	3	0.2062	0.2296	0.1922	0.2671	-1.88	A
	(MG)	4	0.1660	0.1768	0.1440	0.2096	-0.99	A
LEAD (LEA)	(MG)	1	0.0356	0.0332	0.0289	0.0375	1.68	A
	(MG)	2	0.0227	0.0216	0.0182	0.0250	0.97	A
	(MG)	3	0.0878	0.0899	0.0795	0.1004	-0.61	A
	(MG)	4	0.0650	0.0649	0.0558	0.0740	0.03	A
SILICA (SIL)	(MG)	1	0.1002	0.1043	0.0387	0.1700	-0.19	A
	(MG)	2	0.1432	0.1472	0.0566	0.2378	-0.13	A
	(MG)	3	0.0900	0.0753	0.0240	0.1265	0.86	A
	(MG)	4	0.1312	0.0950	0.0249	0.1650	1.55	A
ASBESTOS (ASB)	(F/MM2)	1	205.2000	250.2597	118.0301	431.6020	-0.90	A
	(F/MM2)	2	604.0000	639.1432	382.5582	961.2151	-0.37	A
	(F/MM2)	3	395.0000	502.6067	263.7543	817.8038	-1.24	A
	(F/MM2)	4	350.0000	422.8961	208.8037	711.7602	-0.91	A
1,2-DICHLOROETHANE (DCE)	(MG)	1	0.6310	0.6281	0.5657	0.6904	0.14	A
	(MG)	2	0.8520	0.8483	0.7378	0.9588	0.10	A
	(MG)	3	0.1680	0.1630	0.1387	0.1872	0.62	A
	(MG)	4	0.9582	0.9664	0.8178	1.1151	-0.17	A
TETRACHLOROETHYLENE (PCE)	(MG)	1	0.2483	0.2361	0.1879	0.2843	0.76	A
	(MG)	2	0.4940	0.4733	0.3974	0.5492	0.82	A
	(MG)	3	0.3780	0.3579	0.2912	0.4246	0.90	A
	(MG)	4	0.6700	0.6602	0.5785	0.7418	0.36	A
TRICHLOROETHYLENE (TCE)	(MG)	1	0.5224	0.5246	0.4605	0.5888	-0.10	A
	(MG)	2	0.4350	0.4288	0.3772	0.4804	0.36	A
	(MG)	3	0.8638	0.8828	0.7804	0.9852	-0.56	A
	(MG)	4	0.2133	0.1945	0.1621	0.2268	1.75	A

* Reference values are the mean of the reference laboratories based on original scales except for asbestos. Asbestos results are calculated based on transformed data. Therefore, asbestos performance limits are not symmetrical to the reference values.

\# *Upper limit: reference value + 3 standard deviations*
Lower limit: reference value - 3 standard deviations

& Z Score = (reported result-reference value)/standard deviation

@ A: Analysis acceptable -: Results not reported
H: Results > upper limit (Z > 3), not acceptable L: Results < lower limit (Z < -3), not acceptable

Note: the acceptablity of reported results is based on z-scores. This is why a reported result may appear acceptable according to performance limits, but be identified as an outlier.

PROFICIENCY ANALYTICAL TESTING (PAT) PROGRAM
LABORATORY YEAR-TO-DATE PERFORMANCE REPORT FOR ROUND 124
LAB ID=10696 FEBRUARY 23, 1996
CHEMTEX ENV LAB INC, PORT ARTHUR, TX 77642

SAMPLE TYPE	ROUND	ROUND * PERFORMANCE	ACCUMULATED PERFORMANCE 4 ROUNDS (%)		2 ROUNDS (%)		PROFICIENCY RATING #
METALS	121	12/12					
	122	12/12					
	123	12/12					
	124	12/12	48/48	100	24/24	100	P
SILICA	121	4/4					
	122	4/4					
	123	4/4					
	124	4/4	16/16	100	8/8	100	P
ASBESTOS	121	4/4					
	122	4/4					
	123	4/4					
	124	4/4	16/16	100	8/8	100	P
ORGANICS	121	12/12					
	122	12/12					
	123	12/12					
	124	12/12	48/48	100	24/24	100	P

* The denominators represent the number of total samples analyzed.
The numerators represent the number of acceptable results.
\# P : Proficient N: Nonproficient -: Not Rated
Performance ratings are based on accumulated results over four rounds (one year). A lab's performance on each sample type is rated proficient (P), if: 1) three-fourths (75%) or more of the accumulated results over four rounds are acceptable or 2) for the last two rounds, all samples are analyzed and the results are 100 % acceptable. If a laboratory receives samples for a contaminant and does not report the data, no rating will be given for that contaminant.

PROFICIENCY ANALYTICAL TESTING (PAT) PROGRAM
INDIVIDUAL LABORATORY REPORT FOR ROUND 125
LAB ID=10696 MAY 16, 1996
CHEMTEX ENV LAB INC, PORT ARTHUR, TX 77642

CONTAMINANT (ABV.)	UNIT	SAMPLE NO.	REPORTED RESULTS	REFERENCE VALUES *	ACCEPTABLE RANGE# LOWER	UPPER	Z & SCORE	LAB @ PERFORMANCE
CADMIUM (CAD)	(MG)	1	0.0088	0.0085	0.0075	0.0095	0.92	A
	(MG)	2	0.0140	0.0141	0.0125	0.0158	-0.26	A
	(MG)	3	0.0062	0.0056	0.0049	0.0064	2.11	A
	(MG)	4	0.0110	0.0114	0.0100	0.0129	-0.90	A
LEAD (LEA)	(MG)	1	0.0616	0.0631	0.0562	0.0700	-0.63	A
	(MG)	2	0.0202	0.0195	0.0166	0.0223	0.76	A
	(MG)	3	0.0818	0.0834	0.0745	0.0924	-0.55	A
	(MG)	4	0.0456	0.0482	0.0419	0.0545	-1.24	A
ZINC (ZIN)	(MG)	1	0.1812	0.1792	0.1555	0.2028	0.26	A
	(MG)	2	0.0726	0.0722	0.0608	0.0836	0.11	A
	(MG)	3	0.1342	0.1328	0.1154	0.1502	0.25	A
	(MG)	4	0.0919	0.0953	0.0830	0.1075	-0.82	A
SILICA (SIL)	(MG)	1	0.1200	0.1018	0.0392	0.1645	0.87	A
	(MG)	2	0.0800	0.0676	0.0242	0.1110	0.85	A
	(MG)	3	0.0950	0.1013	0.0398	0.1627	-0.31	A
	(MG)	4	0.0680	0.0566	0.0144	0.0987	0.81	A
ASBESTOS/FIBERS (ASB/MMF)	(F/MM2)	1	368.5000	391.0756	118.9833	820.4396	-0.20	A
	(F/MM2)	2	280.0000	190.9234	55.6933	406.9180	1.38	A
	(F/MM2)	3	327.4000	247.4349	43.4050	618.6104	0.78	A
	(F/MM2)	4	278.9000	227.4610	62.5889	495.1653	0.68	A
METHANOL (MOH)	(MG)	1	1.0895	0.9540	0.7343	1.1736	1.85	A
	(MG)	2	0.1310	0.1312	0.1015	0.1610	-0.02	A
	(MG)	3	0.4607	0.4450	0.3672	0.5229	0.60	A
	(MG)	4	0.8919	0.7634	0.6133	0.9135	2.57	A

* Reference values are the mean of the reference laboratories based on original scales except for asbestos. Asbestos results are calculated based on transformed data. Therefore, asbestos performance limits are not symmetrical to the reference values.
\# Upper limit: reference value + 3 standard deviations
Lower limit: reference value - 3 standard deviations
& Z Score = (reported result-reference value)/standard deviation
@ A: Analysis acceptable -: Results not reported
H: Results > upper limit (Z > 3), not acceptable L: Results < lower limit (Z < -3), not acceptable
Note: the acceptablity of reported results is based on z-scores. This is why a reported result may appear acceptable according to performance limits, but be identified as an outlier.

PROFICIENCY ANALYTICAL TESTING (PAT) PROGRAM
LABORATORY YEAR-TO-DATE PERFORMANCE REPORT FOR ROUND 125
LAB ID=10696 MAY 16, 1996
CHEMTEX ENV LAB INC, PORT ARTHUR, TX 77642

SAMPLE TYPE	ROUND	ROUND * PERFORMANCE	ACCUMULATED PERFORMANCE 4 ROUNDS (%)		2 ROUNDS (%)		PROFICIENCY RATING #
METALS	122	12/12					
	123	12/12					
	124	12/12					
	125	12/12	48/48	100	24/24	100	P
SILICA	122	4/4					
	123	4/4					
	124	4/4					
	125	4/4	16/16	100	8/8	100	P
ASBESTOS/FIBERS	122	4/4					
	123	4/4					
	124	4/4					
	125	4/4	16/16	100	8/8	100	P
ORGANICS	122	12/12					
	123	12/12					
	124	12/12					
	125	4/4	40/40	100	16/16	100	P

* The denominators represent the number of total samples analyzed.
The numerators represent the number of acceptable results.
\# P : Proficient N: Nonproficient -: Not Rated
Performance ratings are based on accumulated results over four rounds (one year). A lab's performance on each sample type is rated proficient (P), if: 1) three-fourths (75%) or more of the accumulated results over four rounds are acceptable or 2) for the last two rounds, all samples are analyzed and the results are 100 % acceptable. If a laboratory receives samples for a contaminant and does not report the data, no rating will be given for that contaminant.

PROFICIENCY ANALYTICAL TESTING (PAT) PROGRAM
INDIVIDUAL LABORATORY REPORT FOR ROUND 126
LAB ID=10696 AUGUST 19, 1996
CHEMTEX ENV LAB INC, PORT ARTHUR, TX 77642

CONTAMINANT (ABV.)	UNIT	SAMPLE NO.	REPORTED RESULTS	REFERENCE VALUES *	ACCEPTABLE RANGE# LOWER	UPPER	Z & SCORE	LAB @ PERFORMANCE
CADMIUM (CAD)	(MG)	1	0.0029	0.0029	0.0024	0.0033	0.32	A
	(MG)	2	0.0074	0.0073	0.0063	0.0084	0.17	A
	(MG)	3	0.0146	0.0147	0.0128	0.0167	-0.19	A
	(MG)	4	0.0048	0.0048	0.0041	0.0055	0.06	A
CHROMIUM (CHR)	(MG)	1	0.2054	0.2137	0.1805	0.2469	-0.75	A
	(MG)	2	0.1184	0.1250	0.1028	0.1472	-0.89	A
	(MG)	3	0.0722	0.0726	0.0594	0.0859	-0.09	A
	(MG)	4	0.0968	0.1016	0.0847	0.1185	-0.85	A
LEAD (LEA)	(MG)	1	0.0228	0.0231	0.0197	0.0264	-0.23	A
	(MG)	2	0.0530	0.0550	0.0483	0.0618	-0.91	A
	(MG)	3	0.0812	0.0830	0.0740	0.0920	-0.60	A
	(MG)	4	0.0316	0.0331	0.0285	0.0376	-0.98	A
SILICA (SIL)	(MG)	1	0.0910	0.0824	0.0234	0.1415	0.43	A
	(MG)	2	0.0750	0.1038	0.0164	0.1911	-0.99	A
	(MG)	3	0.0680	0.0876	0.0348	0.1404	-1.11	A
	(MG)	4	0.1500	0.1406	0.0219	0.2593	0.24	A
ASBESTOS/FIBERS (ASB/MMF)	(F/MM2)	1	270.0000	297.3149	122.3491	548.7066	-0.39	A
	(F/MM2)	2	50.0000	52.5900	7.0250	140.5013	-0.12	A
	(F/MM2)	3	160.0000	188.5294	82.4899	337.7804	-0.70	A
	(F/MM2)	4	300.0000	363.9470	164.0715	642.4070	-0.84	A
BENZENE (BNZ)	(MG)	1	0.0735	0.0731	0.0589	0.0873	0.08	A
	(MG)	2	0.1078	0.0989	0.0788	0.1190	1.33	A
	(MG)	3	0.4939	0.4918	0.4281	0.5554	0.10	A
	(MG)	4	0.3593	0.3579	0.3039	0.4119	0.08	A
O-XYLENE (OXY)	(MG)	1	0.1623	0.1648	0.1395	0.1901	-0.29	A
	(MG)	2	0.8780	0.8760	0.7662	0.9858	0.05	A
	(MG)	3	0.3612	0.3541	0.2955	0.4127	0.36	A
	(MG)	4	0.6686	0.6648	0.5757	0.7539	0.13	A
TOLUENE (TOL)	(MG)	1	0.8514	0.8820	0.7858	0.9783	-0.95	A
	(MG)	2	0.4466	0.4485	0.3900	0.5070	-0.10	A
	(MG)	3	0.7535	0.7588	0.6588	0.8587	-0.16	A
	(MG)	4	0.2644	0.2662	0.2312	0.3012	-0.16	A

* Reference values are the mean of the reference laboratories based on original scales except for asbestos. Asbestos results are calculated based on transformed data. Therefore, asbestos performance limits are not symmetrical to the reference values.
\# Upper limit: reference value + 3 standard deviations
Lower limit: reference value - 3 standard deviations
& Z Score = (reported result-reference value)/standard deviation
@ A: Analysis acceptable -: Results not reported
H: Results > upper limit (Z > 3), not acceptable L: Results < lower limit (Z < -3), not acceptable
Note: the acceptablity of reported results is based on z-scores. This is why a reported result may appear acceptable according to performance limits, but be identified as an outlier.

PROFICIENCY ANALYTICAL TESTING (PAT) PROGRAM
LABORATORY YEAR-TO-DATE PERFORMANCE REPORT FOR ROUND 126
LAB ID=10696 AUGUST 19, 1996
CHEMTEX ENV LAB INC, PORT ARTHUR, TX 77642

SAMPLE TYPE	ROUND	ROUND * PERFORMANCE	ACCUMULATED PERFORMANCE 4 ROUNDS (%)		2 ROUNDS (%)		PROFICIENCY RATING #
METALS	123	12/12					
	124	12/12					
	125	12/12					
	126	12/12	48/48	100	24/24	100	P
SILICA	123	4/4					
	124	4/4					
	125	4/4					
	126	4/4	16/16	100	8/8	100	P
ASBESTOS/FIBERS	123	4/4					
	124	4/4					
	125	4/4					
	126	4/4	16/16	100	8/8	100	P
ORGANICS	123	12/12					
	124	12/12					
	125	4/4					
	126	12/12	40/40	100	16/16	100	P

* The denominators represent the number of total samples analyzed.
The numerators represent the number of acceptable results.
\# P : Proficient N: Nonproficient -: Not Rated
Performance ratings are based on accumulated results over four rounds (one year). A lab's performance on each sample type is rated proficient (P), if: 1) three-fourths (75%) or more of the accumulated results over four rounds are acceptable or 2) for the last two rounds, all samples are analyzed and the results are 100 % acceptable. If a laboratory receives samples for a contaminant and does not report the data, no rating will be given for that contaminant.

PROFICIENCY ANALYTICAL TESTING (PAT) PROGRAM
SUMMARY RESULTS OF REFERENCE LABS AND ALL LABS FOR ROUND 127

CONTAMINANT (UNIT)	SAMPLE NO.	SUMMARY STATISTICS OF REFERENCE LAB N	MEAN*	STD@	RSD(%)&	# LABS RATED	# OF LABS ACCEPTABLE	# LOW OUTLIER	# HIGH OUTLIER
CADMIUM (MG)	1	58	0.0114	0.000455	4.0	357	329	18	10
	2	58	0.0067	0.000285	4.2	357	326	18	13
	3	58	0.0024	0.00014	5.7	357	314	23	20
	4	58	0.0133	0.00049	3.7	357	321	19	17
LEAD (MG)	1	58	0.0349	0.001127	3.2	360	318	26	16
	2	58	0.0965	0.00366	3.8	360	329	25	6
	3	58	0.0273	0.001202	4.4	360	333	20	7
	4	58	0.0815	0.002805	3.4	360	331	25	4
ZINC (MG)	1	58	0.1238	0.004928	4.0	356	316	28	12
	2	58	0.0569	0.002353	4.1	356	315	19	22
	3	58	0.1614	0.00686	4.3	356	319	23	14
	4	58	0.0912	0.003834	4.2	356	323	21	12
SILICA (MG)	1	58	0.0900	0.018	20.0	79	76	1	2
	2	58	0.0606	0.016746	27.6	79	78	1	0
	3	58	0.1736	0.038357	22.1	79	76	1	2
	4	58	0.0806	0.018986	23.5	79	74	1	4
ASBESTOS/FIBERS (F/MM2) +	1	58	223.4154	61.90251	27.7	1027	936	76	15
	2	58	348.5208	99.48814	28.5	1027	949	62	16
	3	58	213.6286	65.90638	30.9	1027	966	53	8
	4	58	89.1815	30.4622	34.2	1027	996	3	28
CHLOROFORM (MG)	1	57	0.1775	0.014916	8.4	312	286	9	17
	2	57	0.3284	0.019895	6.1	312	289	7	16
	3	57	0.7593	0.030166	4.0	312	286	14	12
	4	57	0.5826	0.031746	5.4	312	288	10	14
1,2-DICHLOROETHANE (MG)	1	57	0.8476	0.032175	3.8	313	276	19	18
	2	57	0.2607	0.017519	6.7	313	298	5	10
	3	57	0.5461	0.023528	4.3	313	283	12	18
	4	57	0.7685	0.034362	4.5	313	286	15	12
TETRACHLOROETHYLENE(MG)	1	57	0.2548	0.013776	5.4	312	282	16	14
	2	57	0.7035	0.028755	4.1	312	288	15	9
	3	57	0.3229	0.014472	4.5	312	279	17	16
	4	57	0.4706	0.020083	4.3	312	283	15	14

* MEAN - The mean of the reference laboratories is the reference value listed on the individual laboratory report.
@ STD - standard deviation
& RSD - relative standard deviation=((STD/MEAN)*100%)
\+ - Results for fibers are calculated on transformed data.

PROFICIENCY ANALYTICAL TESTING (PAT) PROGRAM
LABORATORY YEAR-TO-DATE PERFORMANCE REPORT FOR ROUND 127
LAB ID=10696 NOVEMBER 18, 1996
CHEMTEX ENV LAB INC, PORT ARTHUR, TX 77642

SAMPLE TYPE	ROUND	ROUND * PERFORMANCE	ACCUMULATED PERFORMANCE 4 ROUNDS (%)		2 ROUNDS (%)		PROFICIENCY RATING #
METALS	124	12/12					
	125	12/12					
	126	12/12					
	127	12/12	48/48	100	24/24	100	P
SILICA	124	4/4					
	125	4/4					
	126	4/4					
	127	4/4	16/16	100	8/8	100	P
ASBESTOS/FIBERS	124	4/4					
	125	4/4					
	126	4/4					
	127	4/4	16/16	100	8/8	100	P
ORGANICS	124	12/12					
	125	4/4					
	126	12/12					
	127	12/12	40/40	100	24/24	100	P

* The denominators represent the number of total samples analyzed.
The numerators represent the number of acceptable results.
\# P : Proficient N: Nonproficient -: Not Rated
Performance ratings are based on accumulated results over four rounds (one year). A lab's performance on each sample type is rated proficient (P), if: 1) three-fourths (75%) or more of the accumulated results over four rounds are acceptable or 2) for the last two rounds, all samples are analyzed and the results are 100 % acceptable. If a laboratory receives samples for a contaminant and does not report the data, no rating will be given for that contaminant.

AIHA's PAT Results

Participant ID: TX00089 Type: OTHER Requesting Office: R06

	Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation
TRACE METALS IN MICROGRAMS PER LITER:					
001-ARSENIC					
	001	120	120	107- 136	Accept.
003-CADMIUM					
	001	33.0	34.0	27.2- 40.8	Accept.
004-CHROMIUM					
	001	37.0	37.8	32.1- 43.5	Accept.
005-LEAD					
	001	36.5	39.0	27.3- 50.7	Accept.
007-SELENIUM					
	001	28.0	31.1	24.9- 37.3	Accept.
008-SILVER					
	002	53.5	54.2	47.2- 60.2	Accept.
091-COPPER					
	001	640	630	567- 693	Accept.
140-ANTIMONY					
	002	10.2	11.0	7.7- 14.3	Accept.
141-BERYLLIUM					
	001	7.40	7.70	6.55- 8.86	Accept.
142-NICKEL					
	001	370	380	323- 437	Accept.
143-THALLIUM					
	002	5.00	4.50	3.15- 5.85	Accept.
235-ALUMINUM					
	001	55.0	51.0	43.2- 67.3	Accept.
236-MANGANESE					
	001	964	970	911- 1030	Accept.
239-ZINC					
	001	1387	1410	1280- 1530	Accept.
NITRATE/NITRITE/FLUORIDE IN MILLIGRAMS PER LITER:					
009-NITRATE AS N					
	001	2.960	2.90	2.61- 3.19	Accept.
010-FLUORIDE					
	001	7.30	7.20	6.48- 7.92	Accept.
092-NITRITE AS N					
	001	1.152	1.10	0.935- 1.27	Accept.
INSECTICIDES IN MICROGRAMS PER LITER:					
011-ENDRIN					
	001	0.316	0.383	0.268-0.498	Accept.
012-LINDANE					
	001	0.405	0.429	0.236-0.622	Accept.
013-METHOXYCHLOR					
	001	26.62	28.9	15.9- 41.9	Accept.
014-TOXAPHENE					
	002	8.931	14.7	8.09- 21.3	Accept.

Participant ID: TX00089 Type: OTHER Requesting Office: R06

	Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation
095-HEPTACHLOR					
	004	0.801	0.751	0.413- 1.09	Accept.
097-CHLORDANE (TOTAL)					
	003	15.44	16.7	9.19- 24.2	Accept.
172-HEXACHLOROBENZENE					
	004	1.149	0.847	0.322- 1.17	Accept.
256-ALDRIN					
	004	0.886	0.980	0.323- 1.3	Accept.
258-DIELDRIN					
	004	1.563	1.54	1.03- 2.08	Accept.
POLYCHLORINATED BIPHENYLS IN MICROGRAMS PER LITER:					
118-DECACHLOROBIPHENYL					
	001	1.031	1.13	D.L. - 2.26	Accept.
TRIHALOMETHANES IN MICROGRAMS PER LITER:					
017-CHLOROFORM					
	001	21.6	21.7	17.4- 26	Accept.
018-BROMOFORM					
	001	35.3	38.6	30.9- 46.3	Accept.
019-BROMODICHLOROMETHANE					
	001	23.6	26.8	21.4- 32.2	Accept.
020-CHLORODIBROMOMETHANE					
	001	30.4	34.2	27.4- 41	Accept.
021-TOTAL TRIHALOMETHANE					
	001	110.9	121.3	97- 146	Accept.
VOLATILE ORGANIC COMPOUNDS IN MICROGRAMS PER LITER:					
032-VINYL CHLORIDE					
	001	9.42	9.47	5.68- 13.3	Accept.
034-1,1-DICHLOROETHYLENE					
	001	8.66	8.49	5.09- 11.9	Accept.
035-1,2-DICHLOROETHANE					
	001	8.34	9.00	5.4- 12.6	Accept.
036-1,1,1-TRICHLOROETHANE					
	001	11.9	14.5	11.6- 17.4	Accept.
037-CARBON TETRACHLORIDE					
	001	9.50	12.6	10.1- 15.1	Not Accept.
038-TRICHLOROETHYLENE					
	001	15.4	17.4	13.9- 20.9	Accept.
039-BENZENE					
	001	7.32	7.49	4.49- 10.5	Accept.
040-TETRACHLOROETHYLENE					
	002	16.3	18.5	14.8- 22.2	Accept.
041-1,4-DICHLOROBENZENE					
	001	8.92	11.9	9.52- 14.3	Not Accept.
042-T 1,2 DICHLOROETHYLENE					
	002	14.1	11.6	9.28- 13.9	Not Accept.

Participant ID: TX00089 Type: OTHER Requesting Office: R06

	Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation
044-1,2 DICHLOROPROPANE					
	002	16.6	16.4	13.1- 19.7	Accept.
047-TOLUENE					
	002	12.9	13.2	10.6- 15.8	Accept.
048-ETHYLBENZENE					
	002	14.3	14.8	11.8- 17.8	Accept.
049-CHLOROBENZENE					
	002	16.2	16.3	13- 19.6	Accept.
053-STYRENE					
	002	12.1	12.9	10.3- 15.5	Accept.
055-DICHLOROMETHANE					
	001	21.6	12.3	9.84- 14.8	Not Accept.
061-1,1,2-TRICHLOROETHANE					
	001	6.69	6.46	3.88- 9.04	Accept.
090-TOTAL XYLENES					
	002	5.02	10.4	8.32- 12.5	Not Accept.
MISCELLANEOUS ANALYTES:					
023-TURBIDITY(NTU'S)					
	001	6.80	6.30	5.81- 8	Accept.
024-TOTAL FILTERABLE RESIDUE(MILLIGRAMS PER LITER)					
	001	609.0	380	269- 626	Accept.
025-CALCIUM(MG. CACO3/L)					
	001	221.0	215	202- 235	Accept.
026-PH-UNITS					
	001	8.82	9.13	8.85- 9.32	Not Accept.
027-ALKALINITY(MG. CACO3/L)					
	001	39.30	38.1	36.6- 44.9	Accept.
145-SULFATE(MILLIGRAMS PER LITER)					
	001	35.20	81.0	71.9- 87.6	Not Accept.
146-TOTAL CYANIDE(MILLIGRAMS PER LITER)					
	001	0.277	0.200	0.15- 0.25	Not Accept.

********** END OF DATA FOR TX00089 **********
NOTE: FOR LIMITS AND TRUE VALUES, ASSUME THREE SIGNIFICANT DIGITS.
********** END OF REPORT FOR TX00089 **********

* Based on gravimetric calculations, or a reference value when necessary.

Performance Evaluation Report
USEPA Water Supply Study WS037

Participant ID: TX00089 Type: OTHER Requesting Office: R06

	Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation
TRACE METALS IN MICROGRAMS PER LITER:					
001-ARSENIC					
	001	57.5	49.3	41.9- 56.3	Not Accept.
002-BARIUM					
	002	790	773	657- 889	Accept.
003-CADMIUM					
	001	11.2	10.2	8.16- 12.2	Accept.
004-CHROMIUM					
	001	71.5	72.9	62- 83.8	Accept.
005-LEAD					
	001	13.6	13.8	9.66- 17.9	Accept.
007-SELENIUM					
	001	49.2	57.9	46.3- 69.5	Accept.
091-COPPER					
	001	57.5	55.7	50.1- 61.3	Accept.
140-ANTIMONY					
	002	20.1	18.0	12.6- 23.4	Accept.
141-BERYLLIUM					
	001	4.20	4.26	3.62- 4.9	Accept.
142-NICKEL					
	001	55.0	55.0	46.8- 63.3	Accept.
143-THALLIUM					
	002	2.80	2.38	1.67- 3.09	Accept.
239-ZINC					
	001	602	600	536- 652	Accept.
NITRATE/NITRITE/FLUORIDE IN MILLIGRAMS PER LITER:					
009-NITRATE AS N					
	001	8.24	8.30	7.47- 9.13	Accept.
092-NITRITE AS N					
	001	0.54	0.502	0.427-0.577	Accept.
INSECTICIDES IN MICROGRAMS PER LITER:					
011-ENDRIN					
	001	0.205	0.231	0.162- 0.3	Accept.
012-LINDANE					
	001	0.452	0.381	0.21-0.552	Accept.
013-METHOXYCHLOR					
	001	18.11	18.5	10.2- 26.8	Accept.
014-TOXAPHENE					
	002	6.367	8.81	4.85- 12.8	Accept.
095-HEPTACHLOR					
	004	0.561	0.563	0.31-0.816	Accept.
097-CHLORDANE (TOTAL)					
	003	3.373	4.44	2.44- 6.44	Accept.

Performance Evaluation Report
USEPA Water Supply Study WS037

Participant ID: TX00089 Type: OTHER Requesting Office: R06

	Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation
172-HEXACHLOROBENZENE					
	004	0.823	0.806	0.323- 1.14	Accept.
256-ALDRIN					
	004	0.552	0.567	0.186-0.725	Accept.
258-DIELDRIN					
	004	0.507	0.530	0.358-0.708	Accept.
HERBICIDES IN MICROGRAMS PER LITER:					
015-2,4-D					
	001	14.20	14.9	7.45- 22.4	Accept.
016-2,4,5-TP (SILVEX)					
	001	11.30	11.8	5.9- 17.7	Accept.
POLYCHLORINATED BIPHENYLS IN MICROGRAMS PER LITER:					
118-DECACHLOROBIPHENYL					
	001	1.605	0.527	D.L. - 1.05	Not Accept.
ADIPATE/PHTHALATES IN MICROGRAMS PER LITER:					
134-DI (2-ETHYLHEXYL)ADIPATE					
	001	36.20	34.3	11.4- 52.3	Accept.
136-DI (2-ETHYLHEXYL)PHTHAL.					
	001	19.54	21.3	6.98- 34.5	Accept.
TRIHALOMETHANES IN MICROGRAMS PER LITER:					
017-CHLOROFORM					
	001	23.4	22.3	17.8- 26.8	Accept.
018-BROMOFORM					
	001	17.6	18.6	14.9- 22.3	Accept.
019-BROMODICHLOROMETHANE					
	001	12.9	12.7	10.2- 15.2	Accept.
020-CHLORODIBROMOMETHANE					
	001	14.6	14.2	11.4- 17	Accept.
021-TOTAL TRIHALOMETHANE					
	001	68.5	67.8	54.2- 81.4	Accept.
VOLATILE ORGANIC COMPOUNDS IN MICROGRAMS PER LITER:					
032-VINYL CHLORIDE					
	001	12.7	14.8	8.88- 20.7	Accept.
034-1,1-DICHLOROETHYLENE					
	001	15.1	16.5	13.2- 19.8	Accept.
035-1,2-DICHLOROETHANE					
	001	12.9	13.2	10.6- 15.8	Accept.
036-1,1,1-TRICHLOROETHANE					
	001	9.38	10.3	8.24- 12.4	Accept.
037-CARBON TETRACHLORIDE					
	001	10.4	12.7	10.2- 15.2	Accept.

Performance Evaluation Report
USEPA Water Supply Study WS037

Participant ID: TX00089 Type: OTHER Requesting Office: R06

	Sample Number	Reported Value	True Value*	Acceptance Limits	Performance Evaluation
038-TRICHLOROETHYLENE					
	001	9.16	8.70	5.22- 12.2	Accept.
039-BENZENE					
	001	12.0	12.5	10- 15	Accept.
040-TETRACHLOROETHYLENE					
	002	9.25	9.60	5.76- 13.4	Accept.
041-1,4-DICHLOROBENZENE					
	001	5.04	7.31	4.39- 10.2	Accept.
042-T 1,2 DICHLOROETHYLENE					
	002	9.30	14.8	11.8- 17.8	Not Accept.
043-C 1,2 DICHLOROETHYLENE					
	002	12.3	9.72	5.83- 13.6	Accept.
044-1,2 DICHLOROPROPANE					
	002	14.5	14.2	11.4- 17	Accept.
047-TOLUENE					
	002	5.78	5.70	3.42- 7.98	Accept.
048-ETHYLBENZENE					
	002	8.38	9.19	5.51- 12.9	Accept.
049-CHLOROBENZENE					
	002	9.4	8.31	4.99- 11.6	Accept.
053-STYRENE					
	002	7.23	7.40	4.44- 10.4	Accept.
054-1,2 DICHLOROBENZENE					
	002	11.5	14.5	11.6- 17.4	Not Accept.
055-DICHLOROMETHANE					
	001	7.94	8.41	5.05- 11.8	Accept.
061-1,1,2-TRICHLOROETHANE					
	001	12.2	10.7	8.56- 12.8	Accept.
090-TOTAL XYLENES					
	002	6.46	12.9	10.3- 15.5	Not Accept.
MISCELLANEOUS ANALYTES:					
023-TURBIDITY(NTU'S)					
	001	1.50	1.54	1.26- 1.98	Accept.
145-SULFATE(MILLIGRAMS PER LITER)					
	001	312.0	280	253- 316	Accept.
146-TOTAL CYANIDE(MILLIGRAMS PER LITER)					
	001	0.450	0.380	0.285-0.475	Accept.

********** END OF DATA FOR TX00089 **********
NOTE: FOR LIMITS AND TRUE VALUES, ASSUME THREE SIGNIFICANT DIGITS.
********** END OF REPORT FOR TX00089 **********

* Based on gravimetric calculations, or a reference value when necessary.

SPL ENVIRONMENTAL LABORATORIES

CORPORATE QA/QC MANUAL

SPL, Inc.
Corporate Address:
8880 Interchange Drive
Houston, Texas 77054
(713) 660-0901/(800) 969-6775

SPL CORPORATE ENVIRONMENTAL LABORATORY
QUALITY ASSURANCE / QUALITY CONTROL MANUAL

Southern Petroleum Laboratories, Inc.
Corporate Address:
8880 Interchange Drive
Houston, TX 77054
(713) 660-0901

PREFACE

This Quality Assurance / Quality Control Manual reflects the current policies of SPL. However, this document is subject to change by SPL's Quality Assurance Management at any time. In the event of inconsistency among various quality assurance documents, the following order of precedence shall apply: (a) Contract, (b) Quality Assurance Project Plan, or whichever is more current of (c) Standard Operating Procedure, or (d) Quality Assurance Manual.

1.0 APPROVAL

SPL LABORATORIES

APPROVED BY:

H.R. Brown President/CEO, SPL, Inc. (Houston, TX)	12-22-95 Date	Wayne Boling Vice President, Laboratory Services (Lafayette, LA)	12/20/95 Date
John Durand Corporate QA/QC Director (Lafayette, LA)	12/20/95 Date	Cynthia Schreiner QA/QC Officer (Houston, TX)	12/22/95 Date
Idelis Williams QA/QC Officer (Houston, TX)	12/21/95 Date	M. Scott Sample Laboratory Director (Houston, TX)	12/21/95 Date
Karen Grizzaffi QA/QC Officer (Lafayette, LA)	12/20/95 Date	John Troost Laboratory Manager (Lafayette, LA)	12/20/95 Date
Ann Benningfield QA/QC Officer (Traverse City, MI)	12/29/95 Date	Steve Grenda Laboratory Director (Traverse City, MI)	12/29/95 Date
Joel Grice QA/QC Coordinator (Fullerton, CA)	12/28/95 Date	Jack Garvin Laboratory Director (Fullerton, CA)	1/8/96 Date

Document Control Number _____

2.0 TABLE OF CONTENTS

TABLE OF CONTENTS

REVISION/PAGE

COVER PAGE 01/01/97

PREFACE 01/01/97

1.0 APPROVAL 01/01/97

2.0 TABLE OF CONTENTS 01/01/97

3.0 INTRODUCTION 01/01/97
- 3.1 QUALITY ASSURANCE / QUALITY CONTROL STATEMENT OF POLICY 1
- 3.2 LEVELS OF QUALITY CONTROL / REPORT OPTIONS 2
  - 3.2.1 SPL Levels of Reporting 3
  - 3.2.2 Data Package QA Level Cross Reference 4
  - 3.2.3 Report Document Control 4
- 3.3 ANALYST TRAINING POLICY 4
- 3.4 LABORATORY CERTIFICATIONS 5
  - 3.4.1 Status of SPL Laboratory Certifications 5

4.0 ORGANIZATIONAL STRUCTURE 01/01/97
- 4.1 CORPORATE LABORATORY STRUCTURE 1
  - 4.1.1 President. 1
  - 4.1.2 Corporate Director of Analytical Services. 1
  - 4.1.3 Corporate Technical Director. 1
  - 4.1.4 Corporate Quality Assurance/Quality Control Director. 1
  - 4.1.6 Corporate Vice President of Accounts. 2
  - 4.1.7 Corporate MIS Director 2
- 4.2 CORPORATE QUALITY ASSURANCE/ QUALITY CONTROL STRUCTURE 2
- 4.3 LABORATORY STRUCTURE AND RESPONSIBILITIES 2
  - 4.3.1 Laboratory Manager. 2
  - 4.3.2 Quality Control Officers. 2
  - 4.3.3 Project Managers. 3
  - 4.3.4 Laboratory Supervisors. 3
- 4.4 CORPORATE HUMAN RESOURCES STRUCTURE AND RESPONSIBILITIES 3
  - 4.4.1 Human Resources Director 3

4.4.2 Corporate Safety Director 3
4.5 ORGANIZATIONAL CHARTS 4
4.5.1 Corporate Environmental Laboratory Organizational Chart 4
4.5.2 Houston Environmental Laboratory 5
4.5.3 Lafayette Environmental Laboratory 6
4.5.4 Michigan Environmental Laboratory 7
4.5.5 Fullerton Environmental Laboratory 8
4.6 Laboratory Addresses and Phone Numbers 9

5.0 QUALITY ASSURANCE OBJECTIVES 01/01/97
5.1 QUALITY CONTROL SAMPLE CRITERIA 2
5.1.1 Summary of Precision, Accuracy, and Completeness Objectives for Laboratory QC Samples 2
5.1.2 Surrogates 3
5.2 MINIMUM QC ACCEPTANCE CRITERIA 6
5.2.1 EPA 600 Series Conventional Chemistry 6
5.2.2 EPA 200 Series Atomic Absorption Methods 6
5.2.3 EPA Method 200.7, Metals by ICP 7
5.2.4 EPA Total Petroleum Hydrocarbons, Method 418.1 8
5.2.5 EPA Method 601, Volatile Organics 8
5.2.6 EPA Method 602, Volatile Aromatic Hydrocarbons 9
5.2.7 EPA Method 608, Pesticides 10
5.2.8 EPA Method 624, Volatile Oganics by GC/MS 11
5.2.9 EPA Method 625, Smivolatile Organics by GC/MS 13
5.2.10 EPA Method 6010A, Metals by ICP 13
5.2.11 EPA 7000A Method Series, Metals by Atomic Absorption 14
5.2.12 EPA 8000A Method Series, Gas Chromatography 15
5.2.13 EPA Method 8240B, Volatile Organics by GC/MS 16
5.2.14 EPA Method 8270B, Semivolatile Organics by GC/MS 17
5.2.15 EPA Method 8260A, Volatile Organics by GC/MS 18
5.2.16 EPA Method 8310, Polynuclear Aromatic Hydrocarbons by HPLC 19
5.2.17 EPA 9000, Conventional Chemistries 20
5.2.18 EPA Method 9020B, Total Organic Halides 21
5.2.19 EPA Methods 7.3.3.1 AND 7.3.4.2, Reactive Cyanide and Sulfide 21
5.2.20 ASTM Method D92-85, Flashpoint by Cleveland Open Cup 22
5.2.21 ASTM D93-85, SW846 Method 1010, Flashpoint by Pensky-Marten . . 22
5.2.22 DRO by 8015B, Gas Chromatography 23
5.2.23 DRO by Alaska AK102.0, Gas Chromatography 23
5.2.24 DRO by API, Gas Chromatography 24
5.2.25 DRO by California LUFT, Gas Chromatography 25
5.2.26 DRO by California LUFT, Gas Chromatography 26

5.2.27 DRO by IOWA OA-2, Gas Chromatography 27
5.2.28 DRO by Oklahoma Modified 8015, Gas Chromatography 28
5.2.29 DRO by Oregon TPH-D, Gas Chromatography 29
5.2.30 DRO by Tennessee, Gas Chromatography 30
5.2.31 DRO by Washington WTHP-D, Gas Chromatography 31
5.2.32 DRO by Wisconsin Modified DRO, Gas Chromatography 32
5.2.33 GRO by 8015B, Gas Chromatography 32
5.2.34 GRO by Alaska AK101.0, Gas Chromatography 33
5.2.35 GRO by API, Gas Chromatography 34
5.2.36 GRO by California LUFT, Gas Chromatography 35
5.2.37 GRO by IOWA OA-1, Gas Chromatography 36
5.2.38 GRO by Oklahoma Modified 8020/8015, Gas Chromatography 37
5.2.39 GRO by Oregon TPH-G, Gas Chromatography 38
5.2.40 GRO by Tennessee, GAS CHROMATOGRAPHY 39
5.2.41 GRO by Washington WTHP-G, Gas Chromatorgraphy 40
5.2.42 GRO by Wisconsin Modified GRO, Gas Chromatorgraphy 41

6.0 SAMPLE PROCEDURES 01/01/97
6.1 FIELD SAMPLING 1
6.2 SAMPLE CONTAINERS 1
6.3 PRESERVATIVES 2
6.3.1 Containers, Preservatives, Holding Times, 40 CFR Part 136, Table II, Water/Wastewater Samples 2
6.3.2 Test Methods For Evaluating Solid Waste, Physical/Chemical Methods, USEPA SW 846 3rd Edition, September 1994, Revision 2, Table 4-1 ... 9
6.3.3 State Required Methods & Preservatives Note: Check current state regulations. 11
6.4 SAMPLE DISPOSAL 16

7.0 LABORATORY SAMPLE CUSTODY 01/01/97
7.1 LABORATORY SAMPLE CUSTODY OBJECTIVES 1
7.2 LABORATORY CUSTODY 1
7.2.1 Special Custody Procedures 2
7.2.2 Normal Custody Procedure 2
7.2.2.1 Sample Receipt 2
7.2.2.2 Sample Logging 3
7.2.2.3 InternaL Chain-of-Custody 4
7.2.2.4 Subcontracting Laboratories 5
7.3 LABORATORY INFORMATION MANAGEMENT SYSTEMS 5
7.3.1 General 5

7.3.2 Hardware 5
7.3.3 Software 6
7.3.4 System Security: 6
7.3.5 Network Documentation 7
7.3.5.1 Network User Activity 7
7.3.5.2 Network Repair and Maintenance 8
7.3.6 Verification of LIMS Data 8
7.3.7 Software/Hardware Verification 8
Figure 7.1 Chain-of-Custody Form 10
Figure 7.2 Sample Receipt Checklist 11
Figure 7.3 SPL Custody Seal 12
Figure 7.4 Sample Protocol Nonconformance Worksheet 13

8.0 ANALYTICAL PROCEDURES 01/01/97
8.1 GENERAL ANALYTICAL TECHNIQUES 1
8.2 LABORATORY GLASSWARE CLEANING 2
8.2.1 Organic Sample Analyses 2
8.2.2 Metal Sample Analyses 3
8.2.3 Mercury Sample Analysis 3
8.2.4 Nutrient Analyses 4
8.2.5 Residue Analysis 4
8.2.6 General Laboratory Sample Analyses 4
8.2.7 Bioassay Sample Analysis 4
8.3 LABORATORY REAGENT STORAGE 6

9.0 CALIBRATION PROCEDURES AND FREQUENCY 11/01/95
9.1 REAGENTS AND STANDARDS 1
9.1.1 Standard Sources and Preparation 2
9.2 INSTRUMENT CALIBRATION 4
9.2.1 Metals 5
9.2.1.1 Atomic Absorption Spectroscopy - Furnace Analysis (GFAA) . . 5
9.2.1.2 Atomic Emission Spectroscopy - Inductively Coupled Plasma (ICP) 6
9.2.2 Absorption Spectroscopy - UV/Visible Spectrophotometry 6
9.2.3 Absorption Spectroscopy - Infrared Spectrophotometry 6
9.2.4 Total Organic Halide (TOX/TOH) Analyzers 7
9.2.5 Total Organic Carbon Analyzer 7
9.2.6 Inorganic Water parameters 7
9.2.7 Organic Compounds 8
9.2.7.1 Gas Chromatography/Mass Spectrometry 9
9.2.7.2 Gas Chromatography and High Performance Liquid

Chromatography 10
9.2.7.2.1 External Standard Calibration Procedure 10
9.2.7.2.2 Internal Standard Calibration Procedure 10
9.2.7.2.3 Retention Time 11
9.2.8 Support Equipment: 11
9.2.8.1 Balances 11
9.2.8.2 Thermometers 12
9.2.8.3 Refrigerators/Incubators 12
9.2.8.4 Digestion Blocks/Water Baths/Hot Plates 12

10.0 INSTRUMENT REPAIR AND PREVENTIVE MAINTENANCE 01/01/97
10.1 ORGANIC DEPARTMENT 1
10.2 INORGANIC DEPARTMENT 1
10.3 CONTINGENCY PLANS 2
10.4 INSTRUMENT REPAIRS/MAINTENANCE AND FREQUENCY 3
10.4.1 Inductively Coupled Plasma 3
10.4.2 Graphite Furnace Atomic Absorbtion 3
10.4.3 Gas Chromatography 4
10.4.4 High Performance Liquid Chromatography 5
10.4.5 Gas Chromatography - Mass Spectroscopy 6
10.4.6 Total Organic Halide 6
10.4.7 Total Organic Carbon 7
10.4.8 UV-Visible Spectrophotometers 8
10.4.9 Infrared Spectrophotometers 8
10.4.10 pH Meters 8
10.4.11 Turbidity Meters 9
10.4.12 Gel Permeation Cleanup 9
10.4.13 Ion Chromatography 9
10.4.14 Balances 10

11.0 QUALITY CONTROL ASSESSMENT 01/01/97
11.1 FIELD QUALITY CONTROL SAMPLES 1
11.1.1 Trip Blank 1
11.1.2 Field Blank 1
11.1.3 Equipment Blank 1
11.1.4 Field Duplicates 2
11.2 BATCH QUALITY CONTROL SAMPLES 2
11.2.1 Method Blank 2
11.2.2 Laboratory Control Sample 2
11.2.3 Matrix Spike 3
11.2.5 Replicate 3

11.2.6 Surrogate 3
11.3 CALIBRATION VERIFICATION 4
11.4 STATISTICAL CONTROL 4
11.4.1 Definitions 4
11.4.1.1 Accuracy 4
11.4.1.2 Precision 5
11.4.1.3 Mean 5
11.4.1.4 Standard Deviation 5
11.4.2 Control Charts 6
11.5 DETECTION AND REPORTING LIMITS 6
11.5.1 Method Detection Limit 6
11.5.2 Practical (Estimated) Quantitation Limit 7

12.0 DATA REDUCTION 01/01/97
12. 1 DATA REDUCTION 1
12.1.1 Instrument Raw Data Output/Computer Data Files Identification 1
12.1.2 Regression Analyses 1
12.1.3 Conventional Chemistry 3
12.1.3.1 Colorimetric Analyses 3
12.1.3.2 Total Organic Carbon (TOC) and Petroleum Extractable Hydrocarbons 4
12.1.3.3 Titrimetric analyses 4
12.1.3.4 Total Organic Halides 5
12.1.3.5 Gravimetric Analyses 5
12.1.4 Metals 6
12.1.5 Organics 7
12.1.5.1 External Calibration 8
12.1.5.2 Internal Calibration 8
12.2 DATA REVIEW 9
12.3 DATA REPORTING (DOCUMENT CONTROL) 10
12.3 DATA VALIDATION 10
12.4 DATA STORAGE/ARCHIVAL 12
12.5 DOCUMENT CONTROL 13
12.5.1 Document Identification 13
12.5.2 Document Revision 13
12.5.2.1 Doucument Change Request Form 14

13.0 CORRECTIVE ACTION 01/01/97
13.1 QUALITY MEASUREMENTS 1
13.1.1 Primary and Secondary Data Review 1
13.1.2 Performance Audits 1

13.1.3 System Audits and Method Audits 2
13.2 SPL NONCONFORMANCE AND CORRECTIVE ACTION REQUEST FORM 3
13.3 CUSTOMER COMPLAINTS 5

14.0 PERFORMANCE AND SYSTEM AUDITS 01/01/97
14.1 PERFORMANCE EVALUATION SAMPLES 1
14.2 SYSTEM AUDITS 2

15.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT 01/01/97

3.0 INTRODUCTION

3.0 INTRODUCTION

SPL Corporation was formed in 1944 to provide quality service to the oil and gas industry. As environmental concerns and analytical technology expanded, SPL developed the capabilities and resources to provide the same quality services to the environmental industry. SPL environmental laboratories are fully equipped and staffed to provide a wide range of services and analyses. Results of analyses are used to meet the investigatory, regulatory, and legal requirements of clients. SPL is an independent commercial testing laboratory corporation, and provides services to its clients in various industries and governmental agencies.

This Comprehensive Quality Assurance Plan has been developed to provide information to clients concerning SPL's procedures and methods of compliance with quality concerns and requirements. It is intended to provide oversight for many of the procedures and routines followed to assure that the highest achievable standards are met. These standards are set by regulation, by SPL's clients, and by quality concerns internal to SPL. This manual is not exhaustive in its coverage, and specific projects may require more detailed and specific treatment. Standard Operating Procedures (SOPs) have been prepared for the actual test methods used by SPL and are the final reference for laboratory procedures.

3.1 QUALITY ASSURANCE / QUALITY CONTROL STATEMENT OF POLICY

It is the policy of SPL to provide accurate analytical services of verifiable quality. All standard operating procedures shall be designed to provide this quality. Equipment and supplies shall be obtained as needed to provide for the utilization of established technology and methodology. Personnel shall be fully qualified to perform the tests and analyses assigned through a combination of education, training and experience. Continuing education will be provided to ensure that each employee is knowledgeable and competent in their respective responsible analytical areas. Performance of personnel and equipment shall be continuously monitored and documented. Corrective action must be implemented and documented immediately if a quality problem arises. It is the objective of SPL to provide data that is of the greatest possible value and utility to the end-user of the test results.

SPL defines "Quality" as: The characteristics of a product that meet acceptable performance criteria. These criteria are established by governmental regulation, published methodologies and SPL policy. Also, project specific performance criteria may be established based on the project goals, needs, and constraints, and on SPL's commitment to service and technical excellence.

Quality Assurance includes all activities used to ensure and document the accuracy, precision, completeness, and representativeness of the analytical results. Quality Control includes the actions taken to obtain quality assessment data. These actions may include laboratory control

samples, blanks, matrix spikes and duplicate analyses, surrogate recoveries and blind samples.

3.2 LEVELS OF QUALITY CONTROL / REPORT OPTIONS

The quality control procedures and protocols described in this document are used to ensure the accuracy of analytical data. The quality control procedures and acceptance criteria required for a specific client or project may vary. Thus, the data quality objectives described in a Project Quality Assurance Plan will take precedence over the normal laboratory procedures if more stringent. The level of quality control is normally defined by the selection of one of the following:

- USEPA-approved methods for chemical analyses with normal laboratory QC procedures and QC report summaries.
- USEPA SW-846 Methods For Evaluating Solid Wastes analytical methods and QC as described for the method.
- USEPA Contract Laboratory Program and analytical protocols, QA/QC, and report preparation.

The level of QC and QC reporting requirements are a part of the initial project planning procedures. SPL offers four custom levels of Quality Assurance deliverables:

Level 1: Includes analytical results, method detection limits, date of analysis, analyst information, client information and sample information.

Level 2: Includes level 1 and limited QC data summaries. These summaries contain the following data: laboratory control sample, matrix spike, matrix spike duplicate, surrogate recovery and blanks.

Level 3: In addition to Level 2 data, the calibration summaries, and chromatograms are reported. SPL will also schedule QC samples by client or project delivery group if requested.

Level 4: In addition to level 3 reporting, raw data and instrument hard copies are reported. QC samples are from the client, even if not requested. CLP like deliverables are also available if requested.

Generally, SPL will use Level 2 unless otherwise directed by the client. The following table summarizes the documentation for each level of reporting:

3.2.1 SPL Levels of Reporting.

DOCUMENT	LEVEL 2	LEVEL 3	LEVEL 4
COVER PAGE		✓	✓
SIGNATURE PAGE	✓	✓	✓
NARRATIVE		✓	✓
CHAIN-OF-CUSTODY			
SAMPLE RECEIPT CHECKLIST	✓	✓	✓
SAMPLE RESULTS	✓	✓	✓
TICS			✓
SURROGATE RECOVERIES SUMMARY WITH LIMITS		✓	✓
MS/MSD SUMMARY	✓	✓	✓
LCS SUMMARY	✓	✓	✓
METHOD BLANK RESULTS	✓	✓	✓
METHOD BLANK RESULTS SUMMARY			✓
INSTRUMENT TUNES		✓	✓
INTERNAL STANDARD AREA AND RT SUMMARIES		✓	✓
INITIAL CALIBRATION SUMMARY		✓	✓
CONTINUING CALIBRATION SUMMARY		✓	✓
INITIAL AND CONTINUING CALIBRATION RAW DATA			✓
QUANTITATION REPORT		✓	✓
SAMPLE CHROMATOGRAMS		✓	✓
ICP INTERFERENCE CHECK SAMPLE			✓
ICP SERIAL DILUTION SUMMARY			✓
CDRL STANDARD			✓
POST DIGESTION SPIKE SAMPLE RECOVERY			✓
DUPLICATES SUMMARY			✓
STANDARD ADDITION RESULTS-METALS			✓
PREPARATION LOG			✓
ANALYSIS RUN LOG			✓
ICP LINEAR RANGE			✓
ICP INTERELEMENT CORRECTION FACTORS			✓
INSTRUMENT DETECTION LIMITS			✓

3.2.2 Data Package QA Level Cross Reference

SPL QA LEVEL	EPA QA LEVEL	DOD QA LEVEL
1	1	A
2	2	B

SPL QA LEVEL	EPA QA LEVEL	DOD QA LEVEL
3	3	C
4	4	D

3.2.3 Report Document Control.

Release of the final report may be authorized by the Laboratory Director, Project Managers, Quality Control Officers, and Laboratory Supervisors. Reports may only be released to the customer except when approved by the customer. SPL's facsimile transmissions indicate that it contains confidential information and that SPL will pay for its return if it was received in error. Amended reports will be identified by the reporting date and corrected copies will contain a mark in the report header that says "CORRECTED COPY". Subcontract laboratory reports will be included with SPL's report. Subcontracting outside of SPL's network is generally limited to dioxins, furans, and asbestos.

3.3 ANALYST TRAINING POLICY

SPL provides internal training courses, external training courses, basic training, and analytical training. All training records are maintained by the Quality Control Officers. The analyst training policy is defined in a Corporate Standard Operating Procedure # SPL/CE/MI-P08.02. The protocol provides guidance for bench-level basic and analytical training for new analysts. It also provides a method for documenting the training process. New analysts are evaluated by the supervisor as to their technical capability based on their educational level and their laboratory experience. The analyst is then placed in a category based on this evaluation. An Instrument Training Form is completed each time an analyst is trained on an instrument and it is submitted to the QC department for approval and archiving once it is complete. The completion date of bench training and analyst proficiency testing must be documented. Analyst proficiency is determined by the analysis of QC check standards. The presence of these forms and their up-to-date status is periodically audited by the Quality Control Officers.

SOP# SPL\CE\QA-P15.01 describes the protocol that is designed for monitoring the proficiency of analysts and this is a continuing process. The proficiency of trained analysts is measured by their performance on Performance Evaluation Samples (PE samples). PE samples may be single or double blind standards analyzed by the analyst. PE samples may be those submitted by the Quality Control Officer (QAO), by a client, or by a governmental agency. Consecutive failures for the same test requires the initiation of a Consecutive Performance Evaluation Failure Corrective Action Request. Resolution of this request must include additional training and evaluation of the analyst and must be completed within 2 weeks.

3.4 LABORATORY CERTIFICATIONS

SPL participates in laboratory certification programs for States, governmental agencies, and independent certifying entities. SPL's environmental laboratories analyze performance evaluation samples, provide QA/QC documentation, and are subject to site audits conducted by agencies, organizations, and clients. Section 3.1.1 lists the certifications or approvals held by each SPL environmental laboratory. For a more detailed list of certified parameters see the current Statement of Qualifications for SPL, or call any of the QA Officers at the Laboratory of interest.

3.4.1 Status of SPL Laboratory Certifications

SPL-HOUSTON, TEXAS

A2LA ..... Certification Number: 529.01
Arizona ..... Certification Number: AZ0050
Arkansas ..... Certification Number: Not Applicable
Army Corps of Engineers ..... Certification Number: Not Applicable
California ..... Certification Number: 1903
Florida [DER-Corporate] ..... Certification Number: 900450G
Florida [HRS] ..... Certification Number: E87245
Iowa ..... Certification Number: 125
Kansas ..... Certification Number: E-10185
Oklahoma ..... Certification Number: 8714
Minnesota ..... Certification Number: 048-999-344
New Jersey ..... Certification Number: 82961
North Carolina ..... Certification Number: 443
North Dakota..... Certification Number R-143
Rhode Island ..... Certification Number: 147
South Carolina ..... Certification Number: 82008
Tennessee ..... Certification Number: Not Applicable
Washington ..... Certification Number: C156

SPL-LAFAYETTE AREA, LOUISIANA

A2LA ..... Certification Number: 451.01
Arkansas ..... Certification Number: Not Applicable
Florida [DER] ..... Certification Number: 900450G
North Carolina ..... Certification Number: 487
North Dakota ..... Certification Number R-144

South Carolina ..... Certification Number: 73004
Tennessee ..... Certification Number: Not Applicable
Utah ..... Certification Number: E-155
West Virginia ..... Certification Number: 257
Wisconsin ..... Certification Number: 999993060

SPL-TRAVERSE CITY, MICHIGAN

Florida [DER] ..... Certification Number: 900450G
Iowa ..... Certification Number 116
Wisconsin ..... Certification Number: 998020320

SPL-FULLERTON, CALIFORNIA

Arizona ..... Certification Number: AZ0486
Arizona (Mobile Lab) ..... Certification Number: AZ0487
California ..... Certification Number: 1955

4.0 ORGANIZATIONAL STRUCTURE

4.0 ORGANIZATIONAL STRUCTURE

SPL is structured to function as a network rather than as individual laboratories. This network structure includes several positions dedicated to interoffice management. This provides a client, who has large projects that extend over vast geographical areas, the advantage of continuity between SPL laboratories. The continuity is apparent in similar report formats and quality control procedures. Also, the client has global access to all of SPL's laboratories through the network corporate positions. This is an asset when the client requires special invoicing or reporting procedures, problem solving, and special sample handling.

4.1 CORPORATE LABORATORY STRUCTURE

SPL's corporate structure is shown in Section 4.5.

4.1.1 President. The office of president and chief executive officer is held by Mr. Herman Brown. Mr. Brown is located in the Houston laboratory. The president and CEO of SPL determines the corporate goals, policies and structure. He also approves major equipment purchases and oversees strategic planning.

4.1.2 Corporate Director of Analytical Services. This corporate position provides global management of SPL laboratories. This position is occupied by Mr. Bo Blankfield who is based in the SPL-Houston laboratory. All laboratory managers report to him. He has operational oversight of all SPL laboratories. He hires laboratory managers and approves equipment purchases. He is responsible for long term company strategies. He also is involved in the distribution of corporate accounts among the laboratories. He assures that laboratories have redundant instrumentation within and between laboratories. He oversees interoffice communication between laboratories on joint projects.

4.1.3 Corporate Technical Director. This position is occupied by Mr. David Sommers, located at the Houston laboratory. He is responsible for monitoring federal regulations and the publication of new methodologies. He also coordinates SPL's in house training program. He serves as a technical information resource for the company and its clients.

4.1.4 Corporate Quality Assurance/Quality Control Director. This position is held by Mr. John Durand who is based at the Lafayette area laboratory and he reports directly to the president. He is responsible for developing and maintaining the quality assurance and quality control policies and procedures for the company. He oversees the regional QC officers. He is responsible for assuring that all SPL laboratories conform to state and federal regulations. He also updates and implements SPL's quality assurance plan. He oversees state certification of SPL's laboratories.

4.1.5 Corporate Vice President of Sales. This position is held by Mr. Craig Falgout, located at the Lafayette laboratory. He coordinates SPL's marketing effort. He also serves as an advocate for the client, handling customer complaints. All marketing employees report to him.

4.1.6 Corporate Vice President of Accounts. This position is held by Mr. Wayne Boling, located at the Lafayette laboratory. He oversees projects and assures that client's needs are met and he coordinates projects that involve more than one SPL laboratory.

4.1.7 Corporate MIS Director. This position is held by Mr. Richard Kosiba, located at the Houston laboratory. SPL's programers report to him. His department writes LIMs programs, performs database management, performs network management, and manages computer system purchases.

4.2 CORPORATE QUALITY ASSURANCE/QUALITY CONTROL STRUCTURE

SPL's corporate quality assurance/quality control (QA/QC) program is structured to provide the QC staff with direct access to the president. The local QC officer operates independently from the laboratory manager. This provides the QC Officer with freedom to perform audits, request corrective actions, and perform other activities.

4.3 LABORATORY STRUCTURE AND RESPONSIBILITIES

4.3.1 Laboratory Manager. Each laboratory manager is responsible for the day to day activities, hiring practices, and overseeing the regional department supervisors. He is responsible for the methods used by the laboratory, as well as the general flow of samples and data. He approves small equipment purchases. Laboratory managers also often serve as secondary contacts for clients, where project managers serve as the primary contact. He is also responsible for the implementation of quality control procedures outlined in the Quality Assurance Plan.

4.3.2 Quality Control Officers. The principal responsibility of the regional QA/QC officer is to oversee SPL in-house quality control programs: detecting improper methodology and inaccurate data, initiation of corrective actions, developing standard operating procedures (SOPs) for all aspects of the laboratory operations, initiating and overseeing both internal SPL audits and external audits of non-SPL laboratories, final data validation according to QC criteria, and ensuring the application of appropriate levels of QC by the analysts. Their duties also include compiling and submitting quality assurance plans. These positions are held by Idelis Williams and Cynthia Schreiner at the Houston laboratory, Karen Grizzaffi at the Lafayette laboratory, Ann Benningfield at the Michigan Laboratory, and Adrienne Tapia at the Fullerton laboratory.

4.3.3 Project Managers. The Project managers review chain of custodies for accuracy, coordinate analyses, review the final report, monitor holding times, write case narratives, and advise clients. They also respond to bid proposals. They work closely with the sample management officer whose department is responsible for sample receipt, sample storage, and sample kit preparation. Samples are compared to the COC by the sample management personnel upon arrival. Discrepancies are reported to the sample management officer and the project manager so that the customer can be contacted. The sample management personnel are responsible for verifying the preservation of samples, checking the temperature at which it is received and proper storage of samples. They also are responsible for preparing and shipping sampling kits with the proper containers and preservatives.

4.3.4 Laboratory Supervisors. The supervisors are responsible for the delegation of work within their section. They are also responsible for hiring and training their staff. They must assure that analytical tests are performed accurately, on time, and that the proper protocol is employed. They are responsible for implementing the QA/QC guidelines established by regulation and SPL's QA Plan.

4.3.5 Laboratory Technicians. The laboratory technicians are responsible for being familiar with and following the procedures and policies contained in the QA Plan and standard operating procedures. They are also responsible for conducting routine maintenance, standardization, and calibration of instruments and other analytical equipment. They must report all irregular results to the laboratory supervisor.

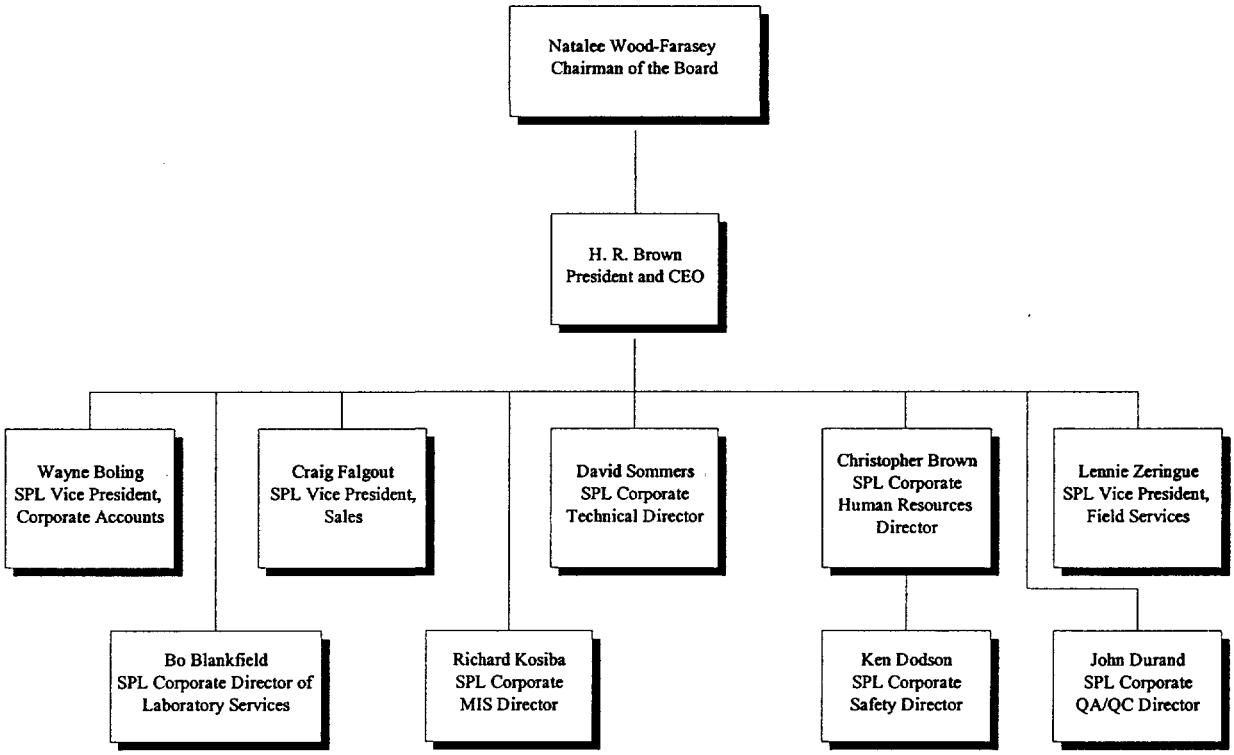
4.4 CORPORATE HUMAN RESOURCES STRUCTURE AND RESPONSIBILITIES

4.4.1 Human Resources Director. The human resources (HR) director is responsible for: developing and communicating SPL's employment policies and practices, handling employee grievances, and managing the service award program. The HR director also supervises the corporate safety director. This position is held by Mr. Christopher Brown and is located at the Houston corporate office .

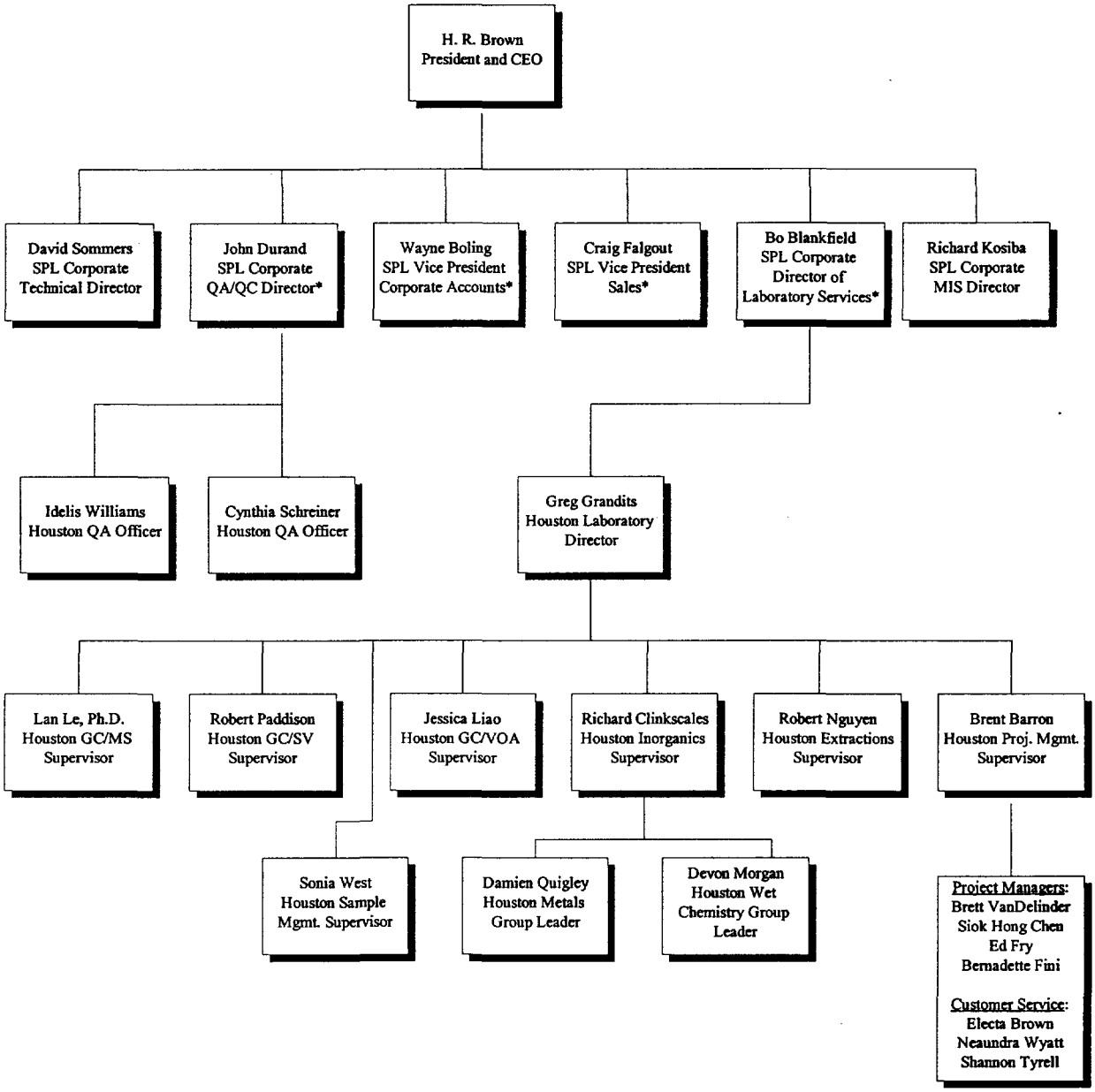
4.4.2 Corporate Safety Director. The corporate safety director manages the safety program for SPL. This includes preparing a chemical hygiene plan and assuring that each laboratory has a current chemical inventory. The safety director also inspects safety equipment such as eyewash stations, emergency showers, fume hoods, and fire extinguishers. He is in charge of safety training and the SARA Title III (right-to-know) program. This position is held by Mr. Ken Dodson and is located at the Houston corporate office.

4.5 ORGANIZATIONAL CHARTS

4.5.1 Corporate Environmental Laboratory Organizational Chart

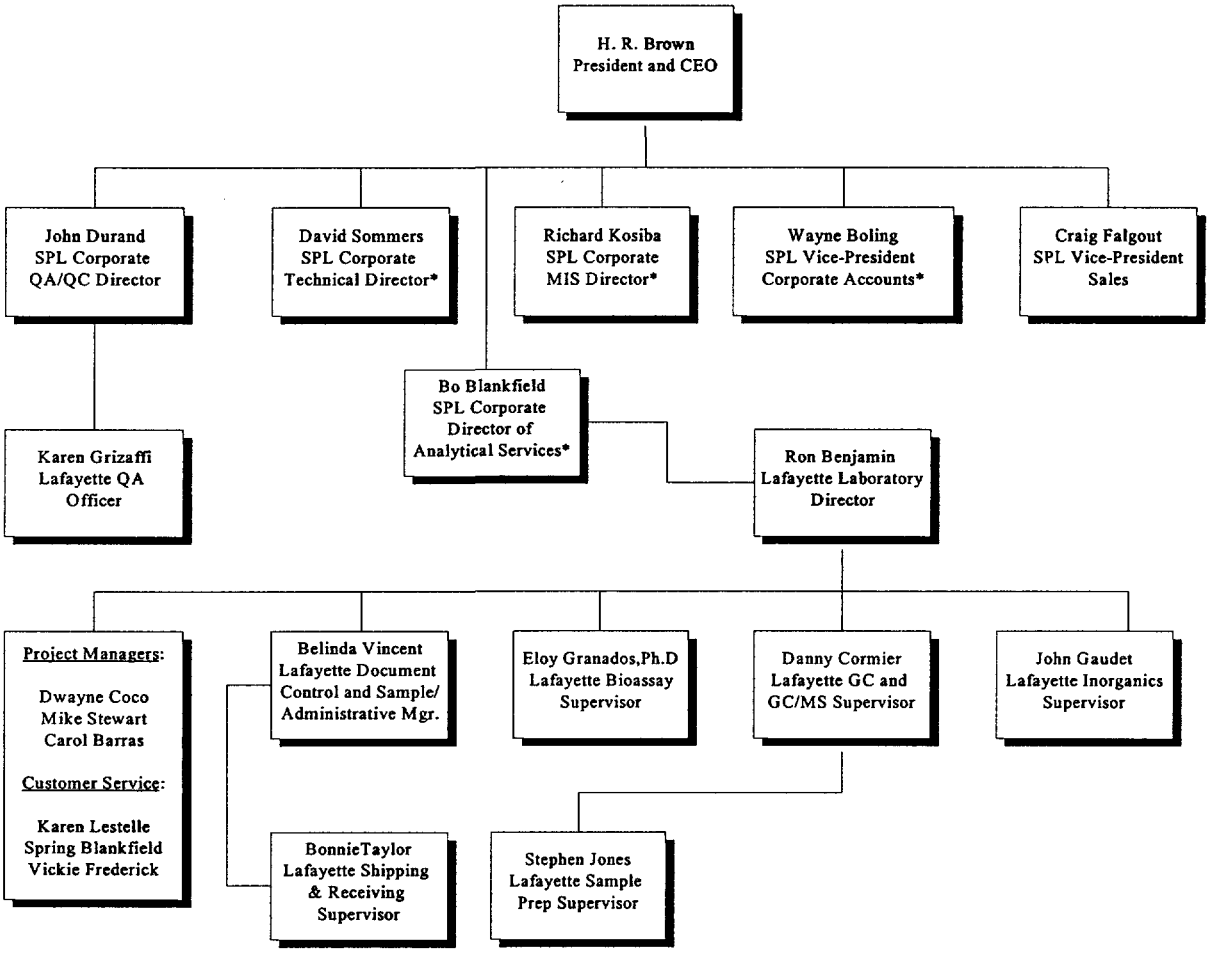


4.5.2 Houston Environmental Laboratory



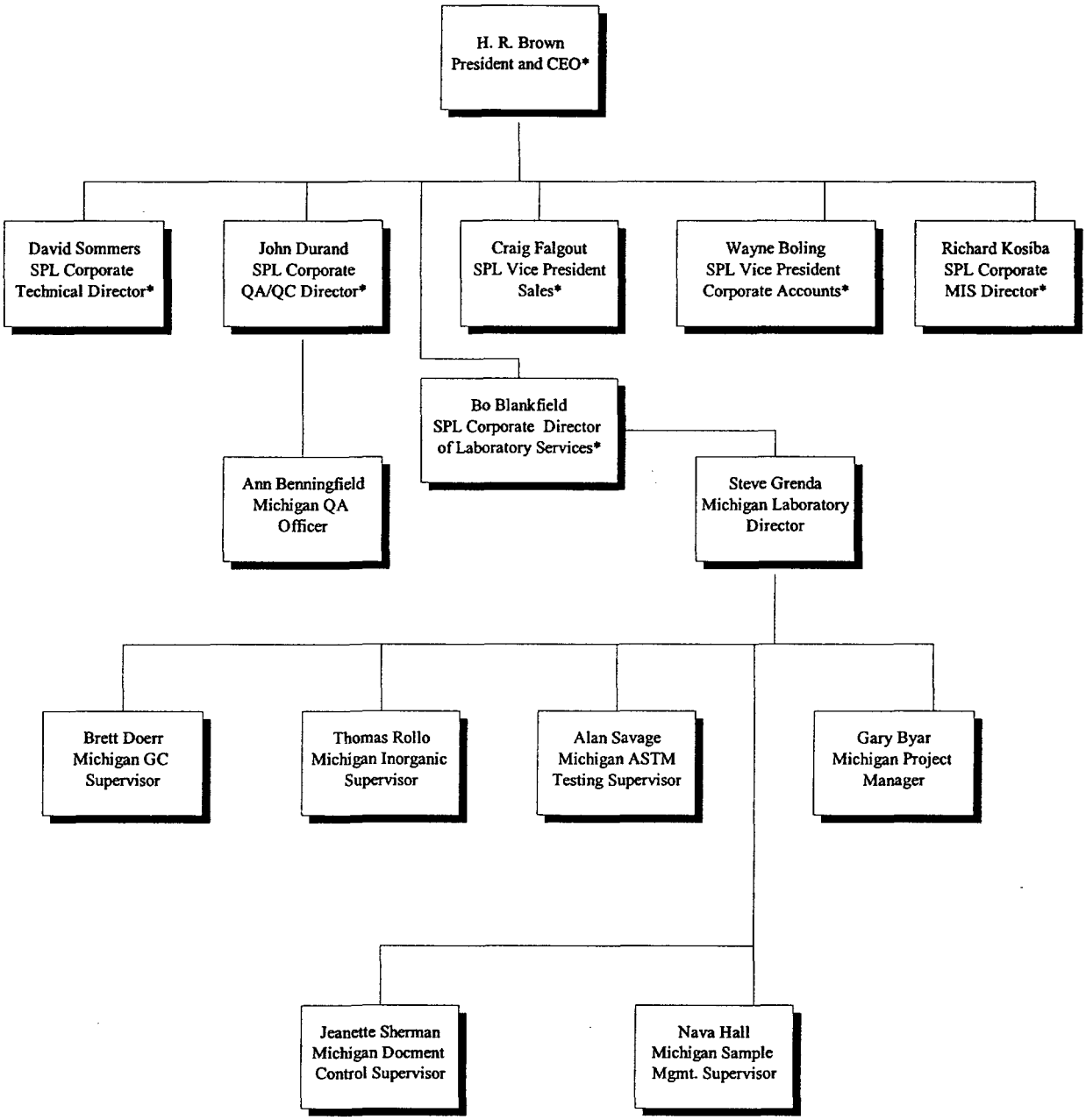
*These individuals are officed in SPL's Lafayette, LA facility but are shown on the organizational chart for accuracy in delineating supervisory and reporting responsibilities.

4.5.3 Lafayette Environmental Laboratory



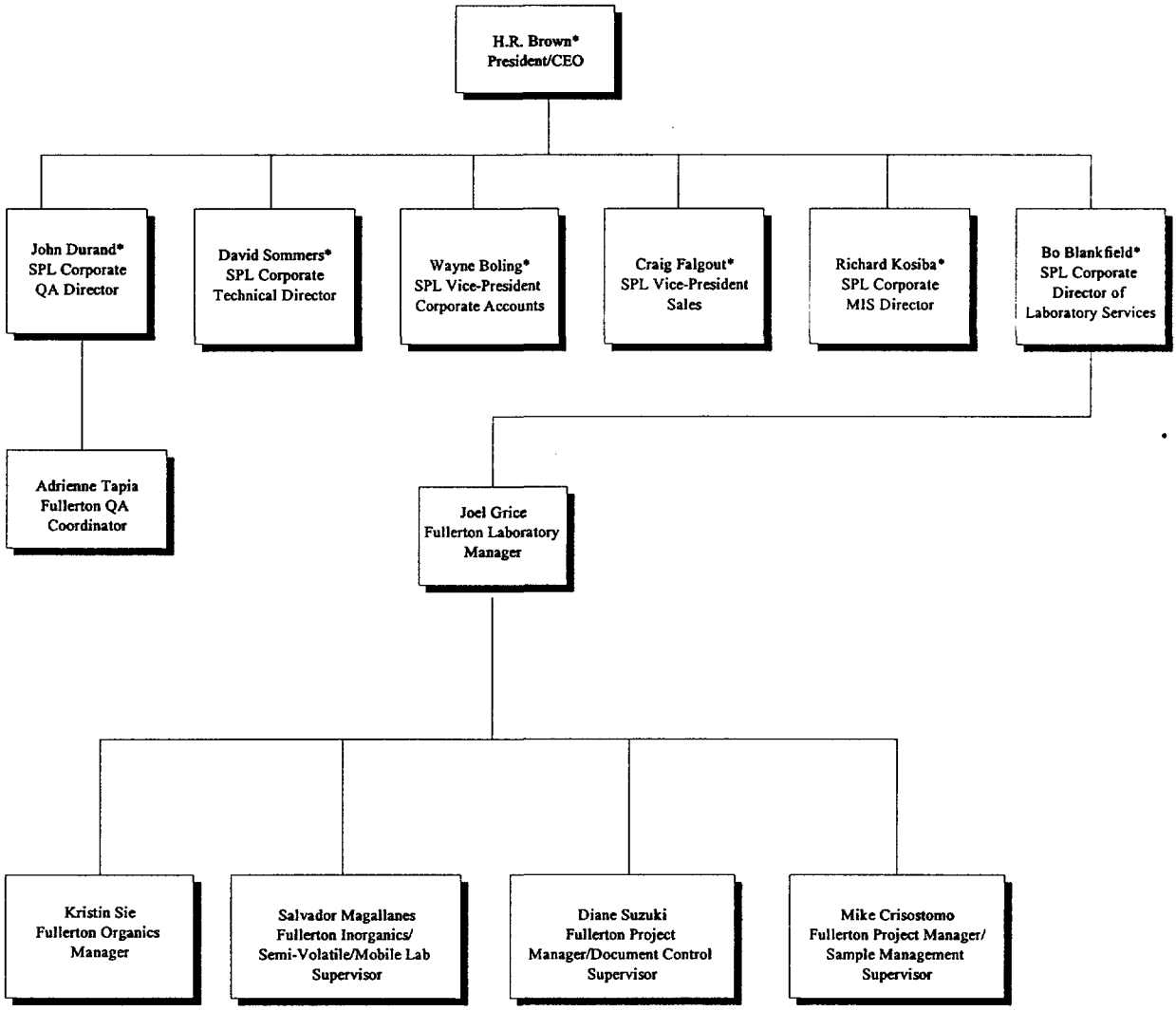
*These individuals are officed in SPL's Houston and Lafayette facilities but are shown on the organizational chart for accuracy in delineating supervisory and reporting responsibilities.

4.5.4 Michigan Environmental Laboratory



*These individuals are officed SPL's Houston and Lafayette facilities but are shown on the organizational chart for accuracy in delineating supervisory and reporting responsibilities.

4.5.5 Fullerton Environmental Laboratory



*These individuals are officed in SPL's Houston and Lafayette facilities but are shown on the organizational chart for accuracy in delineating supervisory and reporting responsibilities.

4.6 Laboratory Addresses and Phone Numbers.

SPL-Houston Corporate Office and Laboratory
8880 Interchange
Houston, Texas 77054
Phone: 713-660-0901
Fax: 713-660-8975

SPL-Lafayette Area Laboratory
500 Ambassador Caffery Parkway
Scott, La 70583
Phone: 318-237-4775
Fax: 318-237-8005

SPL-Traverse City Laboratory
459 Hughes Drive
Traverse City, Michigan 49686
Phone: 616-947-5777
Fax: 616-947-7455

SPL-Fullerton Laboratory
1511 East Orangethorpe Avenue
Fullerton, California 92631
Phone: 714-447-6868
Fax: 714-447-6800

5.0 QUALITY ASSURANCE OBJECTIVES

5.0 QUALITY ASSURANCE OBJECTIVES

The overall QA objective is to develop and implement procedures for chain of custody, laboratory analysis, and reporting that will provide results that are defensible. Specific procedures for chain of custody, laboratory analysis, reporting of data, audits, and preventive maintenance are described in other sections of this GAM. The purpose of this section is to address the specific objectives for accuracy, precision and completeness for the most commonly requested parameters. The laboratory may do work on specific projects that may require more stringent criteria than the lab's normal operating basis. In these cases a project specific QA objective plan may be required.

5.1 QUALITY CONTROL SAMPLE CRITERIA

5.1.1 Summary of Precision, Accuracy, and Completeness Objectives for Laboratory QC Samples

Parameter	Method	Matrix	Precision (RPD)	Accuracy % Recovery	Completeness (%)
Metals	6000/7000 Series	Soil	20	75-125	90
		Water	20	75-125	90
Total Cyanide	9010	Water	20	75-125	90
		Soil	20	75-125	90
Total Phenols	9065	Water	20	75-125	90
		Soil	20	75-125	90
Volatile Organics	EPA CLP SOW or SW-846				
1,1-Dichloroethene		Water	14	61-145	90
		Soil	22	59-172	90
Trichloroethene		Water	14	71-120	90
		Soil	24	62-137	90
Benzene		Water	11	76-127	90
		Soil	21	66-142	90
Toluene		Water	13	76-125	90
		Soil	21	59-139	90
Chlorobenzene		Water	13	75-130	90
		Soil	21	60-133	90
Semivolatile Organics	EPA CLP SOW or SW-846				

5.1.1 Summary of Precision, Accuracy, and Completeness Objectives for Laboratory QC Samples

Parameter	Method	Matrix	Precision (RPD)	Accuracy % Recovery	Completeness (%)
Phenol		Water	42	12-110	90
		Soil	35	26-90	90
2-Chlorophenol		Water	40	27-123	90
		Soil	50	25-102	90
1,4-Dichlorobenzene		Water	28	36-97	90
		Soil	27	28-104	90
N-Nitroso-di-n-prop.		Water	38	41-116	90
		Soil	38	41-126	90
1,2,4-Trichlorobenzene		Water	28	39-98	90
		Soil	23	38-107	90
4-Chloro-3-methy-phenol		Water	42	23-97	90
		Soil	33	26-103	90
Acenaphthene		Water	31	46-118	90
		Soil	19	31-137	90
2,4-Dinitrotoluene		Water	38	24-96	90
		Soil	47	28-89	90
4-Nitrophenol		Water	50	10-80	90
		Soil	50	11-114	90
Pentachlorophenol		Water	50	9-103	90
		Soil	47	17-109	90
Pyrene		Water	31	26-127	90
		Soil	36	35-142	90
Pesticides	EPA CLP SOW or SW-846				
Lindane		Water	20	56-123	90
		Soil	20	46-127	90
Heptachlor		Water	20	40-111	90
		Soil	20	35-111	90
Aldrin		Water	20	40-120	90
		Soil	20	34-132	90
Dieldrin		Water	20	52-126	90
		Soil	20	31-134	90

5.1.1 Summary of Precision, Accuracy, and Completeness Objectives for Laboratory QC Samples

Parameter	Method	Matrix	Precision (RPD)	Accuracy % Recovery	Completeness (%)
Endrin		Water	20	56-121	90
		Soil	20	42-139	90
4,4-DDT		Water	20	38-127	90
		Soil	20	23-134	90

5.1.2 Surrogates

Parameter	Method	Matrix	% Recovery
Volatile Organics	EPA CLP SOW or SW-846		
Toluene-D8		Soil	81-117
		Water	88-110
4-Bromofluorobenzene		Soil	74-121
		Water	86-115
1,2-Dichloroethane-D4		Soil	70-121
		Water	76-114
Semivolatile Organics	EPA CLP SOW or SW-846		
Nitrobenzene-D5		Soil	23-120
		Water	35-114
2-Fluorobiphenyl		Soil	30-115
		Water	43-116
p-Terphenyl-d14		Soil	18-137
		Water	33-141
Phenol-d5		Soil	24-113
		Water	10-94
2-Fluorophenol		Soil	25-121
		Water	21-100
2,4,6-Tribromophenol		Soil	19-122
		Water	10-123
Pesticides/PCB"s	EPA CLP SOW or SW-846		
Decachlorobiphenyl		Soil	60-150
		Water	60-150
Tetrachloro-m-xylene		Soil	60-150
		Water	60-150
Total Petroleum Hydrocarbons	8015B		

5.1.2 Surrogates

Parameter	Method	Matrix	% Recovery
Gasoline Range Organics		Soil	50-150
		Water	50-150
Diesel Range Organics		Soil	20-150
		Water	20-150
Gasoline Range Organics	AK101.0	Soil	50-150
		Water	50-150
Diesel Range Organics	AK102.0	Soil	50-150
		Water	50-150
Gasoline Range Organics	API Method	Soil	50-150
		Water	50-150
Diesel Range Organics		Soil	50-150
		Water	50-150
Gasoline Range Organics	California-Luft	Soil	50-150
		Water	50-150
Diesel Range Organics		Soil	20-150
		Water	20-150
Gasoline Range Organics	Iowa-OA-1	Soil	50-150
		Water	50-150
Diesel Range Organics	Iowa-OA-2	Soil	20-150
		Water	20-150
Gasoline Range Organics	Oklahoma-8015	Soil	50-150
		Water	50-150
Diesel Range Organics	Oklahoma-8015	Soil	20-150
		Water	20-150
Gasoline Range Organics	Oregon-TPH-G	Soil	50-150
Diesel Range Organics	Oregon-TPH-D	Soil	50-150
Gasoline Rnage Organics	Tennessee Method	Soil	50-150
		Water	50-150
Diesel Range Organics	Tennessee Method	Soil	50-150
		Water	50-150
Gasoline Range Organics	Washington-WTHP-G	Soil	50-150
		Water	50-150
Diesel Range Organics	Washington-WTHP-D	Soil	50-150
		Water	50-150

5.1.2 Surrogates

Parameter	Method	Matrix	% Recovery
Gasoline Range Organics	Wisconsin-GRO	Soil Water	Minimum 80 Minimum 80
Diesel Range Organics	Wisconsin-DRO	Soil Water	Minimum 80 Minimum 80

5.2 MINIMUM QC ACCEPTANCE CRITERIA

5.2.1 EPA 600 Series Conventional Chemistry

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Correlation Coeff. $\geq$ 0.995. Must have calibration blank and 3 to 5 standards.	Method dependent, minimum once per quarter.	Generate new calibration curve.
Daily Calibration Verification	% Diff < 10 % from initial Calibration.	Each day. Also after every 10 samples.	Reanalyze or, Generate new calibration curve.
Method Blank	< Detection Limit or < 5 % of regulatory limit.	Each extraction batch.	Reextract, or change solvent lot.
Lab Control Sample (LCS)	Based on lab established control limits. Also should be < 10% diff.	Each extraction batch.	Recalibrate, or if necessary re-analyze.
Matrix Spike	Based on lab established control limits.	Every 10 samples.	Case Narrative if Necessary
Duplicates	Based on lab established control limits.	Every 10 samples.	Case Narrative if Necessary

5.2.2 EPA 200 Series Atomic Absorption Methods

QC Parameter	Acceptance Criteria	Frequency	Correction
Calibration Curve	Linear: Stds must be within 10% of true value. Must have calibration blank and at least 4 stds.	Must Calibrate each day.	Recalibrate

5.2.2 EPA 200 Series Atomic Absorption Methods

QC Parameter	Acceptance Criteria	Frequency	Correctiction
Initial Calibration Blank (ICB)	< Detection Limit	1 per batch.	Recalibrate
Continuing Calibration Blank (CCB)	< Detection Limit	Every 20 samples.	Recalibrate and reanalyze to last passing CCB
Method Blank	< Detection Limit, or < 5% of the regulatory limit, or < 5% of the sample result.	Each digestion batch.	Redigest & reanalyze entire batch.
Initial Calibration Verification (ICV)	+/- 10% of true value.	1 per batch, independent source.	Recalibrate
Continuing Calibration Verification (CCV)	+/- 10% of true value.	Every 20 samples, every 10 samples for furnace, and at end of batch.	Recalibrate and reanalyze to last passing CCV.
Lab Control Sample (LCS)	+/- 20% of true value[1]. (Mandatory)	Each batch.	Recalibrate, or if necessary re-digest.
Matrix Spike	AA , GFAA: 75-125% recovery	Every 10 samples.	Case Narrative if Necessary
Duplicates	20% RPD	Every 10 samples	Case Narrative if Necessary
Serial Dilution (Req. for Furnace)	+/- 10% of original value	When needed	Perform MSA

1. Requirement to be based on control chart, 20% is criteria used when sufficient data is unavailable for control charts.

5.2.3 EPA Method 200.7, Metals by ICP

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Must have a calibration blank and one std.	Must Calibrate each day.	Recalibrate
Initial Calibration Blank (ICB)	< Detection Limit	1 per batch.	Recalibrate
Continuing Calibration Blank (CCB)	< Detection Limit	Every 10 samples analyzed after the CCV.	Recalibrate and reanalyze to last passing CCB

5.2.3 EPA Method 200.7, Metals by ICP

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Method Blank	N/A	Each digestion batch.	Background subtraction is Mandatory.
Initial Calibration Verification (ICV)	+/- 5% of true value.	1 per batch, independent source.	Recalibrate
Continuing Calibration Verification (CCV)	+/- 5% of true value.	After every 10 samples. Should end on a CCV.	Recalibrate and reanalyze to last passing CCV.
Lab Control Sample (LCS)	+/- 10% of true value.	Each batch.	Recalibrate, or if necessary re-digest.
Matrix Spike	90-110% recovery	Every 20 samples.	Case Narrative if Necessary
Duplicates	Not specified.		
Interference Check Standard	+/- 1.5 times Std. Dev. of mean value.	Begin & End of each run OR twice in 8 hours	Recalibrate, Recheck: background and interelement corrections
Serial Dilution	+/- 5% of original value.	When sample result is > 10 times IDL.	Perform MSA

5.2.4 EPA Total Petroleum Hydrocarbons, Method 418.1

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Correlation Coeff. > 0.995. Must have calibration blank and five std.	Quarterly	Recalibrate new 5 point
Calibration Verification	% Diff < 10 % from initial Calibration.	Each day before samples are analyzed and every 10 samples.	Reanalyze or, Recalibrate with new 5 point.
Method Blank	< Detection Limit or < 5 % of regulatory limit.	Each extraction batch.	Reextract, or change solvent lot.

5.2.4 EPA Total Petroleum Hydrocarbons, Method 418.1

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Lab Control Sample (LCS)	Based on lab established control limits. Also should be < 10% diff.	Each extraction batch.	Recalibrate, or if necessary re-extract.
Matrix Spike	Based on lab established control limits.	Every 20 samples.	Case Narrative if Necessary
Matrix Spike Duplicates	Based on lab established control limits.	Every 20 samples.	Case Narrative if Necessary

5.2.5 EPA Method 601, Volatile Organics

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 10 % RSD. Must have calibration blank and three std.	As needed.	Recalibrate new 3 point
Daily Calibration Verification	QC Table 2 in method.	Each day.	Reinject or, Recalibrate with new 3 point.
Method Blank	< Detection Limit	Each batch.	Re-analyze
Lab Control Sample (LCS)	QC Table 2 in method.	10 % of samples (may be reduced if MS/MSDs meet QC criteria).	Recalibrate and re-analyze.
Matrix Spike	Must pass QC Acceptance Criteria on method.	10% of samples.	Case Narrative if Necessary
Matrix Spike Duplicates[1]	Must pass QC Acceptance Criteria on method.	10% of samples.	Case Narrative if Necessary
Internal Standards	Based on lab established control limits.	Every standard, blank, and sample	Reinject, or if necessary reextract.
Surrogates	Based on lab established control limits.	Every standard, blank, and sample	Re-analyze, or flag surrogate data with « and Case Narrative.

1. SPL internal requirement.
2. Confirmation by 2nd column or GC/MS should be used for unfamiliar samples.
3. Note: Retention time windows should be calculated when there is a system or column change.

5.2.6 EPA Method 602, Volatile Aromatic Hydrocarbons

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 10 % RSD. Must have calibration blank and three std.	As needed.	Recalibrate new 3 point
Daily Calibration Verification	QC Table 2 in method.	Each day.	Reinject or, Recalibrate with new 3 point.
Method Blank	< Detection Limit.	Each extraction batch.	Take corrective step and re-analyze batch or flag reports with B.
Lab Control Sample (LCS)	QC Table 2 in method.	10 % of samples (may be reduced if MS/MSDs meet QC criteria).	Recalibrate and re-analyze.
Matrix Spike	QC Table 4 in method.	Every 10 samples.	Case Narrative if Necessary
Matrix Spike Duplicates	Not specified in method.	Not specified in method.	Case Narrative if Necessary
Internal Standards	Based on lab established control limits.	Every standard, blank, and sample	Re-analyze sample. Case narrative if necessary.
Surrogates	Based on lab established control limits.	Every standard, blank, and sample	Re-analyze, or flag surrogate data with « and Case Narrative.

Note: Retention time windows should be calculated when there is a system or column change.

5.2.7 EPA Method 608, Pesticides

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 10 % RSD. Must have calibration blank and three std	.As needed.	Recalibrate new 3 point

5.2.7 EPA Method 608, Pesticides

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Daily Calibration Verification	± 15 % of true value.	Each day.	Reinject or, Recalibrate with new 5 point.
Method Blank	< Detection Limit or < 5 % of regulatory limit.	Each extraction batch.	Reextract.
Lab Control Sample (LCS)	QC Table 3 in method.	10 % of samples (may be reduced if MS/MSDs meet QC criteria).	Recalibrate, or if necessary re-extract.
Matrix Spike	QC Table 4 in method.	Every 10 samples.	Case Narrative if Necessary
Matrix Spike Duplicates	Not specified in method.	Not specified in method.	Case Narrative if Necessary
Internal Standards	Based on lab established control limits.	Every standard, blank, and sample	Reinject, or if necessary reextract.
Surrogates	Based on lab established control limits.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.

Note: Retention time windows should be calculated when there is a system or column change.

5.2.8 EPA Method 624, Volatile Organics by GC/MS

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 35 % RSD. Must have calibration blank and three std.	As needed.	Recalibrate new 3 point
Daily Calibration Verification (QC Check sample)	QC Table 5 in method.	Daily	Reinject or, Recalibrate with new 3 point.

5.2.8 EPA Method 624, Volatile Organics by GC/MS

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Method Blank	< Detection Limit	Each analytical batch, Daily.	Reanalyze blank, determine & eliminate source of contamination.
Lab Control Sample (LCS)	QC Table 5 in method	5 % of samples (may be reduced if MS/MSDs meet QC criteria).	Recalibrate, and re-analyze.
Matrix Spike	QC Table 5 in method	5% of samples.	Case Narrative if Necessary
Matrix Spike Duplicates	QC Table 5 in method	5% of samples.	Case Narrative if Necessary
Internal Standards	Not specified in method.	Every standard, blank, and sample.	Reinject, or if necessary reextract
Surrogates	Not specified in method.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Tune - BFB	Table 2 in method.	Daily.	Trouble shoot and retune until passes.

5.2.9 EPA Method 625, Semivolatile Organics by GC/MS

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 35 % RSD. Must have calibration blank and three std	As needed.	Recalibrate new 3 point
Daily Calibration Verification	± 20 % of true value	Daily	Reinject or, Recalibrate with new 3 point.
Method Blank	< Detection Limit	Each extraction batch.	Reextract.

5.2.9 EPA Method 625, Semivolatile Organics by GC/MS

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Lab Control Sample (LCS)	QC Table 6 in method	5 % of samples (may be reduced if MS/MSDs meet QC criteria).	Recalibrate, or if necessary re-extract.
Matrix Spike	QC Table 6 in method	5% of samples.	Case Narrative if Necessary
Matrix Spike Duplicates	QC Table 6 in method	5% of samples.	Case Narrative if Necessary
Internal Standards	Not specified in method.	every standard, blank, and sample.	Reinject, or if necessary reextract
Surrogates	Not specified in method.	every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Tune - DFTPP	Table 9 in method.	Daily.	Trouble shoot and retune until passes.

5.2.10 EPA Method 6010A, Metals by ICP

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Must have a calibration blank and three stds.	Must Calibrate each day.	Recalibrate
Initial Calibration Blank (ICB)	< Detection Limit	1 per batch.	Recalibrate
Continuing Calibration Blank (CCB)	< Detection Limit	Every 10 samples analyzed after CCV.	Recalibrate and reanalyze to last passing CCB
Method Blank	< Detection Limit, or < 5% of the regulatory limit, or < 5% of the sample result.	Each digestion batch.	Redigest & reanalyze.
Initial Calibration Verification (ICV)	+/- 5% of true value.	1 per batch, independent source.	Recalibrate

5.2.10 EPA Method 6010A, Metals by ICP

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Continuing Calibration Verification (CCV)	+/- 10% of true value.	Every 10 samples and at end of batch.	Recalibrate and reanalyze to last passing CCV.
Lab Control Sample (LCS)	+/- 20% of true value[1]. (Mandatory)	Each batch.	Recalibrate, or if necessary re-digest.
Matrix Spike	80-120% recovery	Every 20 samples.	Case Narrative if Necessary
Matrix Spike Duplicate	80-120% recovery. 20% RPD	Every 20 samples	Case Narrative if Necessary
Interference Check Standard	+/- 20% of true value.	Begin & End of each run OR twice in 8 hours	Recalibrate, Recheck: background and interelement corrections
Serial Dilution	+/- 10% of original value	When needed	Perform MSA
Linear Range Check	+/- 5%	Quarterly	

1. Requirement to be based on control chart, 20% is criteria used when sufficient data is unavailable for control charts.

5.2.11 EPA 7000A Method Series, Metals by Atomic Absorption

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration Curve	Linear Rev 1).Calib. Ref. std must be within 10% of true value.	Must have calibration blank and at least 3 stds. Must Calibrate each day.	Recalibrate
Initial Calibration Blank (ICB)	< Detection Limit	1 per batch.	Recalibrate
Continuing Calibration Blank (CCB)	< Detection Limit	Every 20 samples.	Recalibrate and reanalyze to last passing CCB

5.2.11 EPA 7000A Method Series, Metals by Atomic Absorption

Method Blank	< Detection Limit, or < 5% of the regulatory limit, or < 5% of the sample result.	Each digestion batch.	Redigest & reanalyze entire batch.
Initial Calibration Verification (ICV)	+/- 10% of true value[1].	1 per batch, independent source.	Recalibrate
Continuing Calibration Verification (CCV)	+/- 20% of true value[2].	Every 10 samples and at the end of the batch.	Recalibrate and reanalyze to last passing CCV.
Lab Control Sample (LCS)	+/- 20% of true value[3] (Mandatory)	Each batch.	Recalibrate, or if necessary re-digest.
Matrix Spike	AA, GFAA: 75-125% recovery.(Advisory)	Every 20 samples.	Case Narrative if Necessary
Matrix Spike Duplicate	75-125% recovery. 20% RPD (Advisory)	Every 20 samples	Case Narrative if Necessary

1. Revision 1 requires 10%. CLP allows 20% for mercury 10% for others.
2. Rev. 1 require 20%.
3. Requirement to be based on control chart, 20% is criteria used when sufficient data is unavailable for control charts.

5.2.12 EPA 8000A Method Series, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 20 % RSD	Must have calibration blank and five std.	Recalibrate new 5 point
Daily Calibration Verification	< 15% diff from initial response.	Each day.	Reinject or, Recalibrate with new 5 point.
Continuing Calibration Verification	% Diff for RF < 15% from initial RF.	Every 10 samples and at the end of the batch.	Reinject or, Recalibrate with new 5 point.
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.

5.2.12 EPA 8000A Method Series, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Lab Control Sample (LCS)	QC Table in method.	Each extraction batch.	Recalibrate, or if necessary re-extract.
Matrix Spike	QC Table 4 in method.	Every 20 samples.	Case Narrative if Necessary
Matrix Spike Duplicates	QC Table 4 in method.	Every 20 samples.	Case Narrative if Necessary
Internal Standards	Based on lab established control limits.	Every standard, blank, and sample	Reinject, or if necessary reextract.
Surrogates	Based on lab established control limits.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	< 3 times standard deviation of 3 stds analyzed over 72 hours.	Each time column replaced or conditions change.	Re-establish window.

Note: 2nd column confirmation should be employed if necessary.

5.2.13 EPA Method 8240B, Volatile Organics by GC/MS

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 30 % RSD for CCCs and < 15% for all other compounds. Must have calibration blank and five std	As needed.	Construct calibration curve using 1st or higher regression fit.
Daily Calibration Verification	% Drift for conc. < 20% for CCCs. Min RF for SPCCs is 0.300 (0.10 for Bromoform).	Every 12 hours.	Reinject or, Recalibrate with new 5 point.

5.2.13 EPA Method 8240B, Volatile Organics by GC/MS

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each analytical batch.	Reanalyze blank, determine & eliminate source of contamination.
Lab Control Sample (LCS)	QC Table 6 in method.	Each extraction batch.	Recalibrate and re-analyze.
Matrix Spike	Table 6 in Method or statistically derived control limits, whichever is most stringent.	Every 20 samples.	Case Narrative if Necessary
Matrix Spike Duplicates	Table 6 in Method or statistically derived control limits, whichever is most stringent.	Every 20 samples.	Case Narrative if Necessary
Internal Standards	- 50% to 100% of average area. - must be +/- 0.5 min RT window.	Every standard, blank, and sample	Reanalyze sample.
Surrogates	QC Table 8 in method. Also lab established control limits.	Every standard, blank, and sample	Re-analyze or flag surrogate data with « and Case Narrative.
Tune - BFB	Table 3 in method.	Every 12 hours.	Trouble shoot and retune until passes.

5.2.14 EPA Method 8270B, Semivolatile Organics by GC/MS

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	<30 % RSD for CCCs and <15 % for all other compounds.	Must have calibration blank and five std.	Construct calibration curve using 1st or higher regression fit.
Daily Calibration Verification	% Drift for conc < or equal to 20 for CCC's. 20% drift criteria applicable to all compounds if CCC's not analyzed. Min RF for SPCCs is 0.05.	Every 12 hours.	Reinject or, Recalibrate with new 5 point.

5.2.14 EPA Method 8270B, Semivolatile Organics by GC/MS

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction batch.	Reextract.
Lab Control Sample (LCS)	QC Table 6 in method.	Each extraction batch.	Recalibrate, or if necessary re-extract.
Matrix Spike	Table 6 in method or statistically derived control limits, whichever is most stringent	Every 20 samples.	Case Narrative if Necessary
Matrix Spike Duplicates	Table 6 in method or statistically derived control limits, whichever is most stringent	Every 20 samples.	Case Narrative if Necessary
Internal Standards	- 50% to 100% of average area. - must be +/- 0.5 RT window	Every standard, blank, and sample	Reinject, or if necessary reextract.
Surrogates	QC Table 8 in method. Also lab established control limits.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Tune - DFTPP	Table 3 in method.	Every 12 hours.	Trouble shoot and retune until passes.

5.2.15 EPA Method 8260A, Volatile Organics by GC/MS

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 30% RSD for CCCs and < 15% for all other compounds. RF for Bromoform is >0.10 and chloromethane and 1,1-dichloroethane are 0.10.	Must have calibration blank and five std.	Construct calibration curve using 1st or higher regression fit.
Daily Calibration Verification	% Drift for conc. < 20.	Every 12 hours.	Reinject or Recalibrate with new 5 point.

5.2.15 EPA Method 8260A, Volatile Organics by GC/MS

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Method Blank	< Detection Limit or < 5% of regulatory limit or , < 5 % of sample concentration.	Each analytical batch.	Reanalyze blank. Determine and eliminate source of contamination.
Lab Control Sample (LCS)	QC Table 6 in method.	Each batch.	Correct problem and re-analyze batch. Narrative if necessary.
Matrix Spike	Table 6 in method or statiscally derived control limits, whichever is most stringent.	Every 20 samples.	Case Narrative if necessary.
Internal Standards	50% to 100% of average area. Must be +/- 0.5 min RT window.	Every standard, blank and sample.	Re-analyze sample.
Surrogates	QC Table 8 in method. Also lab. established control limits.	Every standard, blank, and sample.	Re-analyze sample, flag data with « and Case Narrative.
Tune-BFB	Table 4 in method.	Every 12 hours.	Trouble shoot and retune until passes.

5.2.16 EPA Method 8310, Polynuclear Aromatic Hydrocarbons by HPLC

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 20 % RSD	Must have calibration blank and five standards.	Recalibrate new 5 point.
Daily Calibration Verification	% Diff for RF < 15% from initial response.	Each day.	Reinject or, Recalibrate with new 5 point.

5.2.16 EPA Method 8310, Polynuclear Aromatic Hydrocarbons by HPLC

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Continuing Calibration Verification	% Diff for RF < 15 % from initial RF.	Every 10 samples.	Reinject or, Recalibrate with new 5 point.
Quality Control Check Sample	Compare to QC Acceptance Criteria in method.	One per batch.	Check system, recalibrate, reanalyze batch.
Method Blank	< Detection Limit or < 5% regulatory limit or < 5% of sample concentration.	Each extraction batch.	Reextract.
Lab Control Sample (LCS)	QC Table 3 in method.	Each extraction batch.	Recalibrate, or if necessary reextract.
Matrix Spike	Table 3 in method or statiscally derived control limits whichever is most stringent.	Every 20 samples.	Case Narrative if necessary.
Matrix Spike Duplicate	Table 3 in method or statiscally derived control limits whichever is most stringent.	Every 20 samples.	Case Narrative if necessary.
Internal Standards	Based on laboratory control limits.	Every standard, blank, and sample.	Reinject, or if necessary, reextract.
Surrogates	Based on lab. Established control limits.	Every standard, blank, and sample.	Reinject, or if necessary reextract: flag surrogate data with « and Case Narrative.
Retention Time Windows	< 3 times standard deviation of 3 stds analyzed over 72 hours.	Each time column replaced or conditions change.	Re-establish window.

5.2.17 EPA 9000, Conventional Chemistries

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Correlation Coeff. > 0.995. Must have calibration blank and 3 to 5 standards.	Method dependent-minimum once per quarter.	Generate new calibration curve.
Daily Calibration Verification	% Diff < 10 % from initial calibration	Each day. Also after every 10 samples.	Reanalyze or Generate new calibration curve.
Method Blank	< Detection Limit or < 5 % of regulatory limit.	Each extraction batch.	Reextract, or change solvent lot.
Laboratory Control Sample (LCS)	Based on lab established control limits. Also should be < 10 % diff.	Each extraction batch.	Recalibrate, or if necessary reanalyze.
Matrix Spike	Based on lab established control limits.	Every 10 samples.	Case Narrative if necessary.
Matrix Spike Duplicate	Based on lab established control limits.	Every 10 samples.	Case Narrative if necessary.
Duplicates	Based on lab established control limits.	Every 10 samples.	Case Narrative if necessary.

5.2.18 EPA Method 9020B, Total Organic Halides

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Net recovery within 10% of the standard value.	Each analytical batch.	Recalibrate.
Method Blank	< Detection Limit.	Each analytical batch and every 8 samples.	Wash and repeat.
Blank standards	< Detection limit.	Each analytical batch.	Repeat.
Calibration standards	Net response within 10% of the calibration standard value.	Each analytical batch and every 10 samples.	Recalibrate.
Breakthrough	Not exceed 10% of the second column total measurement.	Each analytical batch.	Repeat sample analysis.
Laboratory Control Sample(LCS)	+/- 20% of true value (Mandatory).	Each analytical batch	Recalibrate.

5.2.18 EPA Method 9020B, Total Organic Halides

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Duplicates	RPD 20%	Every sample.	Reanalyze.
Matrix Spike	75-125% Recovery	Every 10 samples.	Case Narrative if necessary.
Matrix Spike Duplicate	75-125% Recovery	Every 10 samples.	Case Narrative if necessary.

5.2.19 EPA Methods 7.3.3.1 AND 7.3.4.2, Reactive Cyanide and Sulfide

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Method Blank	< Detection limit.	Each analytical batch.	Reanalyze. Determine source of contamination.
Check Standard	Statistically derived control limits.	Each analytical batch.	Reanalyze or if necessary prepare new standard.
Duplicates	RPD 20%.	Every 20 samples.	Reanalyze.

5.2.20 ASTM Method D92-85, Flashpoint by Cleveland Open Cup

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Duplicate	+/- 15 degrees F.	Every 20 samples.	Reanalyze.

5.2.21 ASTM D93-85, SW846 Method 1010, Flashpoint by Pensky-Martens

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Standard	79-83 degrees F.	Every analytical batch.	Reanalyze.
Duplicate	+/- 4 degrees F.	Every 20 samples.	Reanalyze.

5.2.22 DRO by 8015B, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 20 % RSD	Must have calibrat. blank and five std.	Recalibrate new 5 point
Daily Calibration Verification	< 15% diff from initial response.	Each day every 12 hours	Reinject or, Recalibrate with new 5 point.
Continuing Calibration Verification	% Diff for RF < 15% from Initial RF.	Every 10 samples	Reinject or, Recalibrate with new 5 point.
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS)	Lab historical limits	Each extraction batch.	Recalibrate, or if necessary re-extract.
Matrix Spike	Lab historical limits	Every 20 samples.	Case Narrative if Necessary
Matrix Spike Duplicates	Based on lab established control limits	Every 20 samples.	Case Narrative if Necessary
Internal Standards	Based on lab established control limits.	Every standard, blank, and sample	Reinject, or if necessary reextract.
Surrogates	Based on lab established control limits.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	< 3 times standard deviation of 3 stds analyzed over 72 hours.	Each time column replaced or conditions change.	Re-establish win

5.2.23 DRO by Alaska AK102.0, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 25% RSD	Must have calibration blank and at least 3 standards - 5 recommended.	Use curve or Recalibrate with new 5 point
Daily Calibration Verification	< 25% diff from initial avg. response factor.	Each day or every 12 hours.	Reinject or, Recalibrate with new 5 point.
Continuing Calibration Verification	% Diff for RF < 25% from initial avg. response factor.	Every 12 hours.	Reinject or, Recalibrate with new 5 point.
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS & LCSD)	Within 25% of true value. %RPD <20.	Every 10 samples.(LCS&LCSD every 20 samples)	Recalibrate, or if necessary re-analyze batch.
Matrix Spike	Not Specified - Default to lab historicals	Recommended. Default to every 20 samples	Case Narrative if Necessary
Matrix Spike Duplicates	Not Specified Default to lab historicals	Recommended. Default to every 20 samples	Case Narrative if Necessary
Internal Standards	Not Recommended	N/A	N/A
Surrogates	50-150% for field samples.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	± 3 times standard deviation of 3 injection of n-Alkane standard analyzed over 72 hours.	Each time column replaced or conditions change.	Re-establish window.

5.2.24 DRO by API, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 25% RSD	Must have calibration blank and at least 3 standards	Recalibrate with new 3 point
Daily Calibration Verification	< 25% diff from predicted response.	Each day.	Reinject or, Recalibrate with new 3 point.
Continuing Calibration Verification	% Diff for calibration factor < 25% from initial standard calibration factor.	Periodically Default to every 10 samples	Reinject or, Recalibrate with new 3 point.
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS)	Within 50 to 100% of true value. %RPD <20.	LCS & LCSD every 20 samples	Recalibrate, or if necessary re-analyze batch.
Matrix Spike	Not Specified - Default to lab historicals	Recommended. Default to every 20 samples	Case Narrative if Necessary
Matrix Spike Duplicates	Not Specified- Default to lab historicals	Recommended. Default to every 20 samples	Case Narrative if Necessary
Internal Standards	Not Recommended	N/A	N/A
Surrogates	50-150% for field samples.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	± 3 times standard deviation of absolute retention time of 3 injections of Gasoline component standard analyzed over 72 hours.	Each time column replaced or conditions change.	Re-establish window.

5.2.25 DRO by California LUFT, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Not specified Default to < 20% RSD	Must have calibration blank and at least 3 standards	Recalibrate with new 3 point
Daily Calibration Verification	% Diff for response < 10% from predicted response.	Each day	Reinject or, Recalibrate with new 3 point.
Continuing Calibration Verification	Not Specified Default to < 10%	Not specified Default to every 12 hours	Recalibrate
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS)	Not Specified Default to laboratory limits	Each extraction batch	Recalibrate and if necessary reextract
Matrix Spike	Not Specified Default to laboratory limits	Every 20 samples	Case Narrative if necessary
Matrix Spike Duplicates	Not Specified Default to laboratory limits	Every 20 samples	Case Narrative if necessary
Internal Standards	Not Recommended	N/A	N/A
Surrogates	Not Specified Default to laboratory historicals	Every standard, blank, and sample	Reinject or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	Not Specified	N/A	N/A

5.2.26 DRO by California LUFT, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Not specified Default to < 20% RSD	Must have calibration blank and at least 3 standards	Recalibrate with new 3 point
Daily Calibration Verification	% Diff for response < 10% from predicted response.	Each day	Reinject or, Recalibrate with new 3 point.

5.2.26 DRO by California LUFT, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Continuing Calibration Verification	Not Specified Default to < 10%	Not specified Default to every 12 hours	Recalibrate
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS)	Not Specified Default to laboratory limits	Each extraction batch	Recalibrate and if necessary reextract
Matrix Spike	Not Specified Default to laboratory limits	Every 20 samples	Case Narrative if necessary
Matrix Spike Duplicates	Not Specified Default to laboratory limits	Every 20 samples	Case Narrative if necessary
Internal Standards	Not Recommended	N/A	N/A
Surrogates	Not Specified Default to laboratory historicals	Every standard, blank, and sample	Reinject or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	Not Specified	N/A	N/A

5.2.27 DRO by IOWA OA-2, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Correlation coefficient of > 0.995 OR < 20% RSD	Must have calibration blank and at least 3 standards	Recalibrate with new 3 point
Daily Calibration Verification	± 20% diff from predicted response.	Each day.	Reinject or, Recalibrate with new 3 point.
Continuing Calibration Verification	Not required Default to ± 20% diff from predicted response	Not required Default to every 10 samples	Reinject or, Recalibrate with new 3 point.

5.2.27 DRO by IOWA OA-2, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS)	Not Required Default to lab historical limits	Each batch	Recalibrate or if necessary reextract batch
Matrix Spike	Lab historical limits	Each Batch of 20 samples	Case Narrative if Necessary
Matrix Spike Duplicates	Lab historical limits	Each Batch of 20 samples	Case Narrative if Necessary
Internal Standards	Not Recommended	N/A	N/A
Surrogates	Lab historical limits.	Every standard, blank, sample, and spike	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	± 3 times standard deviation of absolute retention time of 3 injections of all single component standard mixtures analyzed over 72 hours.	Each time column replaced or conditions change.	Re-establish window.

5.2.28 DRO by Oklahoma Modified 8015, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Correlation Coefficient ≥ 0.99	Must have calibration blank and three std.	Recalibrate new 3 point
Daily Calibration Verification	± 20% of expected result.	Each day.	Reinject or, Recalibrate with new 3 point.
Continuing Calibration Verification	Not Specified Default to ± 20% of expected result	Not specified Default to every 10 samples	Reinject or Recalibrate with new 3 point

5.2.28 DRO by Oklahoma Modified 8015, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each batch, and after every 10 samples.	Reanalyze.
Lab Control Sample (LCS / LCSD)	Waters: ± 20% of known concentration Soils: ± 40% of known concentration	LCS/LCSD every 10 samples.	Recalibrate, or if necessary re-analyze batch.
Matrix Spike	Same as LCS (if analyzed).	Not specifically required. Default to each batch	Case Narrative if necessary
Matrix Spike Duplicates	Same as LCS (if analyzed).	Not specifically required. Default to each batch	Case Narrative if necessary
Internal Standards	Not required.	Not required.	N/A.
Surrogates	Not specified Default to lab historicals	Not specified Default to every standard, sample, blank and spike.	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative
Retention Time Windows	Individual component ± 0.1 min of the RT in the calibration run.	Each time column replaced or conditions change.	Re-establish window.

5.2.29 DRO by Oregon TPH-D, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Linear if using one point. Default to < 20% RSD	Not specified Recommended 4 point	Recalibrate.
Daily Calibration Verification	Not specified. Default to ± 15% of known value.	Not specified. Default each day	N/A.
Continuing Calibration Verification	Not specified. Default to ± 15% of known value.	Not specified. Default to every 10 samples	N/A.
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.

5.2.29 DRO by Oregon TPH-D, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Lab Control Sample (LCS)	Not specified Default to lab historical limits	Not required Default to each batch	Recalibrate or if necessary reanalyze batch
Matrix Spike	Not required. Default to lab historicals	Not required. Default to each batch.	Case Narrative if necessary
Matrix Spike Duplicates	Matrix duplicate criteria not specified. Default to lab historicals	Every 7 samples.	Case Narrative if Necessary
Internal Standards	Not required.	Not required.	N/A.
Surrogates	50 - 150 % recovery.	Prior to extraction for Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	Study is not required.	N/A	N/A.

5.2.30 DRO by Tennessee, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 25% RSD	Must have calibration blank and at least 5 standards	Recalibrate with new 5 point.
Daily Calibration Verification	< 25% diff from predicted response.	Each day.	Reinject or, Recalibrate with new 5 point.
Continuing Calibration Verification	% Diff for calibration factor < 25% from initial standard calibration factor.	Every 10 samples and at the end of the batch.	Reinject or, Recalibrate with new 5 point.
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS)	Within 50 to 100% of true value. %RPD <20.	LCS & LCSD every 20 samples	Recalibrate, or if necessary re-analyze batch.

5.2.30 DRO by Tennessee, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Matrix Spike	Not Specified - Default to lab historicals	Every batch of 20 samples	Case Narrative if Necessary
Matrix Spike Duplicates	Not Specified Default to lab historicals	Every batch of 20 samples	Case Narrative if Necessary
Internal Standards	Not Recommended	N/A	N/A
Surrogates	50-150% for field samples.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	± 3 times standard deviation of absolute retention time of 3 injections of Gasoline component standard analyzed over 72 hours.	Each time column replaced or conditions change.	Re-establish window.

5.2.31 DRO by Washington WTHP-D, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Correlation Coefficient ≥ 0.990 Waters also have option of using CF if RSD ≤ 20%.	Must have calibration blank and at least 5 standards	Recalibrate with new 5 point.
Daily Calibration Verification	± 15% of expected result.	Daily and at end of batch.	Recalibrate with new 5 point.
Continuing Calibration Verification	± 15% of expected result.	Every 10 samples.	Recalibrate with new 5 point.
Method Blank		Every batch (1 per 20 samples).	Reextract or reanalyze.
Lab Control Sample (LCS)	Not required. Default to lab historical limits	Not specified Default to each batch	Recalibrate or reanalyze if necessary
Matrix Spike	Not specified Default to Lab historical limits	Not specified Default to each batch	Reanalyze Case Narrative if necessary

5.2.31 DRO by Washington WTHP-D, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Matrix Spike Duplicates	Matrix duplicate criteria not specified. Default to Lab historical limits	Every 10 samples.	Case Narrative if Necessary
Internal Standards	Not required.	N/A.	N/A.
Surrogates	50-150% for field samples.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	Study is not required.	N/A.	N/A.

5.2.32 DRO by Wisconsin Modified DRO, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Correlation Coefficient ≥ 0.990	Must have calibration blank and five std.	Recalibrate new 5 point
Daily Calibration Verification	± 20 % of known value	Each day.	Reinject or, Recalibrate with new 5 point.
Continuing Calibration Verification	± 20% of known value.	Every 10 samples.	Reinject or, Recalibrate with new 5 point.
Method Blank	Waters: < 0.1 mg/L Soils: < 10.0 mg/kg.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS / LCSD)	80-120% recovery RPD < 20%.	Each extraction batch (every 20 samples).	Reextract or reanalyze.
Matrix Spike	Not required. Default to lab historical limits	Default to each batch	Case Narrative if necessary
Matrix Spike Duplicates	Not required. Default to lab historical limits	Default to each batch	Case Narrative if necessary
Internal Standards	-50% to +100%.	.	.

5.2.32 DRO by Wisconsin Modified DRO, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Surrogates	min 80% recovery.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	0.1 min before the onset of n-decane and ending 0.1 min after the conclusion of n-octacosane	Each time column replaced or conditions change.	Re-establish window.

5.2.33 GRO by 8015B, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 20 % RSD	Must have calibration blank and five std.	Recalibrate new 5 point
Daily Calibration Verification	< 15% diff from initial response.	Each day, every 12 hours	Reinject or, Recalibrate with new 5 point.
Continuing Calibration Verification	% Diff. for RF < 15% from initial RF.	Every 10 samples.	Reinject or, Recalibrate with new 5 point.
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS)	Lab historical limits	Each Batch	Reanalyze batch, Case Narrative if Necessary
Matrix Spike	Lab historical limits	Every 20 samples.	Case Narrative if Necessary
Matrix Spike Duplicates	Lab historical limits	Every 20 samples.	Case Narrative if Necessary
Internal Standards	Based on lab established control limits.	Every standard, blank, and sample	Reinject, or if necessary reextract.

5.2.33 GRO by 8015B, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Surrogates	Based on lab established control limits.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	< 3 times standard deviation of 3 std. analyzed over 72 hours.	Each time column replaced or conditions change.	Re-establish window.

5.2.34 GRO by Alaska AK101.0, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 25% RSD	Must have calibration blank and at least 3 standards - 5 recommended.	Use curve or Recalibrate with new 5 point
Daily Calibration Verification	< 25% diff from initial avg response factor.	Each day or every 12 hours.	Reinject or, Recalibrate with new 5 point.
Continuing Calibration Verification	% Diff. for RF < 25% from initial avg. response factor.	Every 12 hours.	Reinject or, Recalibrate with new 5 point.
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS & LCSD)	Within 25% of true value. %RPD <20.	Every 10 samples.(LCS&LCSD every 20 samples)	Recalibrate, or if necessary re-analyze batch.
Matrix Spike	Not Specified - Default to lab historicals	Every 20 samples.	Case Narrative if Necessary
Matrix Spike Duplicates	Not Specified - Default to lab historicals	Every 20 samples.	Case Narrative if Necessary
Internal Standards	NOT Recommended	N/A	N/A

5.2.34 GRO by Alaska AK101.0, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Surrogates	50-150% for field samples.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	± 3 times standard deviation of 3 injection of n-Alkane standard analyzed over 72 hours.	Each time column replaced or conditions change.	Re-establish window.

5.2.35 GRO by API, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 25% RSD	Must have calibration blank and at least 3 standards	Recalibrate with new 3 point
Daily Calibration Verification	< 25% diff from predicted response.	Each day.	Reinject or, Recalibrate with new 3 point.
Continuing Calibration Verification	% Diff. for calibration factor < 25% from initial standard calibration factor.	Every 10 samples.	Reinject or, Recalibrate with new 3 point.
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS)	Within 50 to 100% of true value. %RPD <20.	LCS & LCSD every 20 samples	Recalibrate, or if necessary re-analyze batch.
Matrix Spike	Not Specified - Default to lab historicals	Every 20 samples.	Case Narrative if Necessary
Matrix Spike Duplicates	Not Specified - Default to lab historicals	Every 20 samples.	Case Narrative if Necessary
Internal Standards	NOT Recommended	N/A	N/A

5.2.35 GRO by API, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Surrogates	50-150% for field samples.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	± 3 times standard deviation of absolute retention time of 3 injections of Gasoline component standard analyzed over 72 hours.	Each time column replaced or conditions change.	Re-establish window.

5.2.36 GRO by California LUFT, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Not Specified - Default to < 20% RSD	Must have calibration blank and at least 3 standards	Recalibrate with new 3 point
Daily Calibration Verification	% Diff. for response < 10% from predicted response.	Each day	Reinject or, Recalibrate with new 3 point.
Continuing Calibration Verification	Not Specified - Default to <10 %	Not Specified -Default to every 12 hours	Recalibrate
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS)	Not Specified - Default to lab historicals	Each Batch	Reanalyze batch, Case Narrative if Necessary
Matrix Spike	Not Specified - Default to lab historicals	Every 20 samples.	Case Narrative if Necessary
Matrix Spike Duplicates	Not Specified - Default to lab historicals	Every 20 samples.	Case Narrative if Necessary
Internal Standards	NOT Recommended	N/A	N/A

5.2.36 GRO by California LUFT, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Surrogates	Not Specified - Default to lab historicals	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	Study is Not Required	N/A	N/A

5.2.37 GRO by IOWA OA-1, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Correlation coefficient of > 0.995 OR < 20% RSD	Must have calibration blank and at least 3 standards	Recalibrate with new 3 point
Daily Calibration Verification	± 20% diff from predicted response.	Each day.	Reinject or, Recalibrate with new 3 point.
Continuing Calibration Verification	± 20% diff from predicted response.	Every 10 samples.	Reinject or, Recalibrate with new 3 point.
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS)	Not Required - Default to Lab historical limits	Default to Each Batch	Reanalyze, Case Narrative if Necessary
Matrix Spike	Lab historical limits	Each Batch - Every 20 samples	Case Narrative if Necessary
Matrix Spike Duplicates	Lab historical limits	Each Batch - Every 20 samples	Case Narrative if Necessary
Internal Standards	NOT Recommended	N/A	N/A

5.2.37 GRO by IOWA OA-1, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Surrogates	Lab historical limits.	Every standard, blank, sample, and spike	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	± 3 times standard deviation of absolute retention time of 3 injections of all single component standard mixtures analyzed over 72 hours.	Each time column replaced or conditions change.	Re-establish window.

5.2.38 GRO by Oklahoma Modified 8020/8015, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Correlation Coefficient ≥ 0.99	Must have calibration blank and three std.	Recalibrate new 3 point
Daily Calibration Verification	± 20% of expected result.	Each day.	Reinject or, Recalibrate with new 3 point.
Continuing Calibration Verification	Not Specified - Default to ± 20% of expected result..	Not Specified - Default to Every 10 samples	Reinject or, Recalibrate with new 3 point.
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each batch, and after every 10 samples.	Reanalyze.
Lab Control Sample (LCS / LCSD)	Waters: ± 20% of known concentration Soils: ± 40% of known concentration	LCS/LCSD every 10 samples.	Recalibrate, or if necessary re-analyze batch.
Matrix Spike	Same as LCS (if analyzed).	Not specifically required - Default to every 20 samples.	Case Narrative if Necessary
Matrix Spike Duplicates	Same as LCS (if analyzed).	Not specifically required - Default to every 20 samples.	Case Narrative if Necessary
Internal Standards	Not required.	Not required.	N/A.

5.2.38 GRO by Oklahoma Modified 8020/8015, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Surrogates	Not specified - Default to Lab historical.	Not specified - default to Every standard, sample, blank, and spike.	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	Individual component ± 0.1 min of the RT in the calibration run.	Each time column replaced or conditions change.	Re-establish window.

5.2.39 GRO by Oregon TPH-G, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Linear if using one point. Default to <20% RSD.	Not specified Recommended 4 point.	Recalibrate.
Daily Calibration Verification	Not specified - Default to ± 15% of known value.	Not specified - Default each day.	Recalibrate.
Continuing Calibration Verification	Not specified - Default to ± 15% of known value.	Not specified - Default to every 10 samples.	Recalibrate.
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS)	Not specified - Default to Lab historical limits.	Not required - default to each batch	Reanalyze, Case Narrative if Necessary.
Matrix Spike	Not required - Default to Lab historicals.	Not required - default to each batch	Reanalyze, Case Narrative if Necessary.
Matrix Spike Duplicates	Matrix duplicate criteria not specified - Default to Lab historicals.	Every 7 samples.	Case Narrative if Necessary
Internal Standards	Not required.	Not required.	N/A.

5.2.39 GRO by Oregon TPH-G, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Surrogates	50 - 150 % recovery.	Prior to extraction for Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	Study is Not required.	N/A.	N/A.

5.2.40 GRO by Tennessee, GAS CHROMATOGRAPHY

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	< 25% RSD	Must have calibration blank and at least 5 standards	Recalibrate with new 5 point.
Daily Calibration Verification	< 25% diff from predicted response.	Each day.	Reinject or, Recalibrate with new 5 point.
Continuing Calibration Verification	% Diff. for calibration factor < 25% from initial standard calibration factor.	Every 10 samples and at the end of the batch.	Reinject or, Recalibrate with new 5 point.
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS)	Within 50 to 100% of true value. %RPD <20.	LCS & LCSD every 20 samples.	Recalibrate, or if necessary re-analyze batch.
Matrix Spike	Not Specified - Default to lab historicals	Recommended - Default to every 20 samples.	Case Narrative if Necessary
Matrix Spike Duplicates	Not Specified - Default to lab historicals	Recommended - Default to every 20 samples.	Case Narrative if Necessary
Internal Standards	NOT Recommended	N/A	N/A

5.2.40 GRO by Tennessee, GAS CHROMATOGRAPHY

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Surrogates	50-150% for field samples.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	± 3 times standard deviation of absolute retention time of 3 injections of Gasoline component standard analyzed over 72 hours.	Each time column replaced or conditions change.	Re-establish window.

5.2.41 GRO by Washington WTHP-G, Gas Chromatorgraphy

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Correlation Coefficient ≥ 0.990 Waters also have option of using CF if RSD ≤ 20%.	Must have calibration blank and at least 5 standards	Recalibrate with new 5 point.
Daily Calibration Verification	± 15% of expected result.	Daily and at end of batch.	Recalibrate with new 5 point.
Continuing Calibration Verification	± 15% of expected result.	Every 10 samples.	Recalibrate with new 5 point.
Method Blank	< Detection Limit or < 5 % of regulatory limit or < 5% of sample conc.	Every batch (1 per 20 samples).	Reextract or reanalyze.
Lab Control Sample (LCS)	Not specified - Default to Lab historical limits.	Not specified - Default to Each batch.	Reanalyze, Case Narrative if Necessary.
Matrix Spike	Not specified - Default to Lab historical limits.	Not specified - Default to every 20 samples.	Reanalyze, Case Narrative if Necessary.
Matrix Spike Duplicates	Matrix duplicate criteria not specified - Default to Lab historical limits.	Matrix Duplicate required every 10 samples.	Case Narrative if Necessary
Internal Standards	Not required.	N/A.	N/A.

5.2.41 GRO by Washington WTHP-G, Gas Chromatorgraphy

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Surrogates	50-150% for field samples.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.
Retention Time Windows	Study is Not required.	N/A.	N/A.

5.2.42 GRO by Wisconsin Modified GRO, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Calibration	Correlation Coefficient ≥ 0.990	Must have calibration blank and five std.	Recalibrate new 5 point
Daily Calibration Verification	PVOC: ± 15% diff from initial response. GRO: ± 20%	Each day.	Reinject or, Recalibrate with new 5 point.
Continuing Calibration Verification	± 20% of known value.	Every 10 samples.	Reinject or, Recalibrate with new 5 point.
Method Blank	Waters: < 50 ug/L Soils: < 5.0 mg/kg.	Each extraction or analysis batch.	Reextract.
Lab Control Sample (LCS / LCSD)	80-120% recovery RPD < 20%.	Each extraction batch (every 20 samples).	Reextract or reanalyze.
Matrix Spike	Not required - Default to Lab historical limits.	Default to every 20 samples.	Case Narrative if Necessary
Matrix Spike Duplicates	Not required - Default to Lab historical limits.	Default to every 20 samples.	Case Narrative if Necessary
Internal Standards	-50% to +100%.	.	.
Surrogates	min 80% recovery.	Every standard, blank, and sample	Reinject, or if necessary reextract; flag surrogate data with « and Case Narrative.

5.2.42 GRO by Wisconsin Modified GRO, Gas Chromatography

QC Parameter	Acceptance Criteria	Frequency	Corrective Action
Retention Time Windows	Study is Not Required.	N/A.	N/A

6.0 SAMPLE PROCEDURES

6.0 SAMPLE PROCEDURES

6.1 FIELD SAMPLING

Generally, field sampling is performed by SPL's clients. SPL performs only limited environmental sampling services.

6.2 SAMPLE CONTAINERS

SPL's laboratories provide clean sample bottles or glassware. Sample bottles are not reused.

Requisite cleaned (or pre-cleaned according to EPA criteria by the supplier) and unused sample containers and closures, preservatives, shipment coolers, packing materials, coolant (wet ice), chain-of-custody forms, custody seals, labels, and shipping forms are provided as a sample container "kit" to clients by SPL's environmental laboratories.

When requested, certified, precleaned sample containers and closures of the highest available quality for trace analyses are procured from container vendors by SPL for its clients. The type of container (VOA vial, jar, or bottle, etc.) is determined by method-specific requirements. These containers are precleaned under the protocols, requirements, and stipulations outlined in:

> **40 CFR**, Part 136, Appendix A, 400-634, 7/1/94; **40 CFR**, Part 136, Appendix C, 637-647, 7/1/94; **40 CFR**, Part 141.30, Subpart C, Appendix C, 700-722, 7/1/94;
>
> **Test Methods for Evaluating Solid Wastes**, USEPA, SW-846, Part IA, 3.1.3, 3rd ed., revision 2, 1994;
>
> **Test Methods for Evaluating Solid Wastes**, USEPA, SW-846, Part IB, 4.1.2, 3rd ed., revision 2, 1994.

Certified containers are those sample containers that have been: (1) cleaned under the protocols listed immediately above; (2) have been quality control tested at a frequency of 2% per production lot for contaminants using USEPA methods 624, 625, 608, 120.1, 335.2, 420.1, and 200 series, depending on container type and intended application; and (3), bear a uniquely numbered certificate of QC analysis, showing production lot number, QC tests performed on the production lot, the lot's QC test results, and date of QC analysis.

When SPL's clients request certified containers, a copy of the applicable certificate(s) by container type and vendor production lot is placed with the sample container in-kit documentation. A Chain-of-Custody form for the containers is completed by the SPL Sample

Management Officer listing container type, vendor, production lot number, and certificate of QC analysis number (see Section 7.2 of this document for additional details). The original of this "container" COC is placed with the sample in-kit documentation and the sample kit is shipped to the client. The SPL Sample Management Officer maintains a copy of each "container" COC on file. Subsequent incoming shipments of samples from the client are then matched with any applicable "container" COCs and SPL's copy of the "container" COC is made a part of the project file, as would normally be done with COCs for samples.

6.3 PRESERVATIVES

SPL provides premeasured amounts of the appropriate preservatives in sample containers prior to delivery of the containers to the client unless otherwise instructed. Reagents used as preservatives for sample containers must be reagent-grade chemicals that meet the current Committee on Analytical Reagents of the American Chemical Society (ACS) specifications, or better, for reagent chemicals (SPL's minimum criterion for purity assay is: >99.0%).

Diluted solutions of these reagent chemicals are made with reagent water that meets ASTM Type II specifications. Balances used in weighings are calibrated daily against in-house NIST/NBS-traceable weights.

6.3.1 Containers, Preservatives, Holding Times, 40 CFR Part 136, Table II, Water/Wastewater Samples

Parameter	Container	Sample Volume	Preservation	Maximum Hold Time
Table 1A-Bacterial Tests: Coliform, total and fecal	P, G	100 ML	Cool 4°C, 0.008% $NaS2O3$[a]	6 hours
Table 1B-Inorganic Tests:				
Acidity				
Alkalinity	P, G	100 ml	Cool 4°C	14 days
Ammonia	P, G	100 ml	Cool 4°C	14 days
	P, G	100 ml	Cool 4°C, $H2SO4$ to pH <2	28 days
Biochemical Oxygen Demand	P, G	1 liter	Cool 4°C	48 hours

6.3.1 Containers, Preservatives, Holding Times, 40 CFR Part 136, Table II, Water/Wastewater Samples

Parameter	Container	Sample Volume	Preservation	Maximum Hold Time
Chemical Oxygen Demand	P, G	50 ml	Cool 4°C, H2SO4 to pH <2	28 days
Chloride	P, G	50 ml	None Required	28 days
Chlorine, Total Residual	P, G	100 ml	None required	Analyze Immediately
Cyanide, Total and Amenable to Chlorination	P, G	1 Liter	Cool 4°C, NaOH pH > 12 0.6g[a] Ascorbic Acid	14 days[b]
Fluoride	P	300 ml	None required	28 days
Hardness	P, G	100 ml	HNO3 or H2SO4 pH < 2	6 months
Hydrogen Ion (pH)	P, G	50 ml	None required	Analyze immediately
Nitrogen, Kjeldahl and Organic	P, G	1 Liter	Cool 4°C, H2SO4 pH < 2	28 days
Nitrate	P, G	50 ml	Cool 4°C	48 hrs
Nitrate/nitrite	P, G	50 ml	Cool 4°C, H2SO4 pH < 2	28 days
Nitrite	P, G	50 ml	Cool 4°C	48 hrs
Oil and Grease	G	1 Liter	Cool 4°C, H2SO4 pH < 2	28 days
Organic Carbon	P, G	25 ml	Cool 4°C, HCL or H2SO4 pH < 2	28 days

6.3.1 Containers, Preservatives, Holding Times, 40 CFR Part 136, Table II, Water/Wastewater Samples

Parameter	Container	Sample Volume	Preservation	Maximum Hold Time
Orthophosphate	P, G	50 ml	Filter Immediately	48 hrs
Oxygen, Dissolved [Probe method]	G, top and bottle	1 Liter	None Required	Analyze immediately
Oxygen , [Winkler Method]	G, top and bottle	1 Liter	Fix on site, store in dark	8 hours
Phenols	G	500 ml	Cool 4°C, H2SO4 pH <2	28 days
Phosphorous, Elemental	G	50 ml	Cool 4°C	48 hours
Phosphorous, Total	P, G	50 ml	Cool 4°C, H2SO4 pH < 2	28 days
Residue, Total	P, G	100 ml	Cool 4°C	7 days
Residue, Filterable	P, G	100 ml	Cool 4°C	7 days
Residue, Nonfilterable	P, G	100 ml	Cool 4°C	7 days
Residue, Settleable	P, G	1 liter	Cool 4°C	48 hrs
Residue, Volatile	P, G	100 ml	Cool 4°C	7 days
Silica	P	50 ml	Cool 4°C	28 days
Specific Conductance	P, G	100 ml	Cool 4°C	28 days
Sulfate	P, G	100 ml	Cool 4°C	28 days
Sulfide	P, G	500 ml	Cool 4°C, Zinc Acetate	7 days
Sulfite	P, G	50 ml	None required	Analyze Immediately
Surfactants	P, G	500 ml	Cool 4°C	48 hours

6.3.1 Containers, Preservatives, Holding Times, 40 CFR Part 136, Table II, Water/Wastewater Samples

Parameter	Container	Sample Volume	Preservation	Maximum Hold Time
Temperature	P, G	100 ml	None required	Analyze Immediately
Turbidity	P, G	100 ml	Cool 4°C	48 hours
Metals:[c]				
Hexavalent Chromium	P, G	200 ml or 50 g	Cool 4°C	24 hours
Mercury	P, G	200 ml or 50g	HNO3 pH < 2	28 days
All other metals	P, G	100 ml	HNO3 pH < 2	6 months
Table 1C-Organic Tests:[d]				
Purgeable halocarbons	G, teflon lined septum	40 ml	Cool 4°C, 0.008% Na2S2O3[a]	14 days
Purgeable Aromatics	G, teflon lined septum	40 ml	Cool 4°C, 0.008% Na2S2O3[a] HCL pH < 2[e]	14 days[e]
Acrolein and Acrylonitrile	G, Teflon lined septum	40 ml	Cool 4°C, 0.008% Na2S2O3[a] Adjust pH to 4-5[f]	14 days
Phenols[g]	G, teflon lined septum	1 Liter	Cool 4°C, 0.008% Na2S2O3[a]	7 days until extraction, 40 days after extraction

6.3.1 Containers, Preservatives, Holding Times, 40 CFR Part 136, Table II, Water/Wastewater Samples

Parameter	Container	Sample Volume	Preservation	Maximum Hold Time
Benzidines[g,h]	G, Teflon lined septum	1 Liter	Cool 4°C	7 days until extraction, 40 days after extraction
Phthalate esters[g]	G, Teflon lined septum	1 Liter	Cool 4°C	7 days until extraction, 40 days after extraction
Nitrosamines[g,j]	G, Teflon lined septum - store in dark	1 Liter	Cool 4°C, 0.008% Na2S2O3[a]	7 days until extraction, 40 days after extraction
PCBs[g]	G, Teflon lined septum	1 Liter	Cool 4°C	7 days until extraction, 40 days after extraction
Nitroaromatics and Isophorone	G, Teflon lined septum, store in dark	1 Liter	Cool 4°C, 0.008% Na2S2O3[a]	7 days until extraction, 40 days after extraction
Polynuclear Aromatic Hydrocarbons	G, Teflon lined septum, store in dark	1 Liter	Cool 4°C, 0.008% Na2S2O3[a]	7 days until extraction, 40 days after extraction

6.3.1 Containers, Preservatives, Holding Times, 40 CFR Part 136, Table II, Water/Wastewater Samples

Parameter	Container	Sample Volume	Preservation	Maximum Hold Time
Haloethers[g]	G, Teflon lined septum	1 Liter	Cool 4°C, 0.008% Na2S2O3[a]	7 days until extraction, 40 days after extraction
Chlorinated hydrocarbons	G, Teflon lined septum	1 Liter	Cool 4°C	7 days until extraction, 40 days after extraction
2,3,7,8-TCDD[g]	G, Teflon lined septum	1 Liter	Cool 4°C, 0.008% Na2S2O3[a]	7 days until extraction, 40 days after extraction
Table 1D-Pesticides				
Pesticides[g]	G, Teflon lined septum	1 Liter	Cool 4°C, pH 5-9[k]	7 days until extraction, 40 days after extraction
Table 1E-Radiological Tests:				
Alpha, beta and radium	P, G	1 Liter	HNO3 pH <2	6 months

Table II Notes:

a Should only be used in the presence of residual chlorine.

b Max. hold time is 24 hrs. when sulfide is present. If sulfide is present, it can be removed by adding cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and NaOH added to pH 12.

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

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

e Samples receiving no pH adjustment must be analyzed within 7 days of sampling.

f pH Adjustment is not required if acrolein will not be measured.

g When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum hold time 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 the residual chlorine with 0.008% sodium thiosulfate, adjusting the pH to 6-9, and store in the dark. Samples preserved in this manner may be held for 7 days before extraction, and for 40 days after extraction. Exceptions to this optional requirement are noted in footnote (a) and footnotes (g) and (h).

h If 1,2-diphenylhydrazine is likely to be present, adjust the pH to 4.0 ± 0.2 to prevent rearrangement to benzidine.

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

j For the analysis of diphenylnitrosamine, add 0.008% sodium thiosulfate and adjust pH to 7-10 with NaOH within 24 hours of sampling.

k 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% sodium thiosulfate.

6.3.2 Test Methods For Evaluating Solid Waste, Physical/Chemical Methods, USEPA SW 846 3rd Edition, September 1994, Revision 2, Table 4-1

Parameter	Container	Sample Volume	Preservation	Maximum Holding Time
Volatile organics (USEPA 8010, 8015, 8020, 8240)	G (2) 40 ml teflon lined septum vials	100 ml	Cool 4°C pH < 2 with H2SO4, HCl, or solid NaHSO4[a]	14 days
	G 4 oz. wide mouth jars with teflon lined septa	50 g	Cool 4°C[b]	14 days

6.3.2 Test Methods For Evaluating Solid Waste, Physical/Chemical Methods, USEPA SW 846 3rd Edition, September 1994, Revision 2, Table 4-1

Parameter	Container	Sample Volume	Preservation	Maximum Holding Time
Semivolatile organics (USEPA 8080, 8270, 8100 etc.)	G 1 gal or 2 x ½ gal or 4 x 1L Amber with teflon lined lid	2-3 liters each method	Cool 4°C[c]	7 days until extraction, 40 days after extraction
	G 8 oz wide mouth Teflon lined cap	50 g each method	Cool 4°C[b]	14 days until extraction, 40 days after extraction
Acrolein and Acrylonitrile	G (2) 40 ml teflon lined septum vials	100 ml	Cool 4°C pH 4-5	14 days
Metals - Total Recoverable (except Hg & Cr6)	G, P	600 ml	HNO_3 to pH <2	6 months
		200 g	none	6 months
Metals - Dissolved	G, P	600 ml	Filter on site; HNO_3 to pH <2	6 months
Metals - Suspended	G, P	600 ml	Filter on site	6 months
Metals - Total	G, P	600 ml	HNO_3 to pH <2	6 months
		200 g	none	6 months
Chromium VI	G, P	400 ml	Cool 4°C	24 hours - Recommended ASAP

6.3.2 Test Methods For Evaluating Solid Waste, Physical/Chemical Methods, USEPA SW 846 3rd Edition, September 1994, Revision 2, Table 4-1

Parameter	Container	Sample Volume	Preservation	Maximum Holding Time
Mercury - Total	G, P	400 ml	HNO_3 to pH <2, Cool 4°C	28 days
	Soils	200 g	Cool 4°C	28 days
Mercury - Dissolved	G, P	400 ml	Filter; HNO_3 to pH <2, Cool 4°C	28 days
Total Organic Halogens	G Teflon lined septa caps	250 ml	pH <2 Cool 4°C	28 days

a. If residual chlorine is present, add 4 drops of 10% sodium thiosulfate to sample in a 4 oz. soil jar, gently mix and transfer to a 40 ml VOA vial, adjust pH < 2, and cool 4°C.
b. Concentrated waste samples do not require preservatives.
c. If residual chlorine is present, add 3 ml of 10% sodium thiosulfate per gallon, cool 4°C.

6.3.3 State Required Methods & Preservatives Note: Check current state regulations.

State	Parameter	Container	Preservation	Maximum Holding Time
Arizona	BTEX / VOCs	WATER - 40 mL VOA vials with teflon lined septa	HCl, 4°C	14 days
		SOIL - Brass or stainless steel sleeves	4°C	72 hours to extraction with methanol, 14 days for analysis

6.3.3 State Required Methods & Preservatives Note: Check current state regulations.

State	Parameter	Container	Preservation	Maximum Holding Time
	TPH	WATER - 40 mL Amber glass VOA vials with teflon lined septa	method 418.1 requirements	
		SOIL -	4°C	14 days
Alaska	GRO	WATER - Triplicate 40 mL Amber Glass VOA vials with Teflon lined Septa caps	200 uL of 1:1 HCl, Cool 4°C	14 days
		SOIL - 4 oz. Amber glass with Teflon lined Septa lids	25 mL methanol	28 days
	DRO	WATER - Duplicate 1 L Amber glass with teflon lined screw caps	HCl to pH2, 4°C	7 days to extraction; 40 days after extraction
		SOIL - 4 or 8 oz. Amber glass with teflon lined lid	4°C	14 days to extraction; 40 days after extraction
California	TPH-Gasoline	WATER - 40 mL VOA vials with teflon lined septa	Cool 4°C	14 days
		SOIL - Wide mouth glass jars with teflon liner OR Stainless steel/brass cylinder	Cool 4°C	14 days

6.3.3 State Required Methods & Preservatives Note: Check current state regulations.

State	Parameter	Container	Preservation	Maximum Holding Time
California	TPH-Diesel	WATER - 1 L glass bottle with teflon lined cap	Cool 4°C	14 days to extraction; 40 days after extraction
		SOIL - Wide mouth glass jars with teflon liner OR Stainless steel/brass cylinder	Cool 4°C	14 days to extraction; 40 days after extraction
Iowa	OA-1	WATER - 40 mL VOA vials with teflon lined septa	1:1 HCl, Cool 4°C	14 days
		SOIL - 4 oz. wide-mouth glass jar with teflon lined lid	4°C	14 days
	OA-2	WATER - 1 L glass jar with teflon lined lid	Cool 4°C	7 days to extraction; 40 days after extraction
		SOIL - Glass with teflon lined lid	Cool 4°C	14 days to extraction; 40 days after extraction

6.3.3 State Required Methods & Preservatives Note: Check current state regulations.

State	Parameter	Container	Preservation	Maximum Holding Time
Pensylvania & Montana	API - GRO (8015 ok in PA)	WATER - Triplicate 40 mL VOA vials with teflon lined septa	200 ul 1:1 HCl to 40 mL, Cool 4°C	14 days
		SOIL - Duplicate tared 40 mL VOA vials (Note: methanol optional in PA)	10 mL methanol, Cool 4°C OR for screening wide-mouth glass jar with a Teflon-lined lid, 4°C	28 days, OR 14 days
	API - DRO	WATER - 1 L glass jar	pH 2, Cool 4°C	7 days to extraction; 40 days after extraction
		SOIL - Glass jar or Core tube.	Cool 4°C	14 days to extraction; 40 days after extraction
Maine	4.1.1 - Fuel Oil in Water	1 L Amber glass with teflon lined cap	Cool 4°C	7 days to extraction; 40 days after extraction
	4.1.2 - Fuel Oil in Soil by Soxhlet	40 mL VOA vial with teflon lined septa	Cool 4°C	14 days
	4.1.3 - Fuel Oil in Soil by Sonication	40 mL VOA vial with teflon lined septa	Cool 4°C	14 days
	4.2.1 - Gasoline in Water by Purge & Trap	40 mL VOA vial with teflon lined septa	Cool 4°C	14 days

6.3.3 State Required Methods & Preservatives Note: Check current state regulations.

State	Parameter	Container	Preservation	Maximum Holding Time
	4.2.3 - Gasoline in Soils by Static Headspace	40 mL VOA vial with teflon lined septa	Cool 4°C	14 days
Minnesota	GRO - Wisconsin Method		Cool 4°C OR Methanol and Cool 4°C	14 days OR 28 days
	DRO - Wisconsin Method			Received at lab within 4 days; extracted within 18 hours from receipt; 7 days
Missouri	TRPH - 418.1	Method requirements	Method requirements	14 days
Nebraska	THPH - 418.1	1 L Glass wide-mouth	5 mL of 1:1 HCl to pH 2, 4°C	7 days (if preserved)
New Mexico	BTEX - 8020	WATER - 40 mL VOA vials	HCl or HgCL2: 4°C	Method requirements
		SOILS - VOA vials	Methanol, 4°C	
North Carolina	Metals	GROUNDWATER ONLY	5 mL Conc. HNO3/L	72 hours to digestion using Std. Methods 3030C

6.3.3 State Required Methods & Preservatives Note: Check current state regulations.

State	Parameter	Container	Preservation	Maximum Holding Time
Oregon	HCID	WATER - VOA vials with teflon lined caps	4°C	14 days
		SOILS - Wide-mouth glass jars with teflon lined screw cap	4°C	14 days
	Metals	SOILS	4°C	14 days
	Total Organic Halogens	WATER - 250 mL Amber Glass	4°C	14 days
Tennessee	Tenessee GRO	WATER - In Triplicate 40 mL VOA vials with teflon lined septa caps	200 uL of 1:1 HCl, Cool to 4°C	14 days
		SOILS - 4 oz. wide-mouth jars with teflon lined septa caps	Cool to 4°C	14 days
	Tennessee DRO	WATER - 1 L Glass	Acid preservation, Cool to 4°C	Extract within 7 days, Analysis within 40 days
		SOIL - Glass	Cool to 4°C	Extract within 14 days, Analysis within 40 days
Wisconsin	Wisconsin GRO, VOC, & PVOC	SOIL	Methanol (immediately)	21 days to Extraction, Analysis 21 days after extraction
	Wisconsin DRO	SOIL - 60 mL VOA vial	Methanol (added at lab within 18 hours of collection)	Extract within 47 days, analysis within 47 days of extraction

6.3.3 State Required Methods & Preservatives Note: Check current state regulations.

State	Parameter	Container	Preservation	Maximum Holding Time
Washington	WTPH-HCID	WATER	4°C	7 days to Extraction,
		SOIL - Wide-mouth jar	4°C	14 days
	WTPH-G	WATER	4°C	14 days
		SOIL	4°C	14 days to Extraction, 21 days to Analysis
	WTPH-D	WATER	4°C	7 days to Extraction, 30 days to Analysis
		SOIL	4°C	14 days to Extraction, 30 days to Analysis
	W-418.1	SOIL	4°C	14 days to Extraction

6.4 SAMPLE DISPOSAL

SPL will dispose of clients samples when requested to do so. Samples may also be returned to the client. Sample disposal protocol is performed according to SPL's SOP # SM-P10.03. Sample disposal responsibility lies with the Sample Custodian or Hazardous Waste Coordinator. QC Officers periodically audit the waste storage facility and disposal records to ensure conformance to the SOP.

7.0 LABORATORY SAMPLE CUSTODY

7.0 LABORATORY SAMPLE CUSTODY

7.1 LABORATORY SAMPLE CUSTODY OBJECTIVES. Sample custody is defined as all records and documentation that is required to trace a sample from point of origin through disposal after analysis. These records must include, but are not limited to:

1) Field notebooks
2) Field sample custody records
3) Laboratory Internal custody records
4) Laboratory sample receipt logs
5) Sample extraction/preparation logs or worksheets
6) Analytical (instrument) logs or worksheets
8) Final reports
9) Sample disposition logs

Legal Chain of Custody is a special type of sample custody in which **all** events associated with a specific sample must be documented in writing. As such, Legal Chain of Custody must include:

1) Field notebooks
2) Field custody records
3) Laboratory Internal custody records
4) Laboratory sample receipt logs
5) Sample extraction/preparation logs or worksheets
6) Analytical (instrument) logs or worksheets
9) Sample disposition logs
10) Final reports
11) Secure, limited access storage areas

7.2 LABORATORY CUSTODY. SPL's laboratories provide sample custody for environmental samples received from clients. Since SPL does not presently engage in field sampling activities, field documentation pertinent to SPL is limited to field sample tags that are attached to samples by clients in the field and Chains-of-Custody that are completed by the client prior to receipt of the samples by SPL. SPL's sample custody documentation includes, but is not limited to, the following records/documents :

- Field sample ID tags;
- Field custody records;
- Laboratory sample login reports;
- Sample extraction/preparation logbooks or worksheets;
- Analytical (instrument) logbooks or worksheets;
- Sample disposition logbooks; and
- Final reports.

7.2.1 Special Custody Procedures. Upon client request or State requirements sample custody begins when trip blanks and clean, empty sample containers leave the SPL laboratory. A Chain-of-Custody (COC) form (see Figure 7.1) is completed for the trip blanks and clean, empty sample containers as if they were actual samples, and validated by relinquishment signature, dating, and time notation.

The COC form, as applied to a shipment of trip blanks and empty, cleaned containers is completed as follows: (1) date/time and initials of trip blank preparation; (2) trip blank matrix (ex. Deionized water, methanol); (3) a vendor production lot number (if applicable) for the selected container type and lot are entered under the "Sample Id." column; (5) the number of containers of a given type or vendor lot number is entered in the "Number of Containers" column; (6) the sample container is entered under the "Bottle" and "Size" columns; (7) the intended use of the container is entered under the "Analysis Requested" column; and (8) the preservative added is entered in the "Pres" column. The rest of the COC is completed as is normally done for samples.

The SPL laboratory maintains a copy of this container COC on file. The client is requested to complete this container COC and send a completed copy along with the sample shipment to SPL. The SPL laboratory Sample Management Officer or designee receives and assumes custody of samples from common carriers and transporters (FEDEX, DHL, UPS, or special courier) until the samples have been properly logged into the laboratory and stored in a secured area appropriate to the analysis intended.

7.2.2 Normal Custody Procedure. Receipt of samples is initiated at SPL laboratories by relinquishment signature, date, and time by the common carrier or transporter (or agent or designee) on the shipment's airbill or bill of lading. Relinquishment of the samples by the client is accomplished by signature, date, and time on the Chain-of-Custody in the field prior to submittal to the common carrier and subsequent sample shipment to SPL. Sample receipt by SPL is accomplished after cross-verification of information on the COC and other associated sample documentation with the sample labels/ID tags as described in the following paragraphs.

Acceptance of the samples after cross-verification by SPL's Sample Management Officer (or designee) is accomplished by signature, date, and time upon the Chain-of-Custody (COC) in acknowledgment of receiving the samples as described in the COC, plus any remarks/notations on the COC made by SPL. The carrier or transporter is identified on the COC, along with the specific and unique airbill or bill of lading number. The space on the COC designated as "Laboratory Remarks" is reserved for noting if the shipment was received whole, complete, and physically undamaged, and cooler temperature.

7.2.2.1 Sample Receipt. Upon receipt of samples, the shipping container is inspected for

warning labels and security seals before opening. Shipping containers are placed in an operating chemical fume hood prior to opening. A **Sample Receipt Checklist** (see Figures 7.2) is completed which documents the condition of the sample shipment. The Chain-of-Custody (COC) and other associated documentation (airbills, bills of lading, etc.) accompanying the samples is correlated with the **field sample container labels/ID tags** to verify accuracy (the field sample container labels/tags must identify the sample with a unique field ID number or field description and a date of collection). Evidence of tampering or broken **custody seals** (see Figure 7.3) are noted by the Sample Management Officer.

The temperature of the samples in the shipping container is measured with a calibrated thermometer, or infrared sensor, and noted on the Sample Receipt Checklist and on the COC with the date and signature of the person making the entry. If samples are received on ice it is also noted. The pH of preserved aqueous samples is checked, with the exception of samples that are to be analyzed for organic volatiles. These procedures (temperature and pH) are verification of proper field preservation of the samples. If the appropriate chemical preservation has not been applied in the field for the samples, this is noted on a Sample Protocol Non-Conformance Worksheet and Sample Receipt Checklist. The appropriate chemical preservation is applied to the sample in SPL's laboratory and also noted on the Sample Protocol Non-Conformance Worksheet and Sample Receipt Checklist. Trip blanks included in the sample kit, but not documented on the COC, are added to the COC by the Sample Management Officer (or his designee).

Any discrepancy between the samples received and the COC information, i.e., broken or leaking sample bottles, or other abnormal situation, is noted on the Sample Protocol Non-conformance Worksheet (Figure 7.4) and is immediately reported to the Project Manager or Lab Director . The client is informed of the problem and corrective action options are reviewed with the client and implemented. Notations of the problem and resolution/corrective action are made on the Sample Protocol Non-Conformance Worksheet. Nonconformance and Corrective Action procedures are described in Section 13. At this point, signature, date, and time acknowledgment of relinquishment and receipt of the samples is noted on the COC by the Sample Management Officer.

7.2.2.2 Sample Logging. The COC, Sample Receipt Checklist, and associated documentation are retained in a project file and copies are transmitted to the Project Manager to verify receipt. These project/work order folders contain copies of the project/work order COC(s) and copies of all other documentation (airbills, bills of lading, telephone conversation logbooks, analysis request forms, etc.) that pertains to the project/work order. The original project file is remitted to the Document Control Officer for copying and archival. The SPL computerized laboratory information management system (LIMS) is used for logging samples into the laboratory, tracking the progress of the analyses, and preparation of the analysis report. **All** information

pertinent to the identification and collection of the sample, client information, and analyses to be performed is entered into the LIMS. Each sample is assigned a unique SPL laboratory number. Samples provided in multiple containers for different tests are identified by the same laboratory identification number followed by a hyphenated numeral identifying each fraction or split. This information is printed on a **laboratory sample label** and these labels are attached to each sample container. Other information entered onto the LIMS during sample logging consists of: date and time of sample collection, sample collector, type of transport to SPL, airbill number, matrix type, sample description, sample field ID, receipt date by SPL, number of samples, analyses requested, sample storage location, sample storage duration, sample disposal information, number of samples per analytical area, sample laboratory ID fraction number, client name, client address, client contact person, client phone number, client facsimile phone number, client purchase order number, and other pertinent client information.

The LIMS also provides tracking of analytical method hold times and client-requested reporting date. A **Work Due List** is printed and used to inform the analysts of the tests to be performed for each sample/split. This Work Due List contains sample-specific information that includes, but is not limited to, SPL laboratory sample number, analyses requested, date of collection, date of expiration, client name, sample due date, sample receipt date and sample storage location.

Sample tracking is available through the LIMS by various management reports available from the LIMS software. The key information included in such management reports includes, but is not limited to, the sample laboratory ID numbers, the client, the number of samples, the date of sample receipt, analyses requested, and report due dates.

All samples are stored in the login/sample storage laboratory following receipt, and are under the custody of the Sample Management Officer. The samples are stored in refrigerators away from all standards, or in secured areas on shelving (VOC samples are segregated from all other samples and chemicals). Locked cold storage is available if requested. All storage units and shelves are numbered for reference. Stored samples are physically segregated in separate storage refrigerators by analysis type (samples for volatile organics are stored in "volatiles only refrigerators"). All standards are stored in physically separate, dedicated refrigerators, away from received samples. The Sample Management Officer or a designee is present in the login laboratory at all times to ensure the integrity and security of the samples. The exterior door of the login laboratory is kept locked at all times.

7.2.2.3 Internal Chain-of-Custody. When samples are removed from sample storage for analysis, the person removing the sample assumes custody of the samples and completes the **Internal Chain-of-Custody Form** for the corresponding laboratory sample number. The Internal Chain-of-Custody Logbook is located in login laboratory. The initials of the analyst

removing the sample, date/time of removal, laboratory to which the sample is being taken, test code, and laboratory sample number(s) of samples being removed is recorded.

During analysis, the sample is under the possession and custody of the person who signed the sample out. The samples, sample digestates, or sample extracts are stored until needed in either refrigerators or in secured analytical areas. **Sample preparation** and **sample analysis logbooks** are maintained for each analytical area. These logbooks include information on the samples such as laboratory sample number), date of sample preparation or analysis, initials of analyst who prepared/analyzed the sample, a chronological sequence of associated samples and pertinent information regarding samples that were prepared/analyzed prior to and subsequent to the sample of interest, and comments regarding the preparation/analysis.

Following completion of the analyses, the sample(s) is returned to the login laboratory. At the time the samples are returned, the analyst returning the sample completes the line on the Internal Chain-of-Custody corresponding to the samples being returned. The entry includes the initials of the person returning the sample, and the date and time of return.

The consecutively numbered Internal Chain-of-Custody forms are computer generated forms bound in books which are kept by the Sample Management Officer. Following the completion of each book, the beginning and end dates and sample numbers are written on the front of the book, and the book is kept in the login laboratory for future reference or is archived permanently for up to seven years.

7.2.2.4 Subcontracting Laboratories. Samples that are to be subcontracted to another analytical laboratory, whether another SPL laboratory or an outside laboratory, are treated identically as described in the previous section. Appropriate shipment containers, packing, coolants, COC documentation (including sample collection date and time, laboratory identification numbers, requested analyses, and date of preparation for extracts and digestates), airbills/bills of lading, and custody seals are used to effect proper transfer of the samples to the subcontracting laboratory. Generally, only dioxins furans, and asbestos are subcontracted outside of the SPL network.

7.3 LABORATORY INFORMATION MANAGEMENT SYSTEMS

7.3.1 General. SPL, Inc. employs local-area networks (LAN). SPL's System J based LIMS (Laboratory Information System) software is resident on the LAN and is used for sample management.. Data is routinely transferred electronically between the three SPL network/LIMS systems on an "as needed" basis.

7.3.2 Hardware. The SPL-Houston LAN hardware consists of a Pentium micro-computer fileserver operating at 90 MHZ clock rate. Ethernet (10 base T) passive backplane active hubs with category 5 certified cable is used to interlink the 90+ nodes currently extant on the LAN. The fileserver is configured with 228 Mbytes of error-correcting RAM memory and RAID 5 compliant hard disks allowing 6 Gigabytes of data storage. A 2 Gigabyte "Hot Spare" hard disk is also installed. Most nodes on this LAN consists of a minimum of an 486 microcomputer equipped with 8 Mbytes RAM, a 210 Mbyte hard disk, and an Ethernet (10 base T) network card. LaserJet printers are configured throughout for total LAN access.

SPL Lafayette hardware consists of an 386 microcomputer fileserver operating at 33 MHZ clock rate. ARCNET active hubs with coaxial cable are used to interlink the 50 nodes currently extant on the LAN. The fileserver is configured with 64 Mbytes RAM memory and 2 Gigabyte Storage Dimensions disk subsystems in a "duplexed" conformation for redundancy. Most nodes on this LAN consists of a minimum of an 286 microcomputer equipped with 640 Kbytes RAM, a 40 Mbyte hard disk, and an ARCNET network card. A second fileserver for CLP Data packages consists of a Pentium microcomputer fileserver operating at 90 MHZ clock rate. The second fileserver is configured with 64 Mbytes RAM memory and 2 Gigabyte hard disk storage.

SPL Traverse City hardware consists of an 386 microcomputer fileserver operating at 33 MHZ clock rate. ARCNET active hubs with coaxial cable are used to interlink the 50 nodes currently extant on the LAN. The fileserver is configured with 64 Mbytes RAM memory and 1.2 Gigabyte Storage Dimensions disk subsystems in a "duplexed" conformation for redundancy. Most nodes on this LAN consists of a minimum of an 386 microcomputer equipped with 640 Kbytes RAM, a 40 Mbyte hard disk, and an ARCNET network card.

7.3.3 Software. The SPL LAN LIMS systems use MS DOS Disk Operating System as the primary operational software shell. Novell NETWARE Ver. 3.11 or 3.12 is employed for the multi-user environment. Radian SAM LIMS software serves as the third operational shell.

7.3.4 System Security:
SPL's LIMS network has four levels of security for the multi-user environment.

1. Login/password security
2. Trustee security
3. Directory security
4. File attributes security

These levels of security are used separately or in various combinations. Login security applies to all SPL users. In order to log in to the Network, SPL users must provide a "username" and its

corresponding password. The username and password must be spelled correctly to login, or access to the Network is denied. A generic "Access Denied" message does not reveal whether or not the username or password or both failed. Other login restrictions include: time restrictions for users; station restrictions for users; limitations on concurrent connections for a single user; account disabling; and, "intruder lockout", where unauthorized users attempting to use invalid passwords are completely blocked from system login.

The second level of network security is trustee security and is used to control an SPL user's ability to work with files in a given directory. A trustee is a user who has been assigned privileges in order to work in a directory and its files. Trustee rights are granted to each SPL user for each directory that the user needs to access. These rights extend down to all succeeding subdirectories of the specified directory, until they are redefined at some lower level or hierarchy. There are eight different trustee rights under SPL's Novell network system that are used separately or in combination:

R = Read from open files
W = Write to open files
O = Open existing files
C = Create and simultaneously open new files
D = Delete existing files
P = Parental:
    Create, rename, erase subdirectories of the directory.
    Set trustee and directory rights in the directory
    Set trustee and directory rights in its subdirectories.
S = Search the directory
M = Modify file attributes

The third level of SPL's network security is directory security, and is used to control the rights of all trustees in a given directory. Each directory has a "maximum rights mask". When each directory is created, the rights mask has the same eight rights that apply to trustee security and are edited to provide security for that directory for **all** trustees.

The last level of SPL's network security is file attributes security, and allows SPL users to control whether an individual file may be modified or shared. If a file is flagged "read-write", SPL users with appropriate trustee rights may read from, write to, rename, or delete the file. If a file is marked "read-only", users may only read it, regardless of other rights. Files flagged as "shareable" can be read by more than one user at a time. This attribute is used with the "read-only" attribute. The "non-shareable" attribute allows only one SPL user at a time to access a file.

The security system employed on the SPL LAN network, as defined by SPL's Novell NETWARE, is identical to that which is resident on the SPL PRIME network, as described above. A redundant security system, integral to SAM LIMS software, duplicates that which is used in the Novell NETWARE environment, giving eight (8) levels of security employed on the SPL LAN LIMS.

7.3.5 Network Documentation.

7.3.5.1 Network User Activity. As a means of documenting network user activity, SPL's network also utilizes an electronic "user log". This feature maintains a log of all SPL network users, their usage times and dates, and the directories and files that were employed by the individual user. This log file is maintained actively for 30 days, at which time it becomes eligible for archival and a new user log file is automatically started.

Logbooks detailing electronic data transfers (EDT) to clients are maintained by the various reporting groups at SPL's laboratories. These EDT logbooks contain sample-specific information that includes, but is not limited to, SPL laboratory sample number, mode of transmission, date of EDT, recipient of EDT information, and a description of information transmitted. Hard copies of transmitted material are maintained as part of the analytical report that is archived. Presently, SPL only provides MS DOS diskette deliverables of test result and QC result summaries to its clients. Modem EDT transfers to clients are available. EDT diskette deliverables are usually furnished to clients in ASCII, DBase III+, DBase IV, Paradox, Lotus 123, or System J formats.

7.3.5.2 Network Repair and Maintenance. Documentation and records are maintained of all repairs and maintenance on SPL's networks, for both hardware and software. The maintenance and repair documentation includes, but is not limited to, date of repair/maintenance, by whom the repair/maintenance was performed, a description of the hardware or software that was repaired/maintained and its location, and a description of what activities were performed to effect the repair/maintenance (this includes revisions and updates/upgrades to the software).

7.3.6 Verification of LIMS Data. As described in Section 12 of this document, data is ultimately verified by each SPL laboratory's analytical area supervisors, who are responsible for data produced from their respective areas. This is also the case for data imported into the LIMS directly from analytical instrumentation. This data is held in a reserved electronic directory(ies) in a separate LIMS database until associated QC data is approved by the review process. Upon approval, the data is verified electronically by a reviewer and then transferred into the main LIMS database for automatic download into the data's respective login files.

Analytical reports are ultimately generated and submitted to the client after verification and signature by the Project Manager and duplication by the Document Control sections. Xerographic copies (hardcopy) of these LIMS-generated reports are archived with the remainder of the report data under Chain-of-Custody security procedures, as are all of SPL's data.

7.3.7 Software/Hardware Verification. A number of diagnostic programs are utilized on SPL's LIMS and networks to verify operational status of hardware and software. These diagnostic programs are commercially available software that were purchased separately or were provided with purchase of the hardware or network software. Some examples of these diagnostic programs are: Norton Utilities, and Novell NETWARE Diagnostics. Internally written software is tested before implementation.

FIGURE 7.1

Chain-of-Custody Form

Page _____ of _____

ISPL®

Environmental Laboratory
8880 Interchange Drive
Houston, Texas 77054
713/660-0901

Analysis Request and Chain of Custody Record

Project No. | Client/Project Name | Project Location

Field Sample No./ Identification	Date and Time	Grab	Comp.	Sample Container (Size/Mat'l)	Sample Type (Liquid, Sludge, Etc.)	Preser-vative	ANALYSIS REQUESTED	LABORATORY REMARKS

Samplers: *(Signature)*	Relinquished by: *(Signature)*	Date: Time:	Received by: *(Signature)*	Date: Time:	Intact
Affiliation	Relinquished by: *(Signature)*	Date: Time:	Received by: *(Signature)*	Date: Time:	Intact
	Relinquished by: *(Signature)*	Date: Time:	Received by: *(Signature)*	Date: Time:	Intact
SAMPLER REMARKS:			Received for laboratory: *(Signature)*	Date: Time:	Laboratory No.
Seal #			Data Results to:		

FIGURE 7.2 Sample Receipt Checklist

Client:	SPL Workorder No:	Yes	No	NA
Project #:	Project Loc:			
Are Custody seals on the shipping container present and intact?				
Chain-of-Custody (COC) present and signed by the sampler?				
Traffic reports, airbills, or bills of lading present?				
Are sample containers intact?				
Are sample tags/field labels present on each sample?				
Are all samples present in the sample kit listed on the COC?				
Do date/time of sample collection agree with COC?				
Do sample tags/field tags agree with COC?				
Does sample type agree with COC?				
Does the number of bottles received for each parameter agree with COC?				
Does the bottle type and volume agree with COC?				
Are the analyses requested listed on the COC?				
Cooler temperature.				
Record the temperature in degrees C in the NA column.				
Is the pH of all preserved samples checked and documented properly?				
Are all samples preserved according to EPA guidelines?				
Are all samples within the EPA maximum holding times?				
Do sample containers conform to EPA guidelines?				
Did the receiving technician record the date/time of receipt and sign the COC?				
Was a nonconformance filled out for any items with a NO response?				
Method of sample delivery to SPL and airbill number where applicable (circle one)?				
Method of sample disposal:(circle one) SPL Disposal HOLD Return to Client				
Receiving Technician signature:		Date/Time:		

FIGURE 7.3
SPL Custody Seal

Date _____

Sig. _____

Figure 7.4 Sample Protocol Nonconformance Worksheet

Prepared by:	Date / Time:
Client:	SPL W/O #:
Submitted to:	Samples Logged In? ❑ YES ❑ NO

Matrix: ❑ SOIL ❑ WATER ❑ AIR ❑ OTHER
Samples Affected: ❑ ALL ❑ Partial (See description)

Description of non-conformance:

Condition	Information	Container
❑ Temp >6C	❑ No collected date	❑ Damaged containers
❑ Expired Hold Time	❑ No COC	❑ Improper containers
❑ Headspace	❑ Samples not labeled	❑ Non-SPL containers
❑ Unpreserved	❑ Sample v. COC ID disagreement	❑ Insufficient containers
❑ Improperly preserved	❑ Container v. COC disagreement	❑ Sample not on COC
❑ Insufficient Sample	❑ Method not specific or not listed	❑ Sample not received

Client Name Contacted:	Date / Time:
Phone:	Action: ❑ Complete Login ❑ HOLD

Client Instructions:

Comments:

Project Manager Signature **Date/Time**

COPIES TO: ❑ File ❑ Project Manager ❑ Area Supervisor ❑ QA rev:3/95.jpa

8.0 ANALYTICAL PROCEDURES

8.0 ANALYTICAL PROCEDURES

Analytical methods are selected for a specific project based upon discussions with the client and state or federal regulatory requirements. SPL's SOPs are generally based on methods from the following references:

- Test Methods for Evaluating Solid Wastes, USEPA, SW-846, 3rd Ed., Final Update II.
- Methods for Chemical Analysis of Water and Wastes, USEPA-600/4-79-020, Revised March 1983.
- Methods for the Determination of Inorganic Substances in Environmental Samples, USEPA-600/R-93/100, August 1993.
- Methods for the Determination of Metals in Environmental Samples, USEPA-600/R-94-111
- Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (600 series methods), 40 CFR Part 136 Appendix A.
- Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater, USEPA-600/4-82-057, Revised October 26, 1984, CFR Vol. 49, No. 209.
- USEPA Contract Laboratory Statement of Work, issued and revised in the form of an Invitation for Bid at the discretion of the USEPA.
- Standard Methods for the Examination of Water and Wastewater, 18th Ed., 1992.
- Specialized tests and procedures are taken from ASTM, USGS, AOAC, API, and the American Society of Agronomy.

The analytical protocols as performed in SPL's laboratories are detailed in Standard Operating Procedures (SOPs) which have been prepared for each analytical test. These SOPs list the reference method, special notes, and specifics concerning SPL's performance of the method. The use of SOPs ensures that identical methodology is followed regardless of analyst. SOPs are closely reviewed by SPL's QA/QC Officers, the and Laboratory Supervisors prior to approval and use. SPL's policy is to review and revise SOPs every 2 years except when regulatory or method changes necessitate an earlier update. These steps are taken to ensure that the requirements of the referenced methods are satisfied.

8.1 GENERAL ANALYTICAL TECHNIQUES

A wide variety of operational procedures are followed to provide data to our clients that meets the QC criteria defined in the above methods. The following are examples of some of these procedures that have direct effect on quality data.

- Deionized water system checks are monitored daily for conductivity. ASTM

Type II water requires conductivity of <1 umhos/cm. Additional reagent water treatment and testing is done for the metals and volatile lab areas.

- Refrigerator blanks are analyzed monthly for volatile contaminants.
- An appropriate sample container is selected at random and analyzed monthly for volatiles, semivolatiles, and metals.
- Only class A volumetric glassware is used in the conventional chemistry analyses for all volumetric measurements or dilutions.
- All standards received and prepared are recorded in logs to provide traceability information as defined in SOP# QA-P5.02.

For more detailed information on procedures see SPL's Standard Operating Procedure Manual.

8.2 LABORATORY GLASSWARE CLEANING

SPL's glassware cleaning protocols conform to the following references:

Test Methods for Evaluating Solid Waste, September 1994, SW 846, Third Edition, Revision 2, Chapter 4, pp 3-5 and Chapter 3, pp 3.

Code of Federal Regulations, July 1993, Part 435, pp.248.

SPL environmental laboratories' procedures for glassware cleaning is documented in Standard Operating Procedure MI-P2.02. A summary of these procedures are listed below:

8.2.1 Organic Sample Analyses

Step	Process
1	Remove surface residuals immediately after use by rinsing with methanol.
2	Remove all labels using a sponge or methanol.
3	Wash with hot tap water and a brush to scrub inside of glassware, stopcocks, and other small pieces, if possible, using a suitable laboratory-grade non-phosphate detergent.
4	Rinse thoroughly with hot tap water.
5	If needed, use an oxidizing biodegradable alkaline concentrate to remove insoluble organic residue.
6	Rinse thoroughly with hot tap water.

7 Rinse thoroughly with ASTM Type II (or better) deionized water.
8 Rinse thoroughly with laboratory grade methanol.
9 Dry the glassware in a 100 degrees C oven. USE CAUTION: SAFETY MEASURES MUST BE ADHERED TO.
10 Store the glassware in a closed, dust-free environment. Under no circumstances should glassware be left in the open without protective covering. Pegboard drying is not recommended.
11 Immediately before using, rinse with the solvent used in analysis.

NOTE: If a residue is still apparent after following the above procedures, the glassware shall be baked in a furnace at 550 degrees F for 30 minutes and rewashed (except for volumetric glassware, which shall be scrubbed and rewashed or discarded).

8.2.2 Metal Sample Analyses

Step	Process
1	Remove all labels using a sponge or methanol.
2	Wash with hot tap water and a brush to scrub inside of glassware using a suitable laboratory-grade non-phosphate detergent.
3	Rinse thoroughly with hot tap water.
4	Rinse or soak with 1:1 HNO3 (nitric acid).
5	Rinse thoroughly with ASTM Type II (or better) deionized water.

NOTE: CHROMIC ACID MUST NOT BE USED TO CLEAN GLASSWARE FOR METALS ANALYSIS.

8.2.3 Mercury Sample Analysis

Step	Process
1	Remove all labels using a sponge or methanol.
2	Wash with hot tap water and a brush to scrub inside of BOD bottles using a suitable laboratory-grade non-phosphate detergent.
3	Rinse thoroughly with hot tap water.
4	Rinse or soak with 1:1 Nitric Acid.
5	Rinse thoroughly with ASTM Type II (or better) deionized water.
6	Rinse or soak with 1:1 Hydrochloric acid.
7	Rinse thoroughly with ASTM Type II (or better) deionized water.

NOTE: CHROMIC ACID SHOULD NOT BE USED TO CLEAN GLASSWARE FOR METALS ANALYSIS.

8.2.4 Nutrient Analyses

Step	Process
1	Remove all labels using a sponge or methanol.
2	Wash with hot tap water and a brush to scrub inside of glassware using a suitable laboratory-grade non-phosphate detergent.
3	Rinse thoroughly with hot tap water.
4	Rinse or soak with 1:1 Hydrochloric Acid.
5	Rinse thoroughly with ASTM Type II (or better) deionized water.

8.2.5 Residue Analysis

Step	Process
1	Remove all labels using a sponge or methanol.
2	Wash with hot tap water and a brush to scrub inside of glassware using a suitable laboratory-grade non-phosphate detergent.
3	Rinse thoroughly with hot tap water.
4	Rinse thoroughly with ASTM Type II (or better) deionized water.
5	Bake at temperature specified in the method prior to use and allow to cool in a desiccator.

8.2.6 General Laboratory Sample Analyses

1. Remove all labels using a sponge or methanol.
2. Wash with hot tap water and a brush to scrub inside of glassware using a suitable laboratory-grade non-phosphate detergent.
3. Rinse thoroughly with hot tap water.
4. Rinse thoroughly with ASTM Type II (or better) deionized water.

8.2.7 Bioassay Sample Analysis

1. Remove all labels using a sponge or methanol.
2. Wash with hot tap water and a brush to scrub inside of glassware using a suitable laboratory-grade non-phosphate detergent.
3. Rinse thoroughly with tap water 5 times.
4. Rinse well with methanol.
5. Rinse thoroughly with ASTM Type II (or better) deionized water.
6. Soak in 10% Hydrochloric acid bath for 4 hours - NOT ANY LONGER.
7. Rinse thoroughly with ASTM Type II (or better) deionized water.

8.3 LABORATORY REAGENT STORAGE

The storage procedures are designed to eliminate contamination as well as provide for a safe environment. Appropriate storage of reagents and solvents are listed below. For detailed information on chemical storage see SPL's Chemical Hygiene Plan.

Chemical	Method of Storage
Nitric acid	Stored in original containers in vented cabinet designed for acid storage. Acids are stored in separate cabinets from other chemicals.
Sulfuric acid	See nitric acid.
Hydrochloric acid	See nitric acid.
Acetic acid	See nitric acid.
Isopropanol	Stored in original containers in vented flammable solvent storage cabinet. All solvents used for VOC analyses are stored in segregated cabinets in the VOC analysis area away from all other solvents.
Methanol	See isopropanol.
Hexane	See isopropanol.
Methylene chloride	See isopropanol.
Chloroform	See isopropanol.
Carbon disulfide	See isopropanol.
Diethyl ether	See isopropanol.
FREON 113 (TF)	See isopropanol.
pH standards	Stored in cabinet designed for standard and reagent chemical storage. Cabinet is located in air conditioned section of the laboratory.
VOAs standards	Stored in refrigerator and/or freezer in the laboratory away from all other standards and chemicals.

Chemical	Method of Storage
SemiVOAs standards	Stored in refrigerator/freezer in the laboratory away from solvents and VOA standards.
Metals standards	See pH standards.
Conventional	See pH standards. If refrigeration is required for storage of these standard materials, refrigerator/freezers are utilized that are segregated from volatile organic and semivolatile organic standards and chemicals.
Other reagents and Chemicals	See conventional chemistry standards.

9.0 CALIBRATION PROCEDURES AND FREQUENCY

9.0 CALIBRATION PROCEDURES AND FREQUENCY

The accuracy of a chemical analysis is dependent on the quality of reference standards and reagents used during the preparation and analysis of the sample. Specific requirements for individual tests are described in the method and summarized according to test method groups in this section. Calibration requirements specified in the method are used if they are more stringent than those listed in this QAP. The purity of reagents must be that of analytical reagent grade as a minimum. Reagent and method blanks are prepared and analyzed with each set of samples to ensure the purity of the materials and solutions used in preparation of the samples. Commercially-obtained primary standards are used for tests for which they are applicable (e.g., organic analyses by GC or GCMS and metals by atomic spectroscopy).

9.1 REAGENTS AND STANDARDS

Analysis standards prepared from stock solutions are stored in containers consistent with their stability. These are labeled with the standard number, date of preparation, concentration of analyte(s), and the preparer's initials. In accordance to SOP # QA-P5.02 a standards preparation logbook is used to document the sources of primary standards, lot numbers of primary standards, dates of receipt, expiration dates, methods of preparation of intermediate and working stock standards, dates of preparation of intermediate and working stock standards, and the preparing analyst(s)/technician(s).

Certifications of manufacturer's analysis and/or traceability of primary standards/sources to EPA certified standards are archived in secured files.

The procedure used for preparation of reagents is also documented in the standards logbook and includes the weights, volumes, dilutions, and source of the stock solution or chemical reagent, and lot number.

All carrier gases and hydrogen used in SPL laboratories are zero grade gases or better, depending on the sensitivity of the instrument or method. Fuel acetylene purity is 99.6%, or better. Oxidant air quality is "zero" grade (<2.0 ppm hydrocarbons).

9.1.1 Standard Sources and Preparation

Standard Source	Standard Type	Standard Storage	Maximum Shelf Life
	Volatile Organics: GC/MS		
Commercial Lab. Supply	Primary stocks	-10 to -20°C	6 months
	Gases (BP < 30°C)	10 to -20°C	1 week
	Intermediate Standard	-10 to -20°C	6 months - except gases
	Working standards	-10 to -20°C	1 day
	Semivolatile Organics: GC/MS		
Commercial Lab. Supply	Primary stocks	-10 to -20°C in dark	1 year
	Intermediate Standard	-10 to -20°C	1 year
	Working standards	4°C	1 week
	Volatile Organics GC		
Commercial Lab. Supply	Primary stocks	-10 to -20°C	1 year
	Gases (BP < 30°C)		1 week
	Intermediate Standard	-10 to -20°C	6 months - except gases
	Working standards	-10 to -20°C	1 day

Standard Source	Standard Type	Standard Storage	Maximum Shelf Life
	Semivolatile Organics (GC and HPLC)		
Commercial Lab. Supply	Primary stocks	4°C in dark	1 year
	Intermediate Standard	4°C	6 months
	Working standards	4°C	6 months
	Atomic Absorption and Inductively Coupled Plasma Spectrophotometers		
Commercial Lab. Supply	Primary stocks	Room Temp	Annual or manufacturers expiration date, whichever is longer
	Intermediate standards	0.15% HNO_3, Room Temp	1 week
	Working standards	0.15% HNO_3, Room Temp	1 week or daily
	Conventional: (sulfide and cyanide) UV-Visible Spectrophotometer		
Commercial Lab. Supply	Primary stocks from source stocks	4°C, pH > 12	As needed
	Working stocks from intermediate stocks	4°C, pH > 12	Standardize daily
	Conventional: (TPH) FTIR Spectrophotometer		
Commercial Lab. Supply	Neat Chemicals	Room temp.	N/A
	Stock	4°C	6 months
	Intermediate standard	4°C	6 months
	Working standards	4°C	6 months

Standard Source	Standard Type	Standard Storage	Maximum Shelf Life
	(TOH) Combustion microcoulometric		
Commercial Lab. Supply	Primary stocks	4°C, pH <2	Manufacturer's expiration date
	Intermediate standard	4°C, pH <2	1 month
	Working standard	4°C, pH <2	1 month
	pH Meter		
Commercial Lab. Supply	Used as received: no working stock solutions prepared.	Room temp.	Manufacturers expiration date
	Turbidimeter		
Commercial Lab. Supply (formazin std)	Primary stocks from source stocks	Room temp.	Manufacturer's expiration date
	Working stocks from intermediate stocks	Room temp.	1 day

9.2 INSTRUMENT CALIBRATION.

The calibration procedures, frequency of initial and continuing calibration verification, and criteria for evaluation of the calibration data are applied as described in the analysis methods. For lab equipment lists see the current Statement of Qualifications for SPL. Section 5 of this manual lists calibration criteria for most major methods in use at SPL. Calibration data are documented in instrument run logbooks and these logbooks reference the standards preparation logbooks to identify sources and methods of preparation of calibration standard solutions used. The procedures for calibration of major instrumentation used by SPL's laboratories are described in the sections below.

9.2.1 Metals. Stock solutions of individual metals for atomic absorption spectroscopic analyses or stock solutions of a mixture specifically prepared for inductively coupled plasma spectroscopic analyses are acquired from commercial suppliers. Certified solutions which are

certified traceable to an NIST/NBS standard are obtained if available. Volumetric dilution of the stock solutions with deionized water and acid(s), which replicates the acid content of the sample digestates, is used for the preparation of calibration standards. The deionized water quality is checked daily by measuring its conductivity.

A Calibration Verification solution is prepared from a different source than that used for preparation of the calibration standards. This solution is used for verification of the initial and/or continuing calibration of the instrument. Calibration verification is performed at or near the mid-point of the linear calibration range or as prescribed by the method.

Laboratory Control Standards (LCS) are purchased from commercial suppliers and are from a different source than that used for instrument calibration. When available, EPA certified standards are purchased. Laboratory control are used to detect any bias present in the preparation and analyses of samples. When available, commercially prepared certified solid samples serve as laboratory control samples for soil or sediment analyses.

QC check samples are also analyzed in response to corrective actions to demonstrate that quality problems have been eliminated. Generally, in this case, four QC check samples are analyzed and the precision and accuracy of the results must pass QC acceptance criteria for spike recovery (See section 11).

9.2.1.1 Atomic Absorption Spectroscopy - Furnace Analysis (GFAA). Standards used for the calibration of the instrument are prepared at a minimum of weekly and ideally each time an analysis is run. The calibration solutions consist of a blank and a minimum of three analytical standards bracketing the analytical range of the instrument. One of the standards must be at the quantitation limit for the metal. The calibration standards are diluted with deionized water containing the same concentration(s) of acid(s) as the sample digestates.

A solution from a source independent of that used for the initial calibration is prepared at a concentration known by the analyst to optimize the probability of reproducibility and accuracy. This solution is identified as the initial calibration verification (ICV) or continuing calibration verification (CCV) solution, depending on its use.

The instrument is calibrated prior to the analysis of each metal. Each calibration solution is measured in duplicate. The analytical blank is analyzed, followed by the analytical standards in the order of increasing concentration.

The accuracy of the initial calibration is verified by the analysis of the ICV standard. QC acceptance criteria are listed in Section 5 of this manual. If the concentration is not within this acceptance range during initial or continuing calibration verification, the problem must be

corrected, the instrument recalibrated, and the calibration verified before analysis of samples is begun.

The calibration blank must be reanalyzed immediately after the ICV and each CCV. The CCV standard and calibration blank must be analyzed at a frequency of once per ten environmental samples, counting duplicate measurements for each sample as one.

9.2.1.2 Atomic Emission Spectroscopy - Inductively Coupled Plasma (ICP). The standards used for calibration of the instrument are obtained commercially. A calibration blank and initial calibration solutions are used to establish calibration for each analyte. The elements being analyzed are divided into 5 separate standard solutions as specified in the method to avoid interferences.

The instrument is calibrated each day it is used. A minimum of two measurements must be made of each analytical standard. The mean of the measurements is used as the intensity obtained. An ICV solution is analyzed immediately after calibration. This solution is prepared from stock solution(s) of a different source than used for preparation of the initial calibration standards, and contains all analytes to be determined. Measurements are obtained at each of the wavelengths used for the analyses of samples. The concentration calculated from the calibration of the instrument must agree with the QC acceptance criteria in Section 5 of this manual for each element, or the instrument is recalibrated for the element(s) that do not meet this criteria. A calibration blank is analyzed immediately after the ICV and each CCV (10 percent frequency). The calibration blank and CCV are not included in determining the frequency of analysis. The acceptance criteria for the method blank is found in Section 5 of this manual.

9.2.2 Absorption Spectroscopy - UV/Visible Spectrophotometry. Analyses requiring colorimetric determinations using UV-visible range spectrophotometers are calibrated at a minimum frequency quarterly with known-concentration multiple analyte solutions that span a linear absorption range versus analyte concentration. An initial calibration verification standard (ICV) is analyzed with each analytical batch of samples to verify replicate response and linearity of the spectrophotometer (at mid-point concentration). Continuing calibration mid-point concentration standards (CCVs) are analyzed every 10 samples to verify continuing linear response of the spectrophotometer. The QC acceptance criteria for the calibration curve, ICVs, CCVs, and blanks are found in Section 5 of the manual.

9.2.3 Absorption Spectroscopy - Infrared Spectrophotometry. Infrared spectrophotometers are calibrated at a minimum quarterly with five-point initial calibration standards for each matrix that span appropriate linear working ranges. Continuing calibration standards (CCVs) for each matrix are analyzed every 10 samples. A reagent blank is analyzed daily. The acceptance criteria for the reagent blank, calibration curve, and CCV are found in

Section 5 of this manual.

9.2.4 Total Organic Halide (TOX/TOH) Analyzers. A variety of calibration standards are required for TOX/TOH analyses. Due to the analysis' design principle, only a single-concentration calibration standard is utilized by the USEPA methodology. The TOX/TOH instrument is initially calibrated for each volume of titrant cell electrolyte used. Typically, titrant cell electrolyte is changed every 12 hours or less of operation. Instrument calibration is performed every time the electrolyte is changed. This calibration consists of duplicate, sequential analyses of the calibration standard. The acceptance criteria is ± 10 % of the theoretical value of the standard's concentration. Thereafter, the same calibration standard is used as a CCV standard at a frequency of 1 in 10 "sample burns".

An absorbing charcoal efficiency standard is analyzed for each lot or batch of charcoal to be used. The acceptance criteria for the charcoal efficiency standard is ± 10% of the theoretical concentration of the standard. A calibration verification standard is also employed that is prepared from a different primary source as is used in the ICV/CCV standard.

Three different blanks are employed in TOX/TOH analyses: nitrate wash blanks, DI water blanks, and a blank standard. The nitrate wash blanks are analyzed at frequency of 1/8 "sample burns". The DI water blanks are analyzed daily or whenever the water source is changed, whichever is more frequent. The blank standard consists of pesticide-grade methanol and is analyzed in duplicate on a daily basis.

9.2.5 Total Organic Carbon Analyzer (TOC). TOC analyzers are calibrated according to the manufacturer's instructions with three-point initial calibration standards (ICVs), with acceptance criteria as listed in Section 5 of this manual. Reagent blanks are analyzed immediately subsequent to the ICVs. Mid-point concentration continuing calibration standards (CCVs) are analyzed at a frequency of one per 10 samples, excluding blanks and ICVs and CCVs. Acceptance criteria for CCVs are found in Section 5.

9.2.6 Inorganic Water parameters. The tests performed for inorganic water quality parameters are defined for the purposes of this document as those described in "Methods for Chemical Analysis of Water and Wastes", USEPA 600/4-79-020, revised March 1983; "Test Methods for Evaluating Solid Wastes", USEPA SW-846, 3rd Ed.; or "Standard Methods for Analysis of Water and Wastewater", 18th Ed., 1992.

Analytical reagent grade chemicals are used for the preparation of all standards, reagents, and solvents. Salts which are thermally stable are dried at 103-105° C and cooled in a desiccator prior to being used for the preparation of primary standard stock solutions. Quantitative dilution of the standard stock solution is used for preparation of analysis standards and spiking solutions.

Standards prepared from concentrated acids, thermally unstable salts, or hygroscopic materials are standardized against primary standards prior to being used for analysis of samples. The frequency of preparation of standards and reagents followed is that specified in each test method. All reagents and standards are prepared in deionized ASTM Type II water or higher quality water.

9.2.7 Organic Compounds. Standard stock solutions for the analyses of organic compounds by gas chromatography (GC) or gas chromatography/mass spectrometry (GCMS) are obtained from commercial sources. Calibration standards are prepared by dilution with the analytical reagent grade solvent (or pesticide grade if required) specified by the test method.

VOLATILES. Standards for volatile organic analyses are prepared from "neat" (undiluted) materials or stock solutions by addition of a known volume of standard to a preweighed 10 mL volumetric flask containing 9.8 mL of solvent. The syringe needle is held immediately above the surface of the solvent. The standard must fall directly into the solvent from the syringe needle tip without touching the flask walls. If the syringe needle tip touches the flask walls, the mixture is discarded. The flask, solvent, and standard are reweighed to determine the amount of standard stock solution or neat sample that is transferred. The mixture is then carefully diluted to volume with solvent and the flask slowly inverted several times to mix.

Stock standard solutions are transferred to a 10 mL Teflon-capped glass vial and stored at -10 to -20° C in the volatile standards freezer. An intermediate standard is prepared weekly and stored in two 1 mL vials. Working standards (50 mL) are prepared daily. 40 mL are used to fill the VOA vial, while the remainder is discarded.

SEMIVOLATILES. Certified stock solutions of semivolatile organic compounds are obtained commercially. Calibration standards are prepared by addition of known volumes of stock solution(s) to a volumetric flask containing solvent, followed by dilution to volume. Calibration standards are prepared at three or five concentrations as required for the test method to be used. One standard is prepared near but above the practical quantitation limit, and others bracket the concentration range of the analytes in the sample at concentrations specified by the method.

The calibration standards are transferred to a glass vial with a Teflon-lined closure and stored in the semivolatile standards refrigerator at 4° C. Standards are prepared each six months or more frequently if evidence of degradation or comparison with check standards indicates a potential problem.

Analytical reagent grade (or pesticide grade if required) solvents are used for extraction of samples. Each lot of solvents obtained from the supplier is screened by GC prior to use. If impurities which will significantly impact the quality of the analyses are present, the remaining

bottles of this lot are not used.

Reagent blanks are prepared and analyzed with each set of samples to ensure the continued integrity of the solvents.

Laboratory Control Standards are purchased from commercial suppliers and are from a different source than that used for instrument calibration. When available, EPA certified standards are purchased.

QC check samples are analyzed in response to corrective actions to demonstrate that quality problems have been eliminated. Generally, in this case 4 QC check samples are analyzed and the precision and accuracy of the results must pass QC acceptance criteria.

9.2.7.1 Gas Chromatography/Mass Spectrometry. Each instrument is tuned prior to initial calibration. The tuning compounds bromofluorobenzene (BFB), and decafluorotriphenylphosphine (DFTPP) are used for volatile and semivolatiles analysis instrument tunes, respectively. In addition benzidine, pentachlorophenol, and DDT are added to the tune compound for semivolatile analyses. These compounds are used to check for peak tailing and degradation influences of instrument conditions. The tuning procedure must meet the criteria specified in the published method. This is performed on the instruments whenever the sources are cleaned and as needed.

The initial instrument calibration is obtained using three to five calibration standards at concentrations specified by USEPA Methods 8240B, 8260A, 8270B, 624, and 625. The calibration standards contain the target compounds, surrogates and internal standards.

The average relative response factor (RRF) for each compound is calculated using the analyte/internal standard sets if specified in the methods. Alternatively the relative standard deviation RSD for the curve is calculated and the acceptance criteria is specified in the method. The acceptance criteria for the RSD of the RRFs for calibration check compounds and minimum average RRFs for system performance check compounds must be achieved prior to analysis of samples. Second order polynomial curve approximation may be used as prescribed by the method. The instrument tune and calibration are verified each 12 hours of operation, or as specified by the method used. Acceptance criteria for continuing calibration specified by the method are met prior to analyses of samples. See Section 5 of this manual for specific acceptance criteria.

9.2.7.2 Gas Chromatography and High Performance Liquid Chromatography. Instruments used for the determination of organic compounds by gas chromatography or HPLC must be calibrated by either the external standard or the internal standard method. The procedures for each of the methods are described.

9.2.7.2.1 External Standard Calibration Procedure. For each analyte of interest, calibration standards are prepared by adding volumes of stock solutions to a volumetric flask and diluting to volume with an appropriate solvent. One of the external standards should be at a concentration near, but above, the practical quantitation limit. The other concentrations should correspond to the expected range of sample concentrations or should define the working range of the detector.

Each calibration standard is analyzed using the technique that will be used to introduce the actual samples into the instrument. Peak height or area responses are tabulated against the mass injected. The results can be used to prepare a calibration curve for each analyte or the ratio of the response to the amount introduced. Response factors (RF) can be calculated for each analyte at each standard concentration. If the percent relative standard deviation (%RSD) of the calibration factor is less than 20% (10% for EPA 600 series) over the working range, linearity through the origin (zero concentration) can be assumed, and the average response factor can be used in place of a calibration curve.

Calibration factor = Total area of peak* / Mass injected (in nanograms)

*For multi-response pesticides/PCBs, use the total area of all peaks used for quantitation.

The calibration curve or response factor must be verified each day by the injection of one or more calibration standards. Section 5 of this manual provides guidance for the frequency of calibration standards. If the response for any analyte varies from the initial calibration curve by more than ± 15 percent or the QC check standard does not fall within the QC acceptance criteria (whichever requirements are in the method), corrective action is taken which may include recalibration, checking calculations, preparing a new standard, and instrument maintenance procedures.

9.2.7.2.2 Internal Standard Calibration Procedure. One or more internal standards that are similar in analytical behavior to the analyte compounds are selected. The measurement of the internal standard must not be affected by the method or matrix of the samples. Due to these limitations, no internal standard applicable to all samples can be recommended.

Calibration standards at a minimum of three to five concentrations (whichever the method requires) for each analyte of interest are prepared by adding volumes of one or more stock standards to a volumetric flask. To each calibration standard, a known constant amount of one or more internal

standards is added and diluted to volume with an appropriate solvent. One of the standards should be at a concentration near, but above, the practical quantitation limit. The other concentrations should correspond to the expected range of concentrations found in actual samples or should define the working range of the detector. Each calibration standard is injected using the same introduction technique that will be applied to the actual samples. Peak height or area responses are tabulated against the concentration of each compound and internal standard. Response factors (RF) for each compound are calculated as follows:

$$RF = \frac{As \times Cis}{Ais \times Cs}$$

where:
As = Response of analyte
Ais = Response of internal standard
Cis = Concentration of the internal standard, ug/L
Cs = Concentration of the analyte, ug/L

If the RF value over the working range is constant, < 20% RSD (< 10% RSD for EPA 600 series); the RF is assumed to be invariant, and the average RF can be used for calculations. Alternatively, the results can be used to plot a calibration curve of response ratios, As/Ais versus RF.

The working calibration curve or RF is verified on each working day by the measurement of one or more calibration standards. Section 5 provides guidance for the frequency of calibration standards. If the response for any analyte varies from the predicted response by more than ± 15% or the QC check standard does not fall within the QC acceptance criteria (whichever requirements are in the method), corrective action is taken which may include recalibration, checking calculations, preparing a new standard, and instrument maintenance procedures.

9.2.7.2.3 Retention Time. The retention time windows for each compound are established from the initial and continuing calibration as described in the respective methods. Retention time windows are established over a 72 hour time frame and are calculated using ± 3 standard deviations from the mean retention time for each individual compound.

9.2.8 Support Equipment:

9.2.8.1 Balances. Each analytical and top-loading balance is calibrated **daily** prior to initial use with appropriate multiple, certified NIST/NBS Class S or ASTM Class 1 weights, ranging from 10 mg to 4 Kg depending on the range of the balance. All balances are serviced semiannually by balance manufacturer service personnel, and calibrated with an independent source of NIST/NBS Class S or ASTM Class 1 weights. Certifications for weights are archived and maintained in secured files by the QA/QC Officer.

9.2.8.2 Thermometers. All SPL laboratory thermometers are calibrated annually against reference thermometers which are certified NIST/NBS-traceable. Metal dial thermometers are calibrated quarterly. Certifications on reference thermometers are archived and maintained in secured files by the QA/QC Officer.

9.2.8.3 Refrigerators/Incubators. All thermometers used in SPL refrigerators and incubators are calibrated annually or quarterly as described above for thermometers. The temperatures of SPL's refrigerators and incubators are monitored and documented daily. These refrigerator/incubator temperature logs are reviewed and maintained on file by the QA/QC Officer.

9.2.8.4 Digestion Blocks/Water Baths/Hot Plates. All SPL digestion blocks, water baths, and hot plates temperatures are monitored. The thermometers in use are calibrated as described above for thermometers. For each batch of samples that are digested, evaporated, or heated in SPL's laboratories, the heating apparatus' temperatures are documented daily or with each use, whichever is more frequent.

10.0 INSTRUMENT REPAIR AND PREVENTIVE MAINTENANCE

10.0 INSTRUMENT REPAIR AND PREVENTIVE MAINTENANCE

Analytical instruments are serviced or inspected at regular intervals. Service contracts for regular maintenance and emergency service are also maintained for most major instruments. An instrument repair/maintenance logbook is maintained for each instrument. Entries include the date of service, type of problem(s) encountered, corrective action taken, and initials of the person verifying the service has been satisfactorily performed.

The instrument sample run logbook is monitored by the analysts to detect any degradation of instrument performance. Changes in response factors or sensitivity are employed as indicators of potential problems. These are brought to the attention of the laboratory supervisor and preventive maintenance or service is scheduled to minimize downtime.

SPL analysts perform routine maintenance, cleaning, and adjustment of the instruments as needed to ensure accurate analysis results. Supervisory personnel and manufacturer's service representatives provide training and assistance with instrument repair. Service contracts with the instrument manufacturers provide for rapid response in the event of catastrophic failure requiring professional repair and service. Back-up instrumentation and an inventory of critical spare parts are maintained to minimize delays in the completion of analyses.

Forms are maintained for recording the temperature of ovens used for solids determinations, storage refrigerators/freezers and incubators. Temperature for digestion blocks/hot plates are recorded in the sample logbooks. Repair or adjustments are performed and documented as needed. The proper operation of balances is checked and documented daily in a logbook by calibration verification with Class S weights. Zero settings of the balances are checked with each use.

10.1 ORGANIC DEPARTMENT. GC/MS: SPL maintains a service contract with the instrument vendor (Hewlett Packard) where preventive maintenance is performed semiannually. All scheduled preventive maintenance is performed according to manufacturer's specifications. The GC/MS electronic data are backed up weekly on magnetic tape.. The GC/MS mechanical pump oils are changed semiannually.

GC: No service contract is maintained since most problems can be repaired by SPL specialists. Service is effected by the instrument vendor on an as-needed basis (service callout).

10.2 INORGANIC DEPARTMENT. Metals: SPL maintains a service contract with the instrument vendor (Perkin-Elmer) for graphite furnace/Zeemann AA's, flame AA's, and (Perkin-

Elmer or Thermo Jarrel Ash) for the ICPAE spectrophotometers.

Conventional Chemistry: UV-visible spectrophotometers, TOC analyzers, and TOX/TOH analyzers are not under service contract with the instrument manufacturers. Service is effected on an as-needed basis (service callout).

10.3 CONTINGENCY PLANS. Emergency contingency plans include:

1. Analysis of the samples on back-up (redundant) in-house instrumentation.
2. Transfer of samples to other approved and appropriate SPL laboratories equipped with redundant instrumentation.
3. Temporary leasing/rental of the needed instrumentation/equipment until SPL's equipment is repaired and back on-line.
4. Transfer of samples to other local competing environmental laboratories (subcontracting). Any subcontracting of analytical work to another laboratory may require the prior approval of the appropriate state regulatory/laboratory accrediting agency and the prior approval of the client.

10.4 INSTRUMENT REPAIRS/MAINTENANCE AND FREQUENCY

10.4.1 Inductively Coupled Plasma

Repair - Maintenance	Performed by	Frequency
Preventative Maintenance:	Perkin Elmer	Every 6 Months
Run ICP wavelenght calibration solution	SPL	Quarterly
Check Yttrium bullet position	SPL	Daily
Check Argon	SPL	Daily
Drain	SPL	Daily
Check torch for deposits	SPL	Daily
Check RF coil for leaks	SPL	Daily
Check air filters		Weekly

Repair - Maintenance	Performed by	Frequency
Check ignitor, gas flows	SPL	Daily
Replace nebulizer/auto-sampler tubing	SPL	As needed, minimum weekly
Change nebulizer tip	SPL	As needed

10.4.2 Graphite Furnace Atomic Absorbtion

Repair - Maintenance	Performed by	Frequency
Check quartz windows	SPL	Daily
Inspect contact rings & graphite tube. Replace as needed.	SPL	Daily
Observe drying of samples	SPL	Daily before analysis
Check alignment of autosampler injector	SPL	Daily
Check Argon/H2	SPL	Daily
Fill separator trap of fume extraction unit with DI water	SPL for PE 5100,SIMAA 6000	Daily
Replace filter of fume extraction unit	SPL for PE 5100, SIMMA 6000	Daily
Check autosampler tubing	SPL	Weekly
Check water level in cooling system	SPL	Daily
Clean graphite tube windows	SPL	As needed
Clean burner head (Flame)	SPL	As needed

Repair - Maintenance	Performed by	Frequency
Clean mixing chamber (Flame)	SPL	As needed
Replace aspirator tubing (Flame)	SPL	As needed

10.4.3 Gas Chromatography

Repair - Maintenance	Performed by	Frequency
Change gas supply cylinder	SPL	When tank pressure ≤ 100 psi main gauge
Change carrier gas dryer tube	SPL	When indicator turns color.
Change guard column	SPL	As needed
Change column	SPL	As needed
Change inj. septa	SPL	Every 50-75 inj
Change/clean/ silanize injector liner	SPL	Monthly
Perform ECD leak wipe test on ECD detectors	SPL	Every 6 months
Steam clean ECD detector	SPL	As needed
Replace PID lamp	SPL	As needed
Clean ELCD cell		As needed
Change n-propanol in ELCD cell reservoir	SPL	As needed
Replace trap on P&T	SPL	As needed
Change resin cartridge composition in ELCD	SPL	As needed

10.4.4 High Performance Liquid Chromatography

Repair - Maintenance	Performed by	Frequency
Back flush column	SPL	Biweekly or as needed
Replace column	SPL	As needed
Balance DAD	SPL	As needed
Replace pump seals	SPL	As needed
Replace PTFE FRIT	SPL	As needed
Replace Deuterium lamp	SPL	As needed

10.4.5 Gas Chromatography - Mass Spectroscopy

Repair - Maintenance	Performed by	Frequency
Repair of all GC/MS/DS electronics assemblies	Hewlett Packard	As needed
Remove, disassemble, clean source and rods	SPL	Monthly or as needed
Replace filaments	SPL	Monthly or as needed
Change vacuum pump oil	SPL	Every 6 months
Change/clean/ silanize injector port liner	SPL	Daily
Change guard column	SPL	As needed
Change chromat. column	SPL	As needed
Change GC septa	SPL	Every 50-75 inj.
Replace electron multiplier	SPL	As needed

Repair - Maintenance	Performed by	Frequency
Change gas supply cylinder	SPL	When tank pressure ≤ 100 psi main gauge
Change carrier gas dryer	SPL	Every 6 months

10.4.6 Total Organic Halide

Repair - Maintenance	Performed by	Frequency
Repair of all TOX electronics assemblies	Mitsubishi/ COSA	As needed
Replace/repack quartz wool in combustion tube	SPL	As needed
Replace titration cell electrodes	SPL	As needed
Replace quartz combustion tube	SPL	As needed
Clean absorber columns, titration cells, dewatering scrubbers	SPL	Daily
Replace O-rings	SPL	As needed
Change gas supply cylinder	SPL	When tank pressure ≤ 100 psi main gauge

10.4.7 Total Organic Carbon

Repair - Maintenance	Performed by	Frequency
Repair of all TOC electronics and optical assemblies	Manufacturer	As needed
Replace combustion tube catalyst	SPL	As needed

Repair - Maintenance	Performed by	Frequency
Replace combustion tube	SPL	As needed
Replace tubing	SPL	As needed
Adjust baseline to zero	SPL	Daily
Replace Halogen Scrubber/CO2 Scrubber	SPL	Quarterly
Check carrier and sparge gas flows	SPL	Daily
Check for bubles in IC chamber-H3PO4 volume	SPL	Daily
Replace NAOH solution in Dehumidifier	SPL	Daily

10.4.8 UV-Visible Spectrophotometers

Repair - Maintenance	Performed by	Frequency
Repair of all spectrophotometer electronics and optical assemblies	Manufacturer	As needed
Replace source lamps	SPL	As needed

10.4.9 Infrared Spectrophotometers

Repair - Maintenance	Performed by	Frequency
Repair of all spectrophotometer electronics and optical assemblies	Perkin Elmer/ Foxboro/Buck	As needed
Change N2 purge on PE 1600	SPL	Pressure < 100 PSI

Repair - Maintenance	Performed by	Frequency
Change Dessicant in optics chamber on PE 1600	SPL	Every 6 months

10.4.10 pH Meters

Repair - Maintenance	Performed by	Frequency
Repair of all electronics assemblies	Orion, Corning	As needed
Replacement of electrodes	SPL	Slope of calibration < 90% or as needed
Refilling of electrode electrolytes	SPL	Monthly

10.4.11 Turbidity Meters

Repair - Maintenance	Performed by	Frequency
Repair of all electronics and optical assemblies	HF, Hach	As needed

10.4.12 Gel Permeation Cleanup

Repair - Maintenance	Performed by	Frequency
Repair	ABC Labs	As needed
Repack column	SPL	As needed

10.4.13 Ion Chromatography

Repair - Maintenance	Performed by	Frequency
Observe retention times for each analyte	SPL	Daily
Check conductivity reading	SPL	Daily
Check pump pressure	SPL	Daily

Repair - Maintenance	Performed by	Frequency
Check eluent volume and flow rate	SPL	Daily
Check gas pressure and flow	SPL	Daily
Observe temp. compensation reading	SPL	Daily
Check all tubing/column connections for leaks	SPL	Daily
Replace guard and analytical columns	SPL	As needed

10.4.14 Balances

Repair - Maintenance	Performed by	Frequency
Repair of all electronics and mechanical assemblies	Mettler, Sartorius	As needed
Calibration, cleaning	Alometrics Balance Systems or Presicion Balance System (PBS)	Every 6 months

11.0 QUALITY CONTROL ASSESSMENT

11.0 QUALITY CONTROL ASSESSMENT

SPL includes quality control samples in the analytical process to assess the process's accuracy and precision, and to detect contamination, and matrix effects.

11.1 FIELD QUALITY CONTROL SAMPLES

SPL performs only limited sampling and so the frequency of most of the field quality control samples are determined by the client.

11.1.1 Trip Blank. The trip blank is prepared at the laboratory by filling a pre-preserved bottle (vial with septum) with reagent water. The trip blank accompanies the sample kit containing the sample bottles to the field and back to the laboratory. The trip blank is not opened in the field. It is stored with the samples at the laboratory.

Purpose: The trip blank is used to determine if contamination of samples is likely due to: 1) absorption of fumes from other samples, 2) contaminated preservatives or bottles, and 3) contaminated reagent water. The trip blank should not have detections above the detection limit.

Frequency: SPL recommends one trip blank for each volatile organic analysis (8010, 8240 etc) in each sample kit.

11.1.2 Field Blank. The field blank is prepared on site by filling a pre-preserved sample container with analyte-free water.

Purpose: The field blank is used to determine 1) the effects of on-site contaminants on samples and, 2) the purity of preservatives and bottles.

Frequency: The frequency is project specific and determined by the client. SPL recommends one field blank for each analytical parameter every 10 samples.

11.1.3 Equipment Blank. An equipment blank is prepared by collecting final decontaminating rinse water (analyte-free) that is rinsed through the sampling equipment. These blanks are stored and transported with the samples.

Purpose: The equipment blank is analyzed to determine the effectiveness of decontaminating procedures and to assess if samples are contaminated from the sampling equipment.

Frequency: The frequency is project specific and determined by the client. SPL recommends an equipment blank after every ten samples collected by a device.

11.1.4 Field Duplicates. Field duplicates are two samples taken from the same point and placed in separate bottles. These are analyzed as separate samples.

Purpose: Field duplicates are used to determine the reproducibility of the sampling technique.

Frequency: The frequency is project specific and determined by the client. SPL recommends the duplication of every tenth sample.

11.2 BATCH QUALITY CONTROL SAMPLES

A batch is a group of samples prepared for analysis at the same time. The number of commercial samples in a batch shall not exceed twenty. SPL analyzes several quality control (QC) samples in each batch that go through the entire analytical process. These QC samples are the method blank, laboratory control sample, matrix spike, matrix spike duplicate, and replicates. In addition to these batch QC samples, organic commercial samples are spiked with one or more surrogates. The frequency and control criteria for these QC samples are listed in Section 5. Control limits are either mandatory or advisory. Mandatory control limits must be met and failure of these criteria require the laboratory to correct the analytical problem and reprocess one or more samples until the samples pass the criteria. Advisory criteria indicate that sample results may be accepted or rejected based on professional judgement. For example, matrix spike results are compared to advisory control limits because matrix interference may be the cause of the QC failure. In this case, other information such as the results of the LCS, surrogate results, method blank results and calibration verification sample results are considered before a pass or fail judgement is made.

11.2.1 Method Blank. The method blank is reagent water or analyte-free sand that is treated as if it were a commercial sample. It goes through the entire analytical process including extraction or digestion.

The purpose of the method blank is to verify that the analytical process does not contribute significant amounts of the target analytes to samples. Control criteria are mandatory except for common laboratory contaminants such as methylene chloride. Low level detections of these compounds are allowed. Target analyte detections in the method blank must be clearly indicated on the analytical report.

11.2.2 Laboratory Control Sample. The laboratory control sample (LCS) is either reagent water fortified with a known amount of the target analytes or a soil reference material that has certified concentrations of target analytes. This sample goes through the entire analytical process. The LCS, because it is free of matrix effects, is a measure of accuracy of the analytical process. The LCS control limits are mandatory. Failure of the LCS dictates that the samples in the batch must be rejected. The entire analytical process must be repeated. Statistically derived control

limits (+/- 3 standard deviations from the mean) should be determined for the LCS.

11.2.3 Matrix Spike. The matrix spike (MS) is a commercial sample that is fortified with a known amount of the target analytes. The matrix spike results are indicators of matrix effects on the recovery of target analytes. Control limits for matrix spike recovery are advisory. If the amount of analyte in the original sample exceeds the amount spiked by a factor of four, the spike recoveries should not be calculated since control limits do not apply.

11.2.4 Matrix Spike Duplicate. The matrix spike duplicate (MSD) is a second matrix spike analyzed in addition to the matrix spike. Precision is calculated by determining the relative percent difference (RPD) between the MS and the MSD. Although precision limits are advisory, more emphasis is given to the RPD than the percent recovery when determining if the spike should be reanalyzed. For instance, if both matrix spikes exhibit low recovery but good precision then it can be assumed that a matrix interference is present. However, if precision between the MS and the MSD is poor, technique error must be eliminated as a possible source of error before the data can be accepted. If sample size is limited and the data must be accepted, then a narrative must be included in the report.

11.2.5 Replicate. Replicates are two subsamples of a sample analyzed separately. Precision is calculated by determining the RPD. It is SPL's policy to analyze matrix spike duplicates rather than replicates when it is accepted by the regulatory agency. This policy is in place for two reasons. First, no precision data is available when the sample has no detectable analytes. Second, control limits are concentration sensitive and are therefore difficult to establish.

11.2.6 Surrogate. Surrogates generally apply only to organic analyses and are non-target analytes that have similar chemical properties to target analytes. One or more surrogates are added to all samples in a batch during extraction and these include commercial samples, spikes, laboratory control samples, and blanks. The percent recovery of surrogates, similar to matrix spikes, is an indicator of matrix effects. Surrogate recovery is also an indicator of extraction efficiency. Samples with surrogate recoveries that fail QC criteria should be reprocessed by reextracting and reanalyzing the sample to verify the presence of matrix effects. Reprocessing is not necessary if the surrogate failure is due to a coeluting interference.

11.3 CALIBRATION VERIFICATION

Calibration procedures are listed in Section 9 and QC control criteria are listed in Section 5. Generally, each inorganic and gas chromatograph instrument batch must have initial calibration, initial calibration verification, initial calibration blank, continuing calibration verification, and continuing calibration blanks. Control limits for these QC standards and blanks are mandatory. Only samples bracketed by continuing calibration verification samples that pass QC criteria can

be accepted. Initial calibration verification samples should be obtained form a second source. Most Gas Chromatograph - Mass Spectroscopy methods stipulate response factor (RF) requirements for either all compounds or specific system performance check compounds (SPCC).

11.4 STATISTICAL CONTROL

Results of batch quality control samples (LCS, MS, MSD, replicates) are compared to criteria that are determined by: 1) method requirements, 2) contract requirements, and 3) statistical analysis. Statistical limits are determined using Shewart control charts. SPL determines statistical control limits for LCS's. The statistical limit must not be broader than method defined limits for accuracy. Shewart control charting is employed to derived surrogate control limits and it may also be used to determine quality control criteria for matrix spike recovery and relative percent difference. Shewart charts are printed quarterly for trend analysis and control limits are updated annually.

11.4.1 Definitions.

11.4.1.1 Accuracy. Accuracy is the closeness or nearness of a data point or analytical result measured by the test method to the true value. Accuracy is expressed as a percentage of the true value. Accuracy of LCS analytes is determined by calculating the percent recovery as follows:

$$RECOVERY = 100 * \frac{Measured\ Value}{Theoretical\ Value}$$

The matrix spike recovery is calculated according to:

$$RECOVERY\% = 100 * \frac{(Spiked\ Sample\ Result - Original\ Sample\ Result)}{Amount\ of\ Spike}$$

11.4.1.2 Precision. Precision is the reproducibility of an analytical procedure resulting from replicate analyses of a homogeneous sample regardless of the true value. The precision of a matrix spiked sample (MS) and a matrix spiked duplicate (MSD) or, by the analysis of replicate aliquots of a sample. In most cases SPL uses MS/MSD to evaluate the precision of a batch. Duplicates are used for those tests that are not amenable to spiking, such as fecal coliform.

Precision is determined by calculating the Relative Percent Difference (RPD) between the Matrix Spike and the Matrix Spike Duplicate as follows:

$$RPD = 100 * \frac{|MS\ Recovery - MSD\ Recovery|}{0.5 * (MS\ Recovery + MSD\ Recovery)}$$

Precision of duplicates (not spiked) are is calculated as follows:

$$RPD = 100 * \frac{|Replicate_1 - Replicate_2|}{0.5 * (Replicate_1 + Replicate_2)}$$

11.4.1.3 Mean. The mean is calculated as follows:

$$Mean = \frac{\Sigma X_{1..n}}{n}$$

Where:

X = each measurement
n = the number of measurements

11.4.1.4 Standard Deviation. Calculate the variance (S^2) and standard deviation (S) of the replicate measurements as follows:

$$S^2 = \frac{1}{n-1}\left[\frac{\sum_{i=1}^{n} Xi^2 - (\sum_{i=1}^{n} Xi)^2}{n}\right] \qquad S = \sqrt{S^2}$$

where:

$X_{i..n}$, are the analytical results in the final method reporting units obtained from the n sample aliquots, summed from I = 1 to n.

11.4.2 Control Charts. Shewart control charts are graphical analyses of accuracy and precision. Accuracy control limits are derived from recovery measurements of laboratory control samples and matrix spikes. Control limits are derived from the standard deviation of the most recent history of n analyses where n is the number of points at a minimum of 30. Usually, the last 50 samples are used to develop a control chart. The standard deviation of the last n recoveries is determined. Control limits are set at the mean -/+ 3 times the standard deviation. Warning limits are within 2 standard deviations of the mean. Control charts are prepared and maintained by SPL's QC officers.

Precision control limits are derived from the Relative Percent Difference (RPD) between replicate measurements from matrix spikes and matrix spike duplicates or sample replicates. The standard deviation of the last n number of RPD's is determined where n is at a least 30. The Control Limit is the mean plus 3 times the standard deviation. The Warning Limit is the mean plus 2 standard deviations. Out-of-control situations are defined as the occurrence of any of the following:

- Any one point is outside of the control limits.
- Any two consecutive points are outside of the warning limits.
- Any seven consecutive points are on the same side of the center line.
- Any eight consecutive points are such that each point is larger or smaller than the point immediately preceding it.
- Any obvious cyclic pattern is observed in the points.

When an out-of-control situation is identified, the data is assessed and a decision is made to implement corrective action. The resolution of the problem as determined by the analysis of control samples is documented by the use of a Nonconformance/Corrective Action Request form and documented in the instrument use log book.

11.5 DETECTION AND REPORTING LIMITS

11.5.1 Method Detection Limit. The method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. MDL's are determined from analysis of a sample in a given matrix containing the analyte. SPL laboratories perform MDL determinations for all applied methodologies **annually** to upgrade these data/values. The procedure used is as given in 40 CFR: Part 136, Appendix B.

SPL uses the MDL as reporting limits for analyses under the Clean Water Act except in EPA's Region VI where minimum quantification limits (MQL) are allowed. The MQL is generally 5 times the detection limits and corresponds to the calibration point with the lowest concentration.

11.5.2 Practical (Estimated) Quantitation Limit. The PQL/EQL is the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. It is generally 5 to 10 times the MDL. For some analytes it is chosen as the least concentrated calibration standard. It is the lowest concentration that a substance can be reliably quantified.

SPL uses the PQL as a reporting limit for all testing performed under the Resource Conservation and Recovery Act.

12.0 DATA REDUCTION, VALIDATION AND REPORTING

12.0 DATA REDUCTION, REVIEW, VALIDATION, AND REPORTING

It is the intent and policy of the SPL environmental laboratories to follow data production and reporting procedures which utilize redundant, step-wise data validation to minimize errors in analytical reports. Laboratory data reduction and verification procedures are required to ensure that the overall objectives of analysis and reporting meet method and project specifications.

12. 1 DATA REDUCTION.

12.1.1 Instrument Raw Data Output/Computer Data Files Identification. SPL laboratories' instrument raw data and computer data files use the laboratory sample identification number as their primary identification. Each SPL laboratory has its own unique laboratory sample identification numbering system that is discrete from all other SPL laboratories. This laboratory sample identification number is utilized as part of the individual analytical areas' instrumentation naming system for electronic files, each analytical area having a slightly different file-naming system that incorporates this primary identification (i.e., GC, GC/MS, metals, inorganics). Additionally, the various SPL laboratory sample identification numbering systems employ both the date of sample receipt and a sequential number. Retrieval of archived data, both hardcopy and electronic, is thus made simple and easy with this numbering system, along with SPL's electronic archival on a file-by-file basis.

The complexity of the data reduction will be dependent upon the specific analytical method and the number of discrete operations (extractions, dilutions, and levels/concentrations) involved in obtaining a sample that can be measured.

Copies of all raw data and calculations used to generate the final results will be retained on file to allow reconstruction of the data reduction process at a later date.

12.1.2 Regression Analyses. Many of the USEPA analytical methods employed by SPL laboratories require the use of mathematical regression or "best curve-fit" for the development of initial calibration curves. Most of the SPL laboratory instrumentation has electronic hardware/software to perform such regression analyses automatically on demand. Most of the statistical mathematics used to perform such regression analyses is relatively forthright. However, in some cases involving high-order polynomial equations (multiple regressions), the mathematics is quite complex and elaborate (e.g., Fermi-Dirac statistics is needed for some third-degree polynomial equations that represent specific laboratory-observed data such as titration curves). To avoid such complexities, a brief discussion of linear regression statistics and its significance to laboratory data calculations is presented as an introduction to statistical theory.

Linear calibration curves follow the mathematical equation for a straight line, i.e.,

$$X = \frac{Y-b}{m} \qquad Y = mX+b$$

where y represents the instrument response, and x is the concentration of the standard solution. To determine the slope, m, and the response intercept, b,

S = sum of all x	Q = sum of all x^2
Y = sum of all y	L = sum of all y^2
P = sum of all xy	D = NQ - S^2

are calculated where N is the number of standard solutions. Thus,

$$m = (NP - SY)/D$$
$$b = (QY - SP)/D$$

The instrument response has a random error component such that not all responses will fall on the least squares line. This random error, represented by e_i, is such that

$$y = y_i + e_i = mX_i + b + e_i$$

where y_i is the response corresponding to the concentration x_i given by $mx_i + b$, and y_i the actual measured response. These deviations from the fitted line are assumed to be normally distributed and can be described by a standard deviation s_e which is called the "standard error of estimate." To calculate s_e, determine e_i for each point and then

$$S_e = [\text{sum of all } e_i^2 /(N-1)]^{1/2}$$

If an unknown solution is now measured, giving an instrument response y_1, then its concentration will be given by

$$x_1 = (y_1 - b)/m$$

and its standard deviation by

$$s_x = s_e/m$$

The correlation coefficient is another measure of the linear relationship between two variables. It is a measure of the degree of association between the variables.
The estimate of the correlation coefficient r is calculated by the equation:

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{n}}{\sqrt{\left(\sum X^2 - \frac{(\sum Y)^2}{n}\right)\left(\sum Y^2 - \frac{(\sum Y)^2}{n}\right)}}$$

where

X = individual values for independent variable
Y = individual values for dependent variable
n = number of pairs of data.

df = n-2

The square of the correlation coefficient is called the coefficient of determination r^2. The coefficient of determination is a measure of the amount of variation in the dependent variable that is accounted for by the independent variable. If the correlation coefficient is +1.0, then $1.0^2 =$ 1.0 or 100% of the variation is accounted for by the independent variable. Any r^2 of 0.99 or better is considered acceptable.

12.1.3 Conventional Chemistry.

12.1.3.1 Colorimetric Analyses. Colorimetric analyses are computer-calculated using a standard calibration curve. The calibration curve is developed by linear regression of absorbance **versus** concentration, obtained from the analyses of a set of concentration-range standards for the specific analyte. The absorption of the prepared sample is compared to this curve, the concentration of the analyte determined, and any dilution factors are employed in calculating the analyte concentration in the sample. The units of concentration employed in the analyses are denoted in mg/L or mg/Kg. The general calculational equations used to determine analyte concentration are:

$$A = C_i M + B$$

where,

C_i = concentration of instrument sample

A = absorbance
M = slope of the calibration curve
B = absorbance intercept (Y-intercept) of the calibration curve

Final sample analyte concentrations are given by:

$$C_f = \frac{C_i \; DV}{W}$$

where,

C_f = final sample analyte concentration
D = dilution factor
V = initial volume of sample prepared
W = weight or volume of sample prepared

12.1.3.2 Total Organic Carbon (TOC) and Petroleum Extractable Hydrocarbons (TPH, 418.1). TOC analyses use infrared spectrophotometer detectors and calibration calculations are performed by computer as is described for colorimetric procedures described above.

12.1.3.3 Titrimetric analyses. Titrimetric analyses are based on the normality of the titrant(s), volume of prepared sample used, a fixed conversion factor for the specific analyte and method,and any dilution factors. Standards of known concentration of the analyte of interest are titrated to check the method accuracy. The units of concentration employed in the analyses are denoted in mg/L, ug/L, mg/Kg, or ug/Kg. General manually-used calculational equations used to determine analyte concentration
are:

$$C_i = \frac{(V_s - V_b)\, NKV_{di}}{W}$$

where,

C_i = concentration by titration
V_s = volume of titrant required for sample
V_b = volume of titrant required for method blank
N = normality of titrant
K = fixed conversion factor, method specific
V_{di}= volume of prepared sample required for titration

W = weight or volume of sample

Final sample analyte concentrations are given by:

$$C_f = \frac{C_i \ DV}{W}$$

where,

C_f = final sample analyte concentration
D = dilution factor
V = initial volume of sample digestate
W = weight or volume of sample digested

12.1.3.4 Total Organic Halides (TOX/TOH). TOX analyzers utilize a single-point calibration standard to verify that the instruments are recovering the calibration standard within the QC tolerances described in USEPA method 9020. The calculation is performed by the on-board instrumentation. The calculation for sample determinations is given by

$$ug/L \quad TOX \quad = \frac{(C_1 - C_3) + (C_2 - C_3)}{V}$$

where,

C_1 = ug chloride on the first column in series
C_2 = ug chloride on the second column in series
C_3 = ug chloride of daily average method blank value for a 40 mg carbon column
V = sample volume in liters

12.1.3.5 Gravimetric Analyses. Gravimetric analyses include tests such as Total Solids, Total Dissolved Solids, Total Suspended Solids. These are calculated by the following formula:

$$Residue \quad mg/L = \frac{A - B * 1000}{C}$$

For Total solids or Total Dissolved Solids the variables are as follows:

A = weight of sample + dish in mg

B = weight of dish in mg
C = volume of sample in ml

For Total Suspended Solids the variables are as follows:
A = weight of filter (or filter + crucible) + residue in mg
B = weight of filter (of filter + crucible) in mg
C = milliliters of sample filtered

Percent Moisture is determined on solid samples and the percent moisture is calculated as follows:

$$Moisture\ \% = \frac{100 * (W - F)}{W}$$

Where,
W = Wet Weight of Sample
F = Dry weight of Sample

12.1.4 Metals. Atomic absorption analyses are computer-calculated by the use of a standard calibration curve. The calibration curve is a plot of absorbance versus concentration, obtained from the analyses of a set of at least 3 concentration-range standards for the specific analyte. The instrumentation utilizes software algorithms to curve-fit absorbance and concentrations by regression analysis. The software program then compares the absorption of the prepared sample to the calibration curve, the concentration of the analyte determined, and any dilution factors are employed in calculating the analyte concentration. The units of concentration employed in the analyses are denoted in mg/L, ug/L, mg/Kg, or ug/Kg.

The software used by all of SPL's Atomic Absorption spectrophotometer is manufactured by Perkin-Elmer. The calculational equation used by the Perkin-Elmer software is given as:

$$C = \frac{K_3^2 A + K_1 A}{K_2 A - 1}$$

where,
$C_i =$ concentration of instrument sample

A = absorbance/emission
K_1, K_2, K_3= concentrations of the calibration curve .
Final sample analyte concentrations are given by:

$$C_f = \frac{C_i \ DV}{W}$$

where,
C_f = final sample analyte concentration
D = dilution factor
V = initial volume of sample digestate
W = weight or volume of sample digested

Inductively coupled plasma emission analyses are computer-calculated by the use of a standard calibration curve. The calibration curve is a plot of emission **versus** concentration, obtained from the analyses of a standard for the specific analytes. The standardization is verified quarterly by the analyst by analyzing a second standard at the high end of the linear range. The acceptance criteria for the linearity check is ± 5 % of the true value of the standard. The software program compares the emission of the prepared sample to the calibration curve, the concentration of the analyte determined, and any dilution factors are employed in calculating the analyte concentrations. The units of concentration employed in the analyses are denoted in mg/L, ug/L, mg/Kg, or ug/Kg.

12.1.5 Organics. GC and GC/MS analyses are computer-calculated by differing techniques, dependent on the method of calibration and sample matrix.

12.1.5.1 External Calibration.

Water matrix:

$$Concentration \quad ug/L = \frac{D \ V_t \ A \ V_t}{A_s \ V_i \ V_s}$$

where,
A_x = analyte response of A_s V_i V_s sample (peak area or height)of standard injected or purged
A_s = external standard response, as in Ax
V_i = volume of extract injected, uL (with purge&trap, V_i is 1)

D = dilution factor
V_t = volume total extract,uL (with purge&trap, V_i is 1)
V_s = volume sample extracted or purged, ml

Nonaqueous matrix:

$$Concentration \quad ng/g = \frac{A_x \; A \; V_t \; D}{A_s \; V_i \; W}$$

where, W = weight of sample extracted/purged, g

12.1.5.2 Internal Calibration

Water matrix-

$$Concentration \quad ng/Kg = \frac{A_x \; A \; V_t \; D}{A_s \; RF \; V_s}$$

where,
A_x = sample analyte response (peak area or height)
C_{is} = amount internal standard added to extract or volume purged,ng
A_{is} = internal standard response, as in A_x RF = analyte response factor

Nonaqueous matrix-

$$Concentration \quad ug/L = \frac{A_x \; C_{is} \; D}{A_{is} \; RF \; V_s \; W_s}$$

where,

W_s = weight of sample extracted,
g A_x, C_{is}, D, A_{is}, RF, V_s= same as above

12.2 DATA REVIEW. Analysts are responsible for adherence to SOPS for applicable methodologies and data quality procedures. QC data summaries are completed as the data are produced and these summaries document the analysis of blanks, replicates, and spiked samples

that are tested concurrently with sample groups.

The analysts in each laboratory must cross-check data calculations and transcriptions between instrument printouts, logbooks, and data report sheets/electronic data transfer files. Copies of all pertinent COCs, data sheets/electronic data files and QC summaries are remitted to the area laboratory Supervisor for review and approval. Any problems are addressed by the laboratory Supervisor and transmitted to the QA/QC Officers. All area laboratory logbooks (for standards, instrument use, instrument repair, analyses, extractions, digestions, etc.) are reviewed and initialed by the respective laboratory Supervisors once a month or more often if required by a specific project.

Warning and control limits are determined annually by SPL's QA/QC Officers using control charts and are distributed by the SPL QA/QC Officers to each area. The sample QC data are compared to these limits to allow analysts to determine the data validity. Data which are outside QC limits are rejected and the analyses rerun for the associated samples. If data cannot be produced which meets acceptable criteria, a Nonconformance/Corrective Action Request Form (see section 13) is initiated by the analyst and the analytical procedure evaluated by the area Supervisor and the QA/QC Officer. Observations of unusual test results or anomalies are noted on the QC summaries, even if the data is within acceptable ranges. The QA/QC Officers provide review of any QC summaries with problems. If no problems are found in the verification of calibration data, duplicate analyses, and spike analyses (i.e. the QC data is within control limits), the data sheet is signed and dated by the Area Supervisor. Data sheets are then remitted to Document Control.

The QA/QC Officers are also responsible for review of blind sample analyses that are randomly made part of sample batches. If the target concentration ranges are not achieved in these blind sample analyses, the section Supervisor and the QA/QC Officer determine if a problem exists and implement any corrective action needed.

12.3 DATA REPORTING. Reports will contain final results (uncorrected for blanks and recoveries), analytical methods, detection limits, surrogate recovery data, method blank data, and results of QC samples (where applicable). The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. The following significant figure rules will be use when reporting results: for inorganic tests 3 significant figures and for organics 2 significant figures. Comparison of the result to the detection limit should be done prior to rounding and anything below the detection limit is reported as ND. Some projects may require reporting the results below the detection limit and qualifying the data with a J flag. In general, this would be limited to reporting limits that are above the MDL or CLP style reports.

Rounding takes place after all calculations. The following rounding procedure must be used:

1. If the figure next beyond the last place to be retained is less than 5 then the figure in the last place is unchanged.

2. If the figure next beyond the last place to be retained is greater than 5 then the figure in the last place is increased by 1.

3. If the figure next beyond the last place to be retained is 5 and there are only zeros or no figures beyond the 5 then the figure to the last place to be retained is unchanged if the number is even, or increased by one if it is odd. If the 5 next beyond the number to be retained is followed by any number other than zero then the retained figure must be increased by 1.

Exceptions to the significant figure rules occur when the analyte concentration is close to the detection limit. The result should not have more numbers to the right of the last significant figure of the detection limit. Below is an example:

Detection Limit= 0.005 mg/L, express results with a default of three significant figures.

Result	**Report**
0.0046	ND
0.0061	0.006
0.0141	0.014 (2 sig figs)
0.1232	0.123 (3 sig figs for inorganics)

Detection Limit= 50 mg/L (the zero is significant)

Result	**Report**
49.9	ND
51.2	51
103.2	103

Final reports are spooled/printed from the LIMS, collated, and submitted to the Project Managers for review and signature.

12.3 DATA VALIDATION. The purpose of analytical data validation is to qualify data for any data quality limitations identified during review. The analyst performing the test shall review 100 percent of the samples in a given batch for validity based on the calibration and QC

criteria set forth in Section 5 of this QAM or appropriate methodology. After the analyst's review has been completed, 100 percent of the data shall be reviewed independently by a senior analyst or secondary reviewer. Client or project specific information will be evaluated by the Project Managers. In addition, appropriate case narratives shall be added to explain any nonconformance issues. Projects data packages are evaluated according to SOPMI-P11. Data qualifiers will be used according to agencies or States requirements (EX. AFCEE, Florida, Wisconsin, etc.). The list of qualifiers to use and the procedures for applying flags to data are described in their respective QAPP'S.

Data validation criteria must include:

1. Holding Times for sample preparation and analysis
2. Laboratory Control Samples
3. Method Blank
4. Equipment Blank
5. Field duplicates
6. Matrix spike data
7. Sample Preservation/Collection
8. Sample Storage
I9. Trip Blank
10. Initial Five Point Calibration
11. Initial Daily Calibration
12. Continuing Calibration
13. Retention Time
14. Surrogates
15. Tune
16. TICS
17. Initial Calibration Curve
18. Initial Calibration Blank
19. Continuing Calibration Blank
20. Method Blank
21. Initial Calibration Verification
22. Continuing Calibration Verification
23. Interference Check Standard
24. Serial Dilution
25. Method of Standard Additions
26. Preparation logs
27. Internal Standards

Some of the most common used data qualifiers are:

B The analyte was found in the associated blank, as well as in the sample.

D The sample is reanalyzed at a higher dilution factor.

E This flag identifies compounds whose concentration exceed the upper level of the calibration range of the instrument.

J The analyte was positively identified above the MDL but below the contract required reporting limit, the quantitation is an estimation.

MI Matrix interference.

N This flag indicates presumptive evidence of a compound. This flag is only used for TICS.

ND The analyte was analyzed for, but not detected.

When the analytical reports are approved for release, copies are made and invoices are prepared. The reports are then mailed or delivered to the client.

12.4 DATA STORAGE/ARCHIVAL

SPL laboratories archive all hardcopy and electromagnetic media that contain raw and refined/reduced data, laboratory notebooks, instrument printouts, COCs, telephone conversation logbooks, project files, all QA/QC files, certifications of analysis, certifications of traceability, all instrument calibration data, instrument repair logbooks and files, final reports, etc. for a minimum of 7 years. These records are archived and stored in separate, dedicated and secured, rooms with limited access. Security is maintained by keeping these rooms locked at all times, except when in use, and by limiting keys to these rooms to a few personnel (Laboratory Director, Document Control Officer, and QA/QC Officer). Additional security is effected by the implementation of Documentary Chains-of-Custody if documents must be removed from archival storage for review. These Documentary COCs verify custody of the records.

Virtually all SPL project/work order documentation is filed according to the sample laboratory identification number, in ascending, sequential order on a file-by-file basis. This also applies to SPL's electronic media (magnetic tapes, magnetic diskettes, magnetic streamer tapes). This

system allows ease of data retrieval and does not significantly disrupt the operation of SPL's computer data systems. GC, GC/MS, and metals initial calibration data document originals are stored/archived in ascending, sequential, chronological order. Boxes/files that contain the archives are labeled with inclusive sample laboratory identification numbers and inclusive dates. After 7 years of archival, SPL's eligible archives are purged and destroyed. Disposal of purged cases/files is accomplished by shredding/ destruction of the material.

12.5 DOCUMENT CONTROL

12.5.1 Document Identification. Controlled documents are those documents that must be replaced when they are revised. Controlled documents have a document control number located on the approval page. This control number is assigned and tracked by the Quality Assurance/Quality Control Officer (QAO). The QAO maintains a logbook of documents and the individual to whom it is assigned. The QAO is responsible for replacing the old version of the document with the revised version so that no copy of the old version remains in the work areas. The old version is marked "REPLACED BY *REVISION NAME*". A copy of the old version is archived as described above. If an uncontrolled version of a document is released it must be clearly marked with "UNCONTROLLED COPY" where the control number should appear.

Document control blocks must also appear on the upper right hand corner of controlled documents. The control block contains an identification (e.g. SOP number), revision date, page number, and total number of pages in the document.

Controlled documents must have approval signatures. The Corporate Quality Assurance Plans must have the approval signatures of the Laboratory Managers, the QAO's, the Corporate Laboratory Director, and the CEO. Quality Assurance Project Plans must have the signature of the Laboratory Director and the QAO. Standard Operating Procedures must have the signature of the department Supervisor and the QAO.

12.5.2 Document Revision. Standard Operating Procedures are reviewed, at a minimum, every two years. If federal or state rulings make an SOP obsolete it is updated immediately. The Corporate Quality Assurance Plan is updated annually unless a major regulatory change necessitates an earlier revision.

Document changes are requested using the Document Change Request Form. Copies are sent to the QAO who must approve all document changes.

12.5.2.1 Document Change Request Form.

DOCUMENT CHANGE FORM

ORIGINATING LAB: Houston ☐ Lafayette ☐ Michigan ☐ Fullerton ☐ DATE :_____

REQUESTED BY:_____ DATE NEEDED: _____

VERIFIED BY: _____

DESCRIPTION OF CHANGE NEEDED: (Provide detailed description)

_____

_____

REFERENCE TO SUPPORT REQUEST:

_____

_____

ATTACH EXAMPLE (If Applicable)

SUBMITTED TO: _____ DATE: _____

DATE CHANGE MADE: _____ APPROVED ☐ REJECTED ☐

COMMENTS:

_____

_____

_____

_____ Date: _____

Approved: Quality Assurance Officer

Copies to: ☐ File ☐ Lab Director ☐ QA Officer ☐ Corporate QA

13.0 CORRECTIVE ACTION

13.0 NONCONFORMANCE AND CORRECTIVE ACTION

13.1 QUALITY MEASUREMENTS

SPL has several measurement systems to assure that its product is of high quality. These systems include:

- Primary and secondary data review.
- Performance audits.
- System audits and method audits.

The purpose of each of these measurement systems is to detect nonconformances. SPL defines a nonconformance as any unapproved deviation from company policy, state or federal regulations, contract requirements, quality control criteria, and standard operating procedures. Nonconformances can be the result of either a random error or a systematic error. Once a nonconformance is identified then an analysis of its cause must ensue to determine if a systematic problem exists. If a systematic problem exists then a corrective action request is issued. The Nonconformance / Corrective Action procedure is detailed in SPL SOP# QA-P17.03. All corrective actions are tracked by the Quality Assurance/Control Officer (QAO). The QAO is responsible for assigning due dates for corrective actions. The QAO must approve all corrective actions and is responsible for determining if the Nonconformance/Corrective Action Request (NCAR) procedure is completed. Copies of all nonconformances are kept in the project file.

13.1.1 Primary and Secondary Data Review. An employee performing any process is responsible for performing the primary task review. This employee is responsible for both determining if any nonconformances exist and initiating the nonconformance procedure. Many processes, such as laboratory analysis, include a secondary review. It is the responsibility of the secondary reviewer to initiate the NCAR procedure if the primary review fails to detect the exception. The primary or secondary reviewer must initiate a NCAR if a systematic problem is detected. Quality control samples (see section 11) must be evaluated both by the primary and secondary reviewers. The minimum acceptance criteria appear in Section 5 of this manual. Other criteria may occur in control limit updates, SOP updates, or contract specific requirements.

13.1.2 Performance Audits. SPL participates in several Performance Evaluation studies (see Section 14). These studies are performed by analyzing samples fortified with target compounds. There are two types of Performance Evaluation studies and these are single-blind studies, and double-blind studies. Single-blind studies are those where the true concentrations are unknown by the analyst. Single-blind performance evaluation studies in which SPL participates are the EPA's Water Pollution studies , EPA's Water Supply study, and ERA's soil study. A double-blind performance standard is one that the analyst does not know the compound concentration nor that the sample is a performance evaluation sample. SPL's double blind performance

evaluation for water is provided by Analytical Standards Incorporated. Some double-blind standards are submitted by clients. It is the QA Officer's responsibility to issue NCARs for all nonacceptable performance evaluation results.

13.1.3 System Audits and Method Audits. Quality Control Officers perform system audits and method audits (described in Section 14). Criteria for these audits are located in test methods, standard operating procedures, Code of Federal Regulations, ISO Guide 25, and SPL's Corporate Quality Assurance Plan. It is the Quality Control Officer's responsibility to issue Corrective Actions Requests for discovered deficiencies.

13.2 SPL NONCONFORMANCE AND CORRECTIVE ACTION REQUEST FORM

SPL/CE/QA-F2.05 **SPL Nonconformance & Corrective Action Record**

Nonconformance

DEPARTMENT:

❒ Shipping & Receiving	❒ Extractions	❒ Organics	❒ Metals
❒ Document Control	❒ Digestions	❒ Water Lab	❒ Client Services

PROBLEM CATEGORY:

❒ Labeling	❒ Holding Time	❒ Improperly Preserved	❒ Headspace
❒ Insufficient Sample	❒ Sample Handling	❒ Method Blank Contamination	❒ Surrogates
❒ LCS	❒ Matrix Spikes	❒ RPD	❒ Sample Prep
❒ Standard Prep & Traceability	❒ Analytical Method	❒ Analytical System	❒ Data Reporting
❒ Data Review & Validation	❒ Management	❒ Communication	❒ PE Studies
❒ Other (describe below)			

Description of Nonconformance:

DUE DATE (for investigation of CAR):

SPL Workorder Number:	Test Parameter:	Matrix:
Date of Sample Collection:	Prep Batch ID:	Analysis Batch ID:

Potential Impact on Client/SPL:

Client Notification Required: YES ❒ NO ❒	Means of Notification:	Responsible Party Signature: Date Client Contacted:

Instructions for Data Reporting:

Submitted for Resolution to:	Originator Signature: Date:	Supervisor Signature: Date:

Is a Corrective Action Necessary for Resolution: YES ❒ NO ❒
(See page 2 for CAR form)

Distribution: ❒ Originator ❒ Manager/Supervisor ❒ Project Manager ❒ QA Dept. ❒ Doc. Control

Corrective Action

Detailed Description of Root Cause:

Corrective Action:

Target Date For Completion:

Supervisor Signature: Date:

Lab Director Signature: Date:

QA Approval Signature: Date:

Corrective Action Verification

Detailed Description:

Corrective Action Satisfactory: YES ❒ NO ❒	Follow Up Required: YES ❒ NO ❒
QA Signature:	Date of Closure:

Distribution: ❒ Originator ❒ Manager Supervisor ❒ Project Manager ❒ QA Dept. ❒ Doc. Control

13.3 CUSTOMER COMPLAINTS

Customer complaints are recorded in the phone logs of the Responsible Party (Project Managers and Supervisors). The record must at a minimum document the following information:

1. Customer Name.
2. Date
3. Customer Phone Number.
4. Work Order or Invoice number if applicable.
5. Description of the problem.
6. Date response is promised to the client.
7. Note if this is a second or more call for the same problem.
8. Resolution status (i.e. resolved by phone, letter, fax, unresolved, none necessary)

Complaints requiring a specific corrective action are handled by completing the Customer Complaint Corrective Action Form (CCAA) as described in SOP QA\P12.01. This form is completed by the person receiving the complaint. The form is addressed to the person responsible for executing the corrective action.

Once the corrective action has been made, the executor of the corrective action enters an explanation of the corrective action on the CCAA form. The CCAA is then returned to the person who initiated it. It is then reviewed, approved and signed by the initiator. The CCAA is then forwarded to the Manager and the QA Officer for approval signatures.

14.0 PERFORMANCE AND SYSTEM AUDITS

14.0 PERFORMANCE AND SYSTEM AUDITS

14.1 PERFORMANCE EVALUATION SAMPLES. In order to assess the accuracy and precision of laboratory procedures and results, performance check samples (PE samples) from several external testing programs and from internal formulations are utilized.

All SPL laboratories analyze double blind aqueous samples quarterly and single blind soil samples semiannually. These samples are purchased from commercial sources (e.g. Analytical Standards Incorporated, Environmental Resource Associates).

SPL, Inc. routinely analyzes USEPA DMR-QA samples required for the performance of NPDES permit analyses. SPL subscribes to the EPA Water Pollution performance evaluation studies and the Lafayette and Houston laboratories participate in EPA's Water Supply study.

Several of SPL's regular clients also submit annual and quarterly client-prepared PE samples to SPL's laboratories. Applicable corrective actions, if necessary, are determined during client reviews of the results for implementation by the respective SPL laboratory.

PE sample results are documented in the form of reports and analytical raw data furnished to SPL's QA/QC Officers by their respective SPL laboratories. These results and data are reviewed by the SPL QA/QC Officers for validity (accuracy, precision, completeness, and appropriate evidentiary documentation). Applicable corrective actions, if necessary, are determined during these reviews for implementation by the respective SPL laboratory. These data and documentation are archived by the respective SPL QA/QC Officers. Those state laboratory accrediting agencies who currently approve or certify SPL laboratories and require the submission of PE samples are furnished reports that outline and detail the QA PE results.

TABLE 14.1

SPL QC Performance Evaluation Samples

PE SAMPLE	SOURCE	FREQUENCY	ANALYTICAL AREAS
External QC	Client	Annual	Metals, GC, GCMS, conv. Chem.
	State agencies	Semiannual	GC/MS, TPH, GC Diesel, Gasoline, metals, Conv. Chemistry, HPLC
	USEPA NPDES DMR-QA	Annual	Metals, GC, GCMS, Conv. Chem.
	USEPA Water Pollution Study	Semiannual	Metals, GC,GCMS Conv. Chem.
	USEPA Water Supply Study	Semiannual	Metals, GC, Conv. Chem.
	USEPA CLP	Dependent on bid	Dependent on bid, solicitation or contract
Double blind Aqueous	ASI OR ERA	Quarterly	Metals, GC, GCMS, Conv. Chem., HPLC
Single Blind Soil	ERA	Semiannual	Metals, GC, GCMS, Conv. Chem.

Monthly QA meetings are held to review current QA data and to evaluate ongoing QA activities. Additionally, some SPL clients hold regular QA meetings with SPL laboratory management staffs to review and discuss QA activities that affect the clients' and SPL's work relationships. Table 14.1 lists the type, sources, and frequencies of QC samples that SPL laboratories analyze.

14.2 SYSTEM AUDITS SPL laboratories will submit to any USEPA or state regulatory agency/state laboratory accreditation agency or client on-site laboratory audit. SPL's environmental laboratories undergo system audits at both regular and irregular time intervals.

There are several different types of system audits performed on SPL laboratories that are listed in Table 14.2.

TABLE 14.2

SPL Laboratories' System Audits

AUDIT TYPE	FREQUENCY	AUDITOR(S)
SPL internal quality system	Quarterly	SPL QA/QC Officers
SPL internal method audits	50 per year	SPL QA/QC Officers
External client	Random ~ 8-10 per year	Client technical QA staff or client QA contractor
External state/municipal	Annual or biannual	Agency technical QA staff
External USEPA CLP	Upon completion of USEPA CLP PE samples in response to a solicitation.	USEPA CLP QA audit contractor
External USEPA Superfund Innovative Technology Evaluation (SITE)	Upon completion of PE samples (annual) Dependent on BID award	USEPA SITE QA audit contractor
External Federal DOE/DOD (HAZWRAP, USATHAMA, US Army Corps of Engineers, CLEAN) US Navy, AFCEE	Upon completion of PE samples	Federal DOE/DOD QA audit subcontractor (Martin Marietta, MITRE Corp.,US Army Corps of Engineers, etc,)

SPL's internal quality system audit examines login procedures, sample handling procedures, standard traceability, data documentation and archival, internal review procedures, document control, and adherence to SPL's Quality Assurance Plan. SPL's internal method audit examines adherence to the method and standard operating procedure requirements. Calculations are verified and data is traced from a randomly chosen report. Deviations from SPL's documented policies or method requirements are documented in an audit report and corrective action requests. QC Officers are responsible for monitoring the progress of corrective actions and they must approve the actions taken.

15.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

15.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

SPL's Laboratory QA/QC Officers prepare and submit internal QA reports to SPL's Corporate Quality Assurance Director. The Corporate QA Director then reports to management monthly (SPL Laboratory Directors/Operations Managers, SPL Vice Presidents, SPL's President/CEO) including, but not limited to, the following: periodic assessment of measurement data accuracy, precision, method detection limits, results of performance audits, results of system audits, significant QA problems, recommended solutions, and outcomes of any corrective actions.

SPL's QA/QC Officers meet weekly with the Laboratory Manager to review measurement data accuracy, precision, completeness, and method detection limits, results of performance audits, results of system audits, significant QA problems and recommended solutions, and outcomes of any corrective actions.

Annual external QA reports are prepared and submitted by the SPL environmental laboratory QA/QC Officers to the QA Officers of various state regulatory/laboratory accrediting agencies under whose auspices SPL's environmental laboratories are authorized to analyze samples.