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Work Plan for

Detroit Coke Corporation
Detroit, Michigan
RCRA Facility Investigation

- **Quality Assurance Project Plan**

Appendix D: TriMatrix Laboratories QA/QC Manual

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DCC 0104

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Quality Assurance Manual

Analytical Services

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Laboratories, Inc.

1.0

TriMatrix Laboratories, Inc.

QUALITY ASSURANCE MANUAL

Revision Number: 1.0

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Quality Assurance Supervisor _____ Date: _____

Laboratory Manager _____ Date: 2/1/96

TABLE OF CONTENTS

				Page #
1.0	**Title Page**			1-1
2.0	**Table of Contents**			2-1
3.0	**Quality System**			3-1
	3.1	**Introduction**		3-1
		3.1.1	The Purpose of this Manual	3-1
		3.1.2	The Need for Analytical Quality Assurance/Quality Control	3-1
		3.1.3	Definition of Terms	3-2
			3.1.3.1 Quality Assurance	3-2
			3.1.3.2 Quality Control	3-3
			3.1.3.3 Quality Assessment	3-3
	3.2	**Quality Policy Statements from Management**		3-3
		3.2.1	Corporate Quality Objectives	3-4
		3.2.2	Corporate Quality Commitments	3-4
	3.3	**Organization and Responsibilities**		3-5
		3.3.1	Corporate Structure	3-5
		3.3.2	Vice President/General Manager	3-5
		3.3.3	Quality Assurance Manager	3-6
		3.3.4	Technical Director/Health & Safety Officer	3-6
		3.3.5	Laboratory Area Managers	3-8
			3.3.5.1 Client Services	3-8
			3.3.5.2 Inorganic Laboratory (Meals and Non-metals)	3-8
			3.3.5.3 Organic Laboratory (Semi-Volatile and Volatile)	3-9
			3.3.5.4 Organic Preparation Laboratory	3-9
		3.3.6	Deputy Technical Directory/Deputy Quality Assurance Officer	3-10

TABLE OF CONTENTS
(Cont.)

			Page #
	3.3.7	Organizational Charts	3-10
	3.3.8	Deputy Technical Director/Deputy Quality Assurance Officer	3-10
3.4	**Relationships**		
	3.4.1	Management - Technical Operations	3-12
	3.4.2	Management - Support Services	3-12
	3.4.3	Management - Quality System	3-16
3.5	**Job Descriptions**		3-18
	3.5.1	Management Staff Members	3-18
	3.5.2	Technical Staff Members	3-26
3.6	**Resumes**		3-42
3.7	**Approved Signatories**		3-52
	3.7.1	Client Invoice Reports	3-52
	3.7.2	Proposals, Price Quotations, and Laboratory Contracts	3-52
	3.7.3	Quality Assurance Project Plans - QAPP's	3-53
	3.7.4	Purchase Agreements/Orders	3-53
	3.7.5	Binding Statements - Laboratory Certifications	3-53
3.8	**Accreditation's, Certifications and Proficiency Programs**		3-54
	3.8.1	Laboratory Certification- Federal, State and Industrial	3-54
	3.8.2	Method / Analyst Certifications	3-56
		3.8.2.1 Method / Analyst Certification - Method Specific	3-56
		3.8.2.2 Method / Analyst Certification - Non Method Specific	3-68
	3.8.3	Training	3-68
	3.8.4	Annual Recertification of Analysts	3-73

TABLE OF CONTENTS
(Cont.)

		Page #
3.9	**Laboratory Scope of Services**	3-75
3.9.1	Method and Matrix Capabilities/Analytical Methodologies	3-75
3.9.2	Detection Limits	3-76
3.9.2.1	Instrument Detection Limit - IDL	3-76
3.9.2.2	Method Detection Limit - MDL	3-77
3.9.2.3	Reporting Detection Limit - RDL	3-77
3.9.3	Procedures for Accepting New Work/Tests	3-79
3.9.3.1	New Test Requests	3-79
3.9.3.2	Method Development and Approval	3-79
3.10	**Laboratory Facilities, Equipment and supplies.**	3-80
3.10.1	Physical Plant	3-80
3.10.1.1	Laboratory Demographics	3-80
3.10.1.2	Reagent water systems	3-81
3.10.1.3	Glassware	3-82
3.10.1.4	Compressed air	3-83
3.10.1.5	Ventilation systems	3-83
3.10.1.6	Electrical services	3-84
3.10.1.7	Laboratory Layout(diagram)	3-84
3.10.2	Equipment Procurement	3-86
3.10.3	Equipment Management/Maintenance/Inventory	3-86
3.10.4	Chemical Procurement and Inventory	3-86
3.10.4.1	Reagents, Solvents and Gases	3-86
3.10.4.2	Certified Standards	3-88

TABLE OF CONTENTS
(Cont.)

				Page #
4.0	Quality Control			4-1
	4.1	Document Control and Maintenance		4-1
		4.1.1	Traceability of Measurements/Documentation Requirements	4-1
		4.1.2	Paperwork/Information Flow	4-1
			4.1.2.1 Project Initiation	4-2
			4.1.2.2 Sample Receipt/Examination	4-3
			4.1.2.3 Sample Log-in	4-12
			4.1.2.4 Worklist /Bench sheets	4-16
			4.1.2.5 Management Reports	4-25
			4.1.2.6 Quality Assurance Reports	4-31
			4.1.2.7 Client Invoice/Quality Control Reporting	4-32
			A) Level 1 Reporting (General Reporting)	4-33
			B) Level 2 Reporting (Batch QC Reporting)	4-34
			C) Level 3 Reporting (Data Assessment)	4-35
			D) Level 4 Reporting (Data Validation)	4-36
			E) Level 5 Reporting (CLP Reporting)	4-39
			4.1.2.8 Project Files	4-45
			4.1.2.9 Quality Control Documents	4-46
			A) Analyst Notebooks	4-46
			B) Instrument Logbooks	4-47
			C) Controlled Temperature Units	4-48
			D) Balance Monitoring	4-51
			E) Standard Record Books	4-51
			F) Pipet Logs	4-52
			G) QC Reports, Lists and Charts	4-52
			4.1.2.10 Confidentiality and Proprietary Rights	4-60
			4.1.2.11 Document Storage and Traceability	4-60

TABLE OF CONTENTS
(Cont.)

			Page #
	4.1.3	Standard Operating Procedures - SOP's	4-62
		4.1.3.1 SOP Catagories - Types	4-63
		4.1.3.2 SOP Development, Formatting, and Review	4-63
		4.1.3.3 SOP Documentation, and Control	4-64
	4.1.4	LIMS Validation Procedures	4-69
		4.1.4.1 GALP Compliance	4-69
4.2	**Sample Control, Flow and Storage**		4-72
	4.2.1	Project Initiation	4-72
		4.2.1.1 Sample Containers and Materials Procurement	4-74
		4.2.1.2 Preparation of Containers	4-74
		4.2.1.3 Sample Container Shipment	4-75
	4.2.2	General Laboratory Security	4-81
	4.2.3	Sample Log-In	4-81
		4.2.3.1 Sample Receipt/Examination	4-81
		4.2.3.2 Computer Log-in	4-82
		4.2.3.3 Project and Sample Verification	4-83
		4.2.3.4 Sample Distribution	4-83
		A) Sample Splitting - Water Samples	4-83
		Bottles and Preservatives	
		Inorganic Analyses	
		Organic Analyses	
		B) Sample Splitting - Solid Samples	4-84
		Bottles and Preservatives	
		Inorganic analyses	
		Organic analyses	
		C) Sample Identification/Labeling	4-85
		D) Sample Storage	4-86

TABLE OF CONTENTS
(Cont.)

			Page #
	4.2.4	Chain-of-Custody (COC)	4-87
		A) External COC	4-87
		B) Internal COC	4-87
		C) Sample Security	4-89
		D) Sample Disposal	4-89
4.3	**Calibration and Calibration Verification**		4-91
	4.3.1	Field Equipment	4-92
	4.3.2	Laboratory Instrumentation	4-94
	4.3.2.1	Inorganic/Classical Chemistries	4-94
	4.3.2.2	Atomic Absorption/Emission Systems	4-95
	4.3.2.3	Gas/Liquid Chromatography	4-96
	4.3.2.4	Mass Spectroscopy	4-96
	4.3.3	Laboratory Equipment	4-101
4.4	**Data Reduction, Validation and Reporting**		4-102
	4.4.1	Field Data	4-103
	4.4.2	Laboratory Data	4-103
4.5	**Verification Practices - External/Internal Quality Control**		4-110
	4.5.1	Standard Reference Materials	4-110
	4.5.2	Internal Quality Control Programs	4-110
	4.5.3	External Quality Control Programs - Proficiency Testing	4-126
4.6	**Data Assessment Procedures**		4-127
	4.6.1	Precision	4-127
	4.6.2	Accuracy	4-127
	4.6.3	Completeness	4-128

TABLE OF CONTENTS
(Cont.)

		Page #
4.7	**Procedures for Corrective Actions**	4-128
4.7.1	Quality Control Failures	4-130
4.7.2	Procedural Failures	4-131
4.7.3	Test Specification Failures	4-132
4.7.4	Customer Complaints	4-133
4.8	**Departures from Documented Procedures**	4-133
4.8.1	Management Policies	4-133
4.8.2	Method Modifications and Variances	4-133
4.9	**Performance and System Audits**	4-134
4.9.1	Internal Audits	4-134
4.9.1.1	System Audits	4-134
4.9.1.2	Documentation Audits	4-134
4.9.1.3	Surveillance Audits	4-135
4.9.1.4	Quality Assurance Reports to Management	4-135
4.9.2	External Audits	4-136
4.9.2.1	On-site Audits	4-136
4.9.2.2	Double Blind Evaluation Studies	4-136
5.0	**References**	5.1
6.0	**Tables**	6.1
7.0	**Appendices**	7.1
8.0	**Glossary of Terms**	8.1

FIGURES

Figure #	Description	Page #
1	Flow Diagram of Administration and Quality Assurance Information	3-7
2	Organizational Chart-TRIMATRIX Corporate	3-11
4	Relationships - Management to Technical Operations	3-13
5	Relationships - Management to Support Services	3-15
6	Relationships - Management to Quality System	3-17
7	Method Analyst Certification Record - Method Specific	3-59
8	Analyst Certification Records	3-74
9	Regions of the Analyte Signal	3-78
10	Laboratory Floor Plan	3-85
11	Document Flw Diagram	4-5
12	Project Information Form	4-6
13	Sample Collection and Preservation Guidelines	4-7
14	Short Hold-Time Analyses	4-8
15	Coller Receipt Form	4-9
16	Sample Preservation - Log Form	4-10
17	Problem Submittal Report	4-11
18-20	Example-Selected Laboratory Forms	4-13
21-27	Example-Completed Benchsheets	4-18
28-32	Example Management Reports	4-26
33	Report Generation Process	4-44
34	Controlled Temperature Unit Daily Logsheet	4-49
35	Standard Operating Procedure; Corrective Action; Controlled Temp. Units	4-50
36-39	Statistical Quality Control Chart	4-53
40	SOP Approval Form	4-65
41	SOP Page Format	4-66
42	SOP Master Section Reference	4-67
43	Controlled Document Paper Example	4-68
44	Sample Flow Diagram	4-73
45	Cover Letter to Accompany	4-77

46	Example MSDS Sheet	4-78
47	Exetrnal Chain of Custody	4-79
48	Pre-Printed Return Shipping Label	4-80
49	External Chain of Custody Record	4-88
50	Internal Chain of Custody Record	4-90
51	Data Reduction, Validation, and Reporting	4-104
52	TRIMATRIX Non-Compliance Report Form	4-137

TABLES

1	Responsibilities of Training Activities	3-72
2	TRIMATRIX QA/QC Type Designations	4-42
3	Quality Control Report Types	4-58
4	Data Archiving System - Document and Electronic Archives	4-61
5	SOP Categories	4-63
6	Calibration Procedures and Frequencies - Field Equipment	4-93
7	Calibration Procedures and Frequencies - Laboratory Equipment	4-97
8	Quality Control Types, Descriptions and Frequencies	4-111
9	ICP Run Sequence for Trace Metals	4-125

APPENDICES

A	Example - Employee Training Record	7-2
B	Equipment List	7-11
C	Quality Control Reports	7-20
D	Bottle and Preservation Requirements	7-36

3.0 QUALITY SYSTEM

3.1 INTRODUCTION-THE TRIMATRIX QUALITY SYSTEM

3.1.1 The Purpose of This Manual

The purpose of this manual is to outline the organization, specify the procedures, and define the technical requirements to be utilized by the TriMatrix Environmental Laboratories. The goal is to ensure that the data is of the required quality, is reproducible, and is generated in a time-efficient manner. This manual details a Quality Assurance/Quality Control (QA/QC) program affecting every individual involved in the analytical efforts at TriMatrix, from project initiation, to sample receiving, to final report generation. Some of the areas covered will only have a cursory discussion, while others will be covered in detail, or will be included in more than one section. The manual describes the realistic functioning of the laboratory and the quality programs in place, understanding that not every situation is covered nor every contingency explored.

3.1.2 The Need for Analytical Quality Control

In the increasingly competitive business of environmental laboratory services, the primary tenet of continued success is to efficiently provide results of the necessary quality. TriMatrix agrees with this principle, considers analytical quality assurance and quality control to be of great importance, and has incorporated it as a central pillar of our efforts to remain on the leading edge of this field. The requirements we place on ourselves are in concert with the needs and agendas of other organizations, such as the Environmental Protection Agency (EPA), our governmental and industrial clients, and the various state and local regulatory agencies.

Quality assurance and quality control absorb nearly fifty percent of all the available effort for routine analysis and are continuing to evolve and grow in importance. It would seem that this quality control effort would detract from profitability and not be practical for a commercial laboratory. However, the

quality assurance activities are absolutely essential for two reasons: 1) accurate analytical data can be obtained only with the concurrent use of extensive quality control to monitor the many process variables that can introduce errors into chemical analyses. 2) clients make crucial business decisions based on the data supplied by the laboratory regarding the concentration of analytes in water, effluent, soil, air, and waste samples. Lab data which is not properly supported by quality assurance/quality control can be questionable and lead to faulty or erroneous decisions in field situations. In the total analytical effort, the space taken by quality control samples in each testing batch ensures the accuracy of the client analyses.

3.1.3 Definition of Terms

3.1.3.1 Quality Assurance

Quality Assurance is defined as those operations and procedures which are undertaken to provide measurement data of defined quality that have a stated probability of being correct. The measurement system that is part of the quality assurance program, must be in a state of statistical control in order to justify the probability statement.

The operations and procedures that are established as part of the overall quality assurance program encompass all aspects of the laboratory operations including but are not limited to: organizational structure, human resources, physical resources, metrology, methodology, data reduction and validation, and trouble shooting. All aspects of QA are organized, implemented, and monitored through written operating procedures.

3.1.3.2 Quality Control

Quality control is defined as the basic ingredients necessary to produce a good measurement program. These ingredients include but are not limited to: correct methodologies and proper use of these methodologies, proper calibration and calibration verification, statistical monitoring of accuracy and precision, interference monitoring, reagent control, data processing, analyst training and certification, and instrument maintenance.

These basic ingredients must be accompanied by proper documentation. Adequate records are maintained to support our claims for the quality of data, to identify assignable causes in the event of measurement problems, to improve the accuracy and precision of our measurement systems, and to provide a historical record of our testing activities.

3.1.3.3 Quality Assessment

Quality assessment is defined as those specific steps which are utilized to assess the quality of the measurement process. These steps include but are not limited to: use of control charts to plot multiple data points versus time and verify whether the testing is in a state of statistical control; quality control samples (e.g. standards, laboratory control samples, blanks, duplicates, spikes, etc.); internal performance audits (system, documentation, surveillance); external performance audits (teams of auditors from clients and regulatory agencies); certification programs conducted by states such as Michigan, Wisconsin, and California; annual performance evaluation sample programs from the USEPA (WS, WP, DMR-QA), state certifying agencies, and some clients.

3.2 QUALITY POLICY STATEMENTS FROM MANAGEMENT

As communicated from top management down through the entire organization, TriMatrix Laboratories, Inc. is driven by the following quality objectives and quality commitments:

3.2.1 Corporate Quality Objectives

- To create and maintain a uniform and controlled pattern for the performing of every routine task within the organization, based on standard operating procedures.

- To generate laboratory data which is scientifically sound, legally defensible, and of known high quality.

- To build the necessary quality into our work place and services to ensure successful relationships with, and contribute to the future of, our customers, employees, vendors, and parent corporation.

- To develop, deliver, and maintain excellence in every area of our operations.

- To work with customers to provide services that always meet or exceed their expectations.

3.2.2 Corporate Quality Commitments

- To support quality and continually underwrite the substantial cost of quality assurance even though these expenses do not result in increased productivity or a tangible product.

- To maintain a work environment in which employees are free from commercial pressures in the performance of their duties.

- To maintain a work environment in which all employees are free from organization or client related pressures that may influence the quality of their work.

- To ensure that client confidentiality and information are strictly protected.

- To implement continuous improvement in every area of laboratory activity.

- To create and maintain a Quality Culture where there is an all-encompassing determination to meet the needs of customers both inside and outside the organization and deliver quality to the customer.

Included with these improvements and commitments is an annual review process where the management of TriMatrix Laboratories performs a comprehensive review of all quality systems in place. This review is performed to monitor the effectiveness of the quality system and provide feedback for continuous improvement. Because this QA manual plays an important role in the TriMatrix quality system, it will be a central part of the annual review by the management of TriMatrix Laboratories.

3.3 ORGANIZATION AND RESPONSIBILITIES

An efficiently-operating organization requires a quality control program which facilitates a high level of communication and information flow from all directions. To implement this objective, each person in our organization gives input to and receives information from the quality system. This information flow allows directives from management to be implemented with minimum disruption, permits analysts to measure the caliber of their work, and provides the means for creating improvements.

3.3.1 Corporate Structure

Flow of both administrative and quality control information is presented in Figure 1. The purpose of this diagram is to graphically display the corporate philosophy concerning the interaction of QA/QC and the generation of analytical data. The general flow of data in this format gives QA/QC independence in fulfilling its functions while still acting as a liaison in coordination with the administrative chain. To further explain this interaction, a more detailed description of roles and responsibilities are presented for each key laboratory position.

3.3.2 Laboratory Manager

The responsibilities of the Laboratory Manager are directed at the overall operation and management of all corporate laboratories. Primary responsibilities

include, but are not limited to: 1) develop and meet budgets established for the laboratory, 2) manage analytical services productivity and quality, 3) oversee and develop new business activities including client relations development, 4) plan analytical services organization, leadership and management programs, and 5) develop and manage human resources including career path planning.

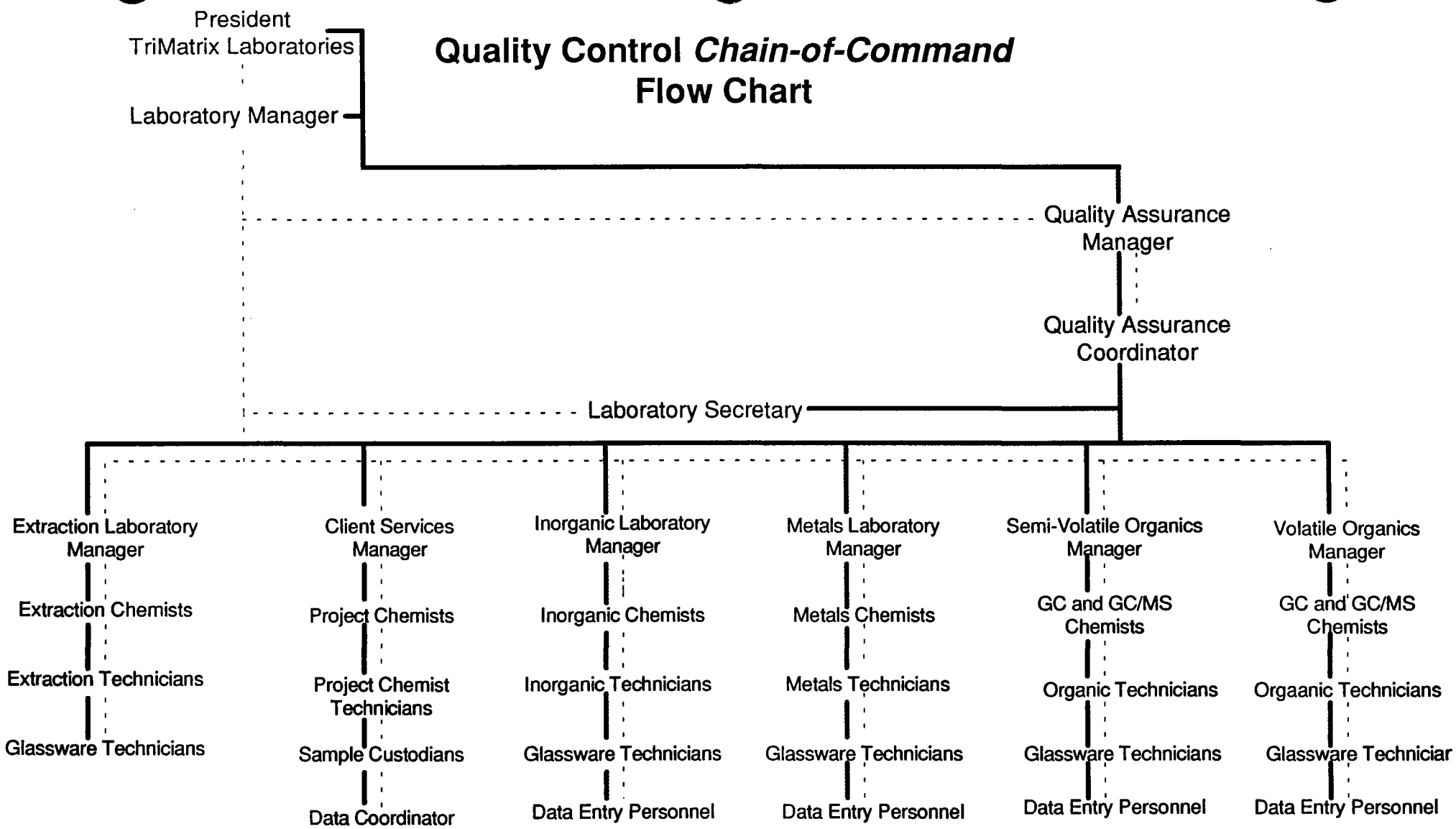
3.3.3 Quality Assurance Manager

The Quality Assurance Manager is primarily responsible for the implementation, maintenance, reporting and development of all QA/QC activities performed within the laboratory. Some of the duties performed by this person include, but are not limited to: 1) QA/QC systems development and monitoring, 2) coordination of all documentation procedures including the development and control of standard operation procedures, 3) monitoring method and quality control requirements as published by regulatory agencies, 4) performing internal lab audits including the submission of double-blind evaluations to the analytical system, 5) maintenance of in-house QA/QC monitoring procedures and policies, 6) providing quality assurance training to all staff members, 7) managing all activities of other QA/QC staff members, 8) performing duties as Deputy Technical Director when necessary.

3.3.4 Technical Director/Health and Safety Officer

The technical director/health and safety officer is responsible for the overall technical capabilities and direction of the laboratory, as well as the implementation, monitoring, and maintenance of all laboratory safety and chemical hygiene programs. Specific responsibilities include: 1) organization and management of all new analytical technologies developed by the laboratory, 2) preparation and publication of all laboratory Quality Assurance Project Plans (QAPP's), 3) equipment procurement management, 4) development and maintenance of health and safety programs and manuals and, 5) management and development of the health and safety coordinator.

Quality Control *Chain-of-Command* Flow Chart



Administrative Flow - - - - -

Quality Control Flow ———

TriMatrix Laboratories, Inc.

Figure 1

3.3.5 Laboratory Area Managers

Laboratory Area Managers are responsible for the overall supervision of their respective laboratory sections or areas. General responsibilities include management of staff activities, such as scheduling and method development; budgeting; training; and general supervision. Each section or area manager is also responsible for all data generated and all correspondence that is produced by their respective staff members.

3.3.5.1 Client Services

The laboratory client services manager supervises both the client services group and the administrative staff within the laboratory. Responsibilities of the client services manager includes those outlined in section 3.3.5 with specific emphasis on the following activities: 1) development and management of all project chemists, project chemist technicians, log-in staff, bottle preparation staff, and laboratory administrative staff; 2) project management; 3) coordination of proposal preparation and marketing activities for existing and new clients; 4) monitoring of final report turnaround times and; 5) maintenance of client satisfaction with laboratory services.

3.3.5.2 Inorganic Laboratory (Metals and Non-metals)

The inorganic laboratory manager supervises all aspects of the inorganic laboratory, which includes the metals and non-metals laboratories. Responsibilities include those outlined in section 3.3.5 with specific emphasis on the following activities: 1) development and management of all inorganic chemists, analysts, technicians, and data entry personnel, 2) implementation of quality systems and controls within the inorganic laboratory, 3) scheduling of all inorganic testing activities, 4) meeting productivity goals and project deadlines, 5)technical development of the inorganic laboratory staff, 6) development and maintenance of the inorganic laboratory's SOPs, 7) coordination of methods development

with the senior inorganic staff and technical director, 8) approval of all inorganic laboratory data, or the delegation thereof, 9) monitoring of all procurement activities and, 10) reporting to management on overall inorganic laboratory performance.

3.3.5.3 Organic Laboratory (Semi-Volatile and Volatile)

The organics laboratory manager supervises all aspects of the semi-volatile organics and volatile organics laboratories. Responsibilities include those outlined in section 3.3.5 with specific emphasis on the following activities: 1) development and management of all organic chemists, analysts, technicians, and data entry personnel, 2) implementation of quality systems and controls within the organic laboratories, 3) scheduling of all organic testing activities, 4) meeting productivity goals and project deadlines, 5) technical development of the organic laboratories' staff, 6) development and maintenance of laboratories' SOPs, 7) coordination of methods development with senior organic staff members and the technical director, 8) approval of all organic data, or the delegation thereof, 9) monitoring of all procurement activities and, 10) reporting to management on overall performance of the organic laboratories.

3.3.5.4 Organic Preparation Laboratory

The organic preparation laboratory manager is responsible for all aspects of this branch of the laboratory. Responsibilities include those outlined in 3.3.5 with specific emphasis on the following activities: 1) development and management of all extraction chemists and technicians, 2) implementation of quality systems and controls within the extraction laboratory, 3) scheduling of all extraction activities, 4) meeting productivity goals and project deadlines, 5) technical development of the extraction laboratory staff, 6) development and maintenance of extraction SOPs, 7) coordinate methods development with extraction chemists, the technical director, and the Organic Laboratory Manager, 8) approval of

all extraction procedures and, 9) monitoring of all procurement activities and 10) reporting to management on overall performance of the organic preparation laboratory.

3.3.6 Organization Charts

Presented in Figure 2 is an organizational chart illustrating the structure within the laboratory.

3.3.7 Deputy Technical Director/Deputy Quality Assurance Officer

In the absence of the Laboratory Technical Director, the Quality Assurance Manager is designated as the Deputy Technical Director with the responsibility of fulfilling an interim role as outlined in sections 3.3.4 and 3.5.1.2 of this manual.

In the absence of the Quality Assurance Manager, the QA/QC Coordinator is designated as the Deputy Quality Assurance Officer with the responsibility of fulfilling an interim role as outlined in sections 3.3.3 and 3.5.1.3 of the manual.

Figure 2

TriMatrix Laboratories, Inc.

Environmental Laboratory
Grand Rapids, Michigan
January, 1996

President
Jerry Parmentier

Sales & Marketing
Bob Miller
Mike Movinski

Human Resources
Patricia Schemmel

Lab Manager
Doug Kriscunas

QA\QC Manager
Scott Tittle
Hanna Debassal: QC Data Coordinator

Business Manager
Phil Harvatine

Pat Scholten: Lab Computer Systems Programmer

Client Services Manager
Gary Wood

Greg Hayes
Project Chemist

Lorie White
Project Chemist

Barry Hulzenga
Project Chemist
Health & Safety Officer

Stacy Martin
Administrative Assistant

Donna Lubberts
Marketing Assistant
Data Coordinator

Bill Housekeeper
Lab Field Technician

Keith Banchoff
Project Technician

Jeff Noorman
Project Technician

Kristi Kriger
Project Technician
Sample Coordinator

Inorganic Lab Manager
Betty Doyle

Metals Lab

Denise Coffey
Group Leader
Administration

J.T. Whitmore
Metals Chemist

Dave Johnson
Metals Chemist

Sarah Tate
Metals Analyst

Marge Scott
Metals Chemist

Karl Zeller
Metals Chemist

Ron Wind
Metals/Glassware Tech

Amanda Silverthorn
Glassware Tech

Karen White
Data Entry Clerk

Inorganic Lab

Tim Lundholm
Senior Inorganic Chemist

Heather Brady
Inorganic Analyst

Gretchen Housekeeper
Inorganic Chemist
Group Leader

Laurel White
Inorganic Chemist

Ken Witt
Inorganic Chemist

Shelly Jewell
Inorganic Chemist

Barb Steere
Inorganic Chemist

Chris Proper
Data Entry Clerk

Organic Lab Manager
Jeff Glaser

Semi-Volatile Lab

Janet Kudirka
Organic Chemist, MS

Jim Koedam
Organic Chemist, MS

Mariano Vanegas
Organic Chemist, GC

Ray Johnson
Organic Technician

Jim O'Keefe
Organic Chemist, GC

Dawn Kaufman
Organic Chemist

Volatile Lab

Jim DeVera
Organic Analyst

Gerald Holycross
Organic Chemist

Shana McCrumb
Organic Chemist

Phuong Tran
Organic Chemist

Michelle Dewitt
Organic Chemist

Kris VanHaitsma
QC Chemist

Adrienne Wells
Data Entry Clerk

Organic Extraction Lab Manager
Randy Scott

Rhonda Pikaart
Organic Chemist

Scott Hetrick
Organic Chemist

Raymond Vanderborgh
Organic Chemist

Jeff Stehouwer
Organic Chemist

Bill Dawes
Waste Technician

Cynthia Mills
Glassware Technician

Pete Vickery
Extraction Chemist

Kirk Speaks
Extraction Technician

3.4 RELATIONSHIPS

Relationships within the analytical laboratory, in concert with management, are organized into three main categories: Technical Operations, Support Services, and the Laboratory Quality System. The relationships between management and these operational services and systems must be fully defined and monitored in order to maintain the delicate balance in a cost-effective, highly-technical, quality laboratory operation. An overview of each of these relations is presented as follows:

3.4.1 Management-Technical Operations

The relationship between management and technical operations is illustrated in Figure 3. In this relationship, the main role of management is to provide guidance and financial support to the programs and directives of the technical director. The organization, under the direction of the Corporate Technical Director for laboratory operations, is composed of the Deputy Director and all area managers. Through this structure, technical operational enhancements and developments occur and are applied through the laboratory staff.

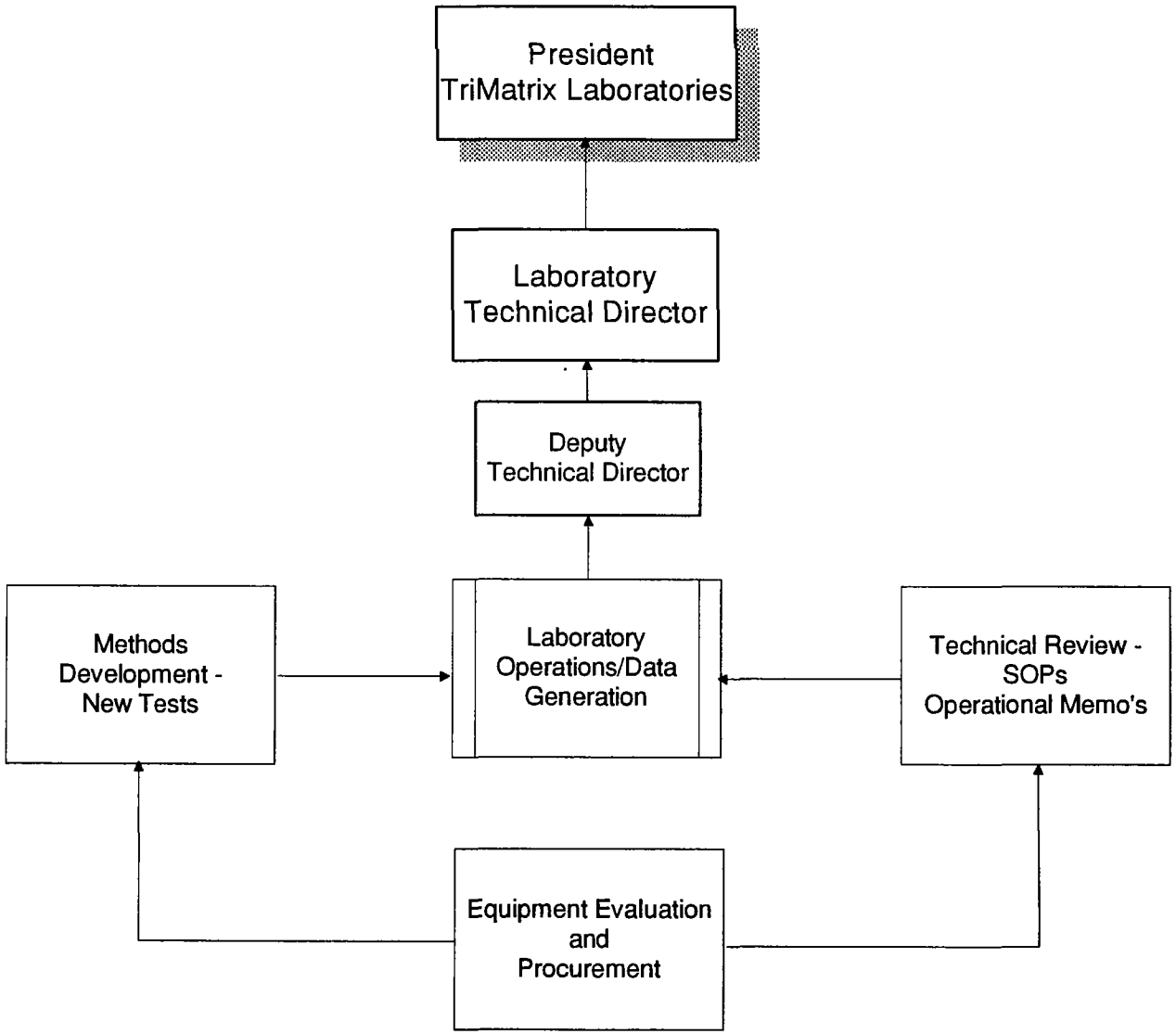
3.4.2 Management-Support Services

The relationship between management and all branches of support services is illustrated in Figure 4. In this relationship, management's role is substantial in the day-to-day operation of these support groups.

The primary laboratory support groups are Client Services, Marketing and Sales, and LIMS system support. These groups report directly to the Laboratory Director for all aspects of their daily activities.

Secondary relationships are maintained with the Laboratory Administrative Assistant, Secretary, and Corporate Business, Accounting and Human Resources Departments. Some groups within this secondary category maintain relationships not only with the Laboratory Director, but other management groups within the TriMatrix organization.

RELATIONSHIPS
MANAGEMENT - TECHNICAL SERVICES



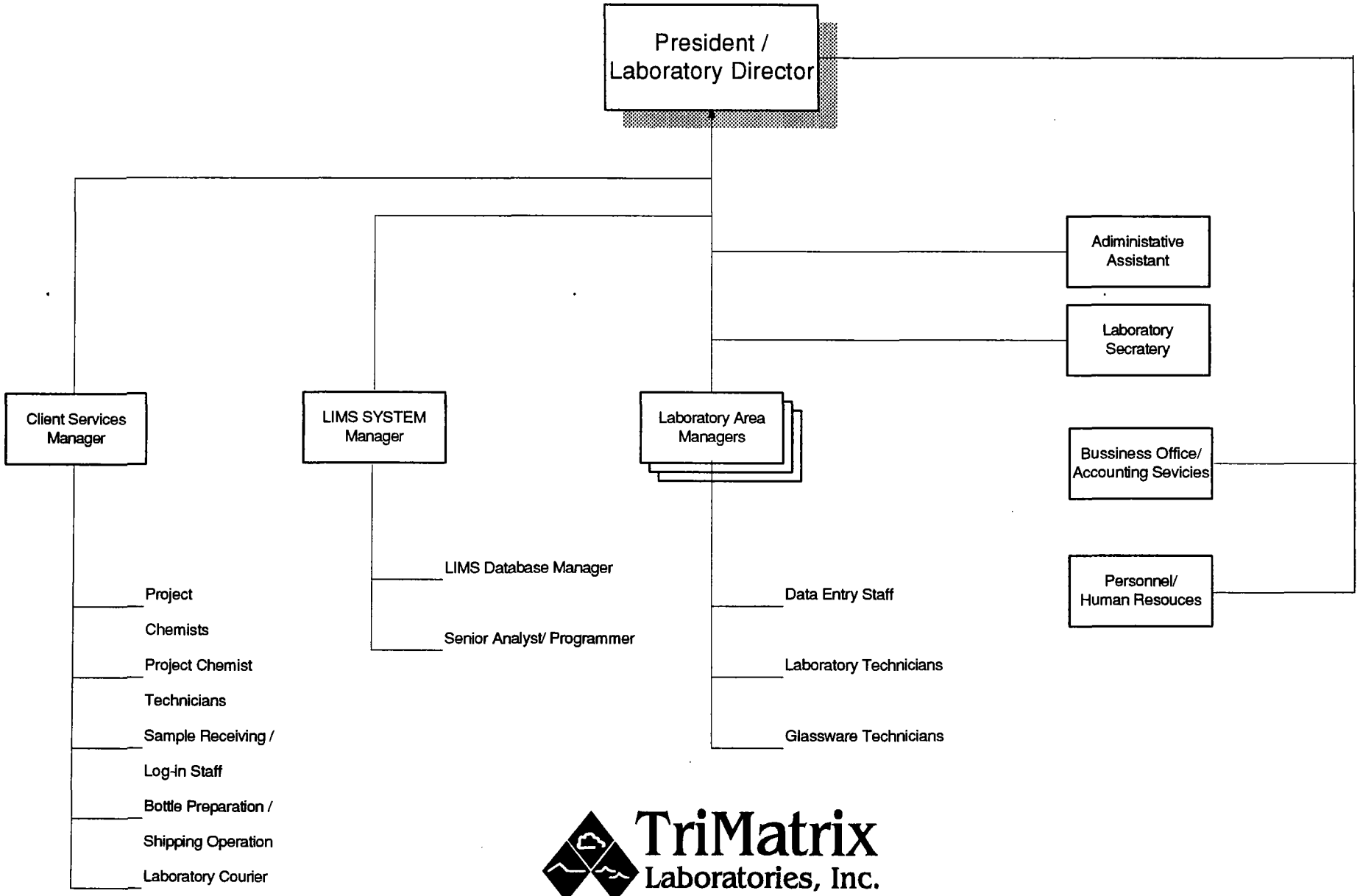
TriMatrix
Laboratories, Inc.

Figure 4

A tertiary relationship has been developed between the laboratory director and the laboratory area managers. This relationship supports such activities as productivity monitoring, cost containment, equipment procurement, operations management, personnel/human resources activities, technical support, data validation, and method development.

RELATIONSHIPS

MANAGEMENT - SUPPORT SERVICES



TriMatrix Laboratories, Inc.

Figure 5

3.4.3 Management-Quality System

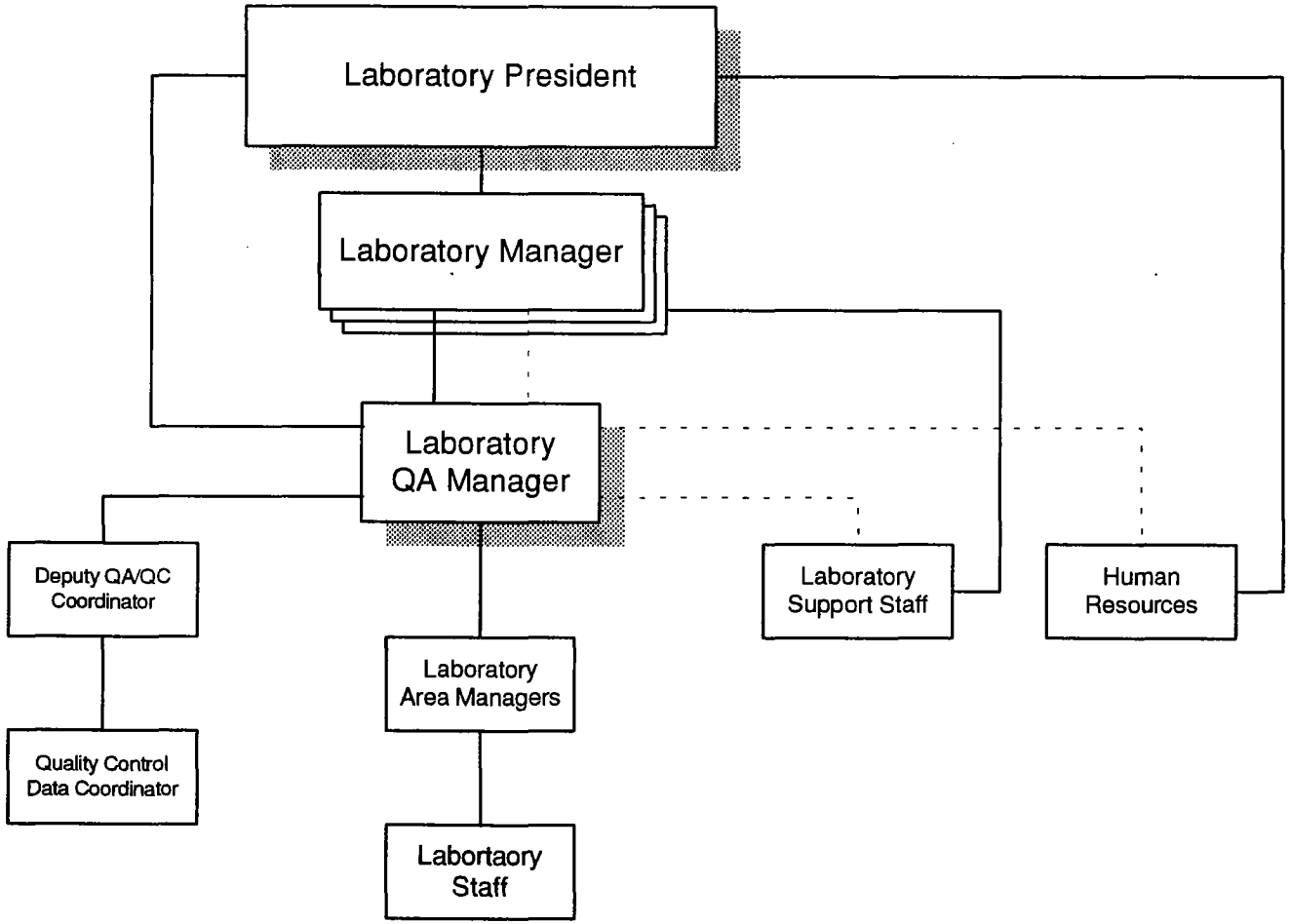
The relationship between management and the laboratory quality system is illustrated in Figure 5. In this relationship, management plays a secondary role in the overall scheme. This secondary role is designed to provide the corporate quality assurance officer with guidance, corporate perspective, and structured support in the development, implementation, and maintenance of quality system programs and activities.

This relationship is vital to the success of TriMatrix Laboratories. Without a good cost-effective quality system, the overall caliber of laboratory data and the success of all laboratory operations could be jeopardized.

A tertiary relationship also exists between management, the quality system, and the supporting cast of the laboratory QA/QC staff. This relationship includes but is not limited to: laboratory management directives, human resources/personnel activities, and corporate directives. These activities are implemented and maintained without disruption to the quality system.

RELATIONSHIPS

MANAGEMENT - Quality System



TriMatrix Laboratories, Inc.

Figure 6

3.5 JOB DESCRIPTIONS

3.5.1 Management Staff Members

3.5.1.1 Laboratory Manager

Job Description

The Laboratory Manager directs the laboratory. The manager works through the laboratory staff to improve data quality, overall productivity, staff development, safety/training programs, and overall profitability. This position has profit/loss accountability. Budgets are developed with senior management annually. The Manager is also involved in business development/sales activities directly, as well as having sales staff reporting to him or her.

Background/Educational Requirements

The Manager possesses minimally a bachelors degree in science, preferably chemistry. Advanced degrees in the sciences and/or business are preferred. The Manager has a minimum of 7 years direct work experience in the environmental testing industry. This work experience includes having conducted environmental analyses and several years of demonstrated supervisory experience.

Duties and Responsibilities

1. Development and fulfillment of budgets.
2. Management of division productivity and quality.
3. Management of proposal preparation with other companies.
4. Development of new business and maintenance of client relationships.
5. Development of laboratory organization, leadership and management planning.
6. Working with the Human Resources department to develop staff members and their career paths.
7. Performing all other duties as deemed necessary by management.

3.5.1.2 Technical Director Laboratory Operations

Job Description

The Technical Director (TD) of laboratory operations is responsible for the development and improvement of all technical operations within the laboratory division. The TD oversees the investigation of all new instruments and apparatuses, method development, and general technical advancement of the laboratory. The technical director is also responsible for informing the deputy technical director of all current and pending projects and activities.

Duties and Responsibilities

1. The continual technical development of the TriMatrix laboratory pertaining to current and future analytical practices.
2. Overseeing the technical development of all TriMatrix employees in the area of USEPA method comprehension and implementation.
3. Development of new analytical methods within the laboratory.
4. Providing technical advice regarding all equipment and apparatus procurement and acquisitions.
5. Performing technical review of all Quality Assurance Project Plans (QAPPs).
6. Performing other duties as deemed necessary by management.

3.5.1.3 Quality Assurance Manager

Job Description

The Quality Assurance (QA) Manager has the responsibility for development, implementation, improvement, and maintenance of all quality systems within the TriMatrix laboratory. The QA Manager monitors all analytical methods and procedures performed by the laboratory, and provides assurance that they comply with regulatory agency requirements.

Background Education Requirements

The manager possesses a B.S. in science, preferably in chemistry, and suitable work experience. The work experience includes several years of analytical work and a demonstrated ability to work with and train staff members. A strong working knowledge of quality assurance and statistical quality control procedures, specifically as they apply to USEPA analytical protocols, is required.

Duties and Responsibilities

1. Development and implementation of systems that will measure and monitor the quality of all laboratory data.
2. Maintenance of the documentation system for generation, control, and archiving of all laboratory forms, SOPs, and protocols.
3. Approving all SOPs and monitoring their compliance with regulatory agency requirements.
4. Maintaining and updating the laboratory Quality Assurance Manual.
5. Submitting a monthly report identifying the quality control data generated by each lab area, the percent of data in control, and what activities were undertaken for out-of-control data.
6. Continually investigating and improving procedures to increase the percent of data within control limits.
7. Maintenance of federal, state, and industrial certifications and accreditations, as required.

7. Monitoring internal quality programs within the laboratory and reporting their status to management.
8. Training and documenting all new staff members in all aspects of the laboratory quality system.
9. Performing all other duties deemed necessary by management.

3.5.1.4 Client Services Manager

Job Description

The Client Services Manager has the responsibility for the general supervision of the project chemist, project technicians, sample receiving staff, bottle preparation staff, and laboratory administrative staff in a professional manner. These oversight responsibilities include meeting project due dates, preparing and reviewing quotations, project initiation and management, client satisfaction management, and the supervision and training of staff. The client services manager strives to improvement the acquisition and on-time delivery of laboratory projects.

Background/Educational Requirements

The manager possesses a B.S. in science, preferably in chemistry, and has 5-10 years of work experience. The work experience includes 3-5 years of laboratory experience, involvement in client management activities, and a demonstrated ability to supervise and train laboratory staff.

Duties and Responsibilities

1. Responsible for the productivity and quality of the client services group.
2. Management of large level 3 or higher projects.
3. Quality control program implementation and maintenance.
4. Supervision and technical development of employees.
5. Development and maintenance of standard operating procedures.
6. Assisting and coordinating marketing activities through proposal preparation and client visitation.
7. Performing other activities deemed necessary by management.

3.5.1.5 Organic Laboratory Manager

Job Description

The organic laboratory manager has the responsibility of overseeing the supervision and operation of the semi-volatile and volatile organic laboratories in a professional manner. These oversight responsibilities include meeting project schedules and the supervision and training of staff members. The organic manager will continually work to improve the quality of data generated.

Background/Educational Requirements

The manager possesses a B.S. degree in science, preferably chemistry, and 5-10 years work experience. The work experience includes a minimum of 5 years performing organic analyses utilizing GC and GC/MS techniques. The manager must also demonstrate the ability to supervise and train organic staff members.

Duties and Responsibilities

1. Responsible for the productivity and quality of organic chemistry projects and data.
2. Operation and maintenance of instrumentation.
3. Quality control program implementation and maintenance
4. Reviewing and final approval of all volatile organic data.
5. Developing schedules for in-house work that will allow on-time report generation.
6. Supervision of supply acquisition activities.
7. Supervision and technical development of employees.
8. Development and maintenance of standard operating procedures
9. Methods development.
10. Performing all other activities deemed necessary to management.

3.5.1.6 Organic Extraction Laboratory Manager

Job Description

The organic extraction laboratory manager has the responsibility of overseeing the management and operation of the organic extraction laboratory in a professional manner. These oversight responsibilities include meeting project schedules and the supervision and training of staff. The organic extraction manager continually works to improve the quality of data generated.

Background/Educational Requirements

The manager possesses a B.S. in science, preferably chemistry, and 5-10 years of work experience. The work experience includes 3-5 years of performing semi-volatile organic analyses or extractions, and a demonstrated ability to supervise and train staff members.

Duties and Responsibilities

1. Responsible for the productivity and quality of all semi-volatile organic extractions.
2. Operation and maintenance of extraction equipment and apparatus.
3. Quality control program implementation and maintenance.
4. Reviewing and performing final approval of organic extraction information.
5. Development of schedules for in-house work that will allow on-time report generation.
6. Supervising the acquisition of supplies.
7. Supervision and technical development of employees.
8. Methods development.
9. Development and maintenance of standard operating procedures.
10. Performing other activities deemed necessary by management.

3.5.1.7 Inorganic Laboratory Manager

Job Description

The inorganic laboratory manager has the responsibility of overseeing the supervision and operation of the metals and non-metals laboratories in a professional manner. These oversight responsibilities include meeting project schedules and the supervision and training of staff. The inorganic laboratory manager continually works to improve the quality of data generated.

Background/Educational Requirements

The manager possesses a B.S. in science, preferably in chemistry, and suitable work experience. The work experience includes 5-10 years of performing metals analysis and a demonstrated ability to supervise and train staff members.

Duties and Responsibilities

1. Responsible for the productivity and quality of inorganic chemistry projects and data.
2. Assuring proper operation and maintenance of instrumentation.
3. Quality control program implementation and improvement.
4. Reviewing and performing approval of all metals laboratory data.
5. Developing schedules for in-house work that will allow on-time report generation.
6. Supervising supply acquisition.
7. Supervision and technical development of employees.
8. Development and maintenance of standard operation procedures.
9. Methods development.
10. Performing other activities deemed necessary by management.

3.5.2 Technical Staff Members

3.5.2.1 Organic Group Leader

Job Description

The organic group leader performs organic analyses on environmental samples utilizing GC, GC/MS, and High Performance Liquid Chromatography (HPLC). The organic group leader is responsible for conducting analyses, troubleshooting instrumentation, performing the required quality control activities, and scheduling analyses so that projects will be completed on-time. The implementation of new methods will be required as new environmental regulations mandate or allow their use.

Background/Educational Requirements

The organic group leader will possess a science degree, preferably in chemistry, and/or suitable work experience. The work experience will include several years of performing organic analyses and a demonstrated ability to supervise and train inorganic staff members.

Duties and Responsibilities

1. Responsible for the productivity and quality of organic chemistry projects and data.
2. Operation, maintenance, and troubleshooting of instrumentation.
3. Quality control program implementation and maintenance.
4. Reviewing organic data.
5. Developing schedules for in-house work that will allow on-time report generation.
6. Maintenance of acceptable productivity.
7. Supervision and technical development of employees.
8. Improving all aspects of operations while emphasizing quality and efficiency.
9. Developing and researching new and better procedures.
10. Performing analyst and method certification as needed.
11. Maintaining a complete lab notebook in an organized manner.
12. Adhering to lab safety procedures.
13. Keeping lab neat and clean.
14. Performing all other activities deemed necessary to management.

5.3.2.2 Inorganic Group Leader

Job Description

The inorganic group leader performs a variety of analyses in the metals and/or non-metals laboratory.. The inorganic group leader is responsible for conducting analyses, troubleshooting instrumentation, performing the required quality control activities, and scheduling analyses so that projects will be completed on-time. The implementation of new methods will be required as new environmental regulations mandate or allow their use.

Background/Educational Requirements

The inorganic group leader will possess a science degree, preferably in chemistry, and/or suitable work experience. The work experience will include several years of performing organic analyses and a demonstrated ability to supervise and train inorganic staff members.

Duties and Responsibilities

1. Responsible for the productivity and quality of organic chemistry projects and data.
2. Operation, maintenance, and troubleshooting of instrumentation.
3. Quality control program implementation and maintenance.
4. Reviewing organic data.
5. Developing schedules for in-house work that will allow on-time report generation.
6. Maintenance of acceptable productivity.
7. Supervision and technical development of employees.
8. Improving all aspects of operations while emphasizing quality and efficiency.
9. Developing and researching new and better procedures.
10. Performing analyst and method certification as needed.
11. Maintaining a complete lab notebook in an organized manner.
12. Adhering to lab safety procedures.
13. Keeping lab neat and clean.
14. Performing all other activities deemed necessary to management.

3.5.2.3 Client Services Group Leader

Job Description

The client services group leader function is to manage the members of the Project Chemist group as well as fulfilling the duties of a Project Chemist. The Group Leader will provide training and support to the client services staff.

The emphasis of the client service role is on being the technical liaison between the client and the laboratory. The client service representative is responsible for providing our clients with prompt, courteous, and responsive service.

The Group Leader must be a good organizer and capable of doing some passive marketing. This position will be within the Client Services area and will report to the Client Services Manager.

Background/Educational Requirements

The group leader will possess a B.A. or B.S. degree in chemistry or related laboratory science. The work experience will include at least two years as a client service representative, demonstrated leadership skills, and knowledge of the methods used in the environmental testing industry.

Duties and Responsibilities

1. Maintenance of acceptable productivity.
2. Maintenance of a high-quality work product.
3. Consulting with clients and meeting the clients' needs.
4. Working with appropriate lab managers to schedule work.
5. Supervising the members of the client services group.
6. Monitoring and making sure client due dates are met.
7. Developing staff members through training and coaching.
8. Marketing new clients via phone calls and follow-up literature.
9. Holding regularly-scheduled meetings to keep staff members informed.
10. Performing all other activities deemed necessary to management.

3.5.2.4 Senior Inorganic Chemist

Job Description

The senior inorganic chemist performs inorganic chemical analyses accurately and efficiently in the metals and/or non-metals laboratories. This chemist follows established laboratory methods and performs all Quality Control practices applicable to those methods. The senior chemist also assists in method development, instrument troubleshooting, and the training of analysts or chemists as needed.

Background/Educational Requirements

The senior inorganic chemist will possess a degree in Chemistry and several years of suitable work experience. The senior inorganic chemist will have proven experience in developing and implementing new analytical techniques.

Duties and Responsibilities

1. Obtaining the knowledge and ability to perform all necessary inorganic analyses.
2. Acquiring the ability to calibrate, operate, and maintain all instruments/apparatus required to perform the inorganic analyses.
3. Performing routine care and maintenance of the instruments/apparatus utilized in conducting the inorganic procedures.
4. Performing all QA/QC procedures that have been outlined for a particular test.
5. Maintaining a high level of productivity and quality.
6. Certifying all new analytical methods via the method certification guidelines as outlined in our Quality Control Manual.
7. Maintaining an individual lab notebook.
8. Following all Laboratory Safety Procedures.
9. Maintaining a clean and organized work area.
10. Performing all other activities deemed necessary to management.

3.5.2.5 Inorganic Chemist

Job Description

Performs classical chemical analyses accurately and efficiently, following established laboratory methods, while following all Quality Control Practices applicable to those methods.

Background/Educational Requirements

Requires a degree in Chemistry and/or related field with at least two years of College Chemistry and work experience.

Duties and Responsibilities

1. Performing all inorganic chemical analyses in an accurate and efficient manner.
2. Maintenance of acceptable productivity.
3. Performing analyst and method certification as needed.
4. Carrying out all required QC procedures and make sure results fall within accepted limits.
5. Keeping all worksheets and calculations up-to-date.
6. Maintaining a complete lab notebook in an organized.
7. Troubleshoot problems with instrumentation/equipment.
8. Performing routine maintenance and care of laboratory equipment.
9. Keeping track of and meeting all hold times and due dates.
10. Following lab safety procedures.
11. Keeping lab neat and clean.
12. Developing and researching new and better procedures.
13. Assisting in the scheduling of projects as they come in.
14. Improving all aspects of job, while emphasizing quality and efficiency.
15. Performing any duties deemed appropriate by the supervisor.

3.5.2.6 Organic Chemist

Job Description

The organic chemist performs organic analyses on environmental samples utilizing gas chromatography and/or gas chromatography mass spectrometry. The organic chemist is responsible for conducting analyses, troubleshooting instrumentation and performing the required quality control activities. The implementation of new methods will be required as new environmental regulations mandate their use.

Background/Educational Requirements

The organic chemist will possess a B.S. in chemistry or a related field. Work experience may contain analytical experience with environmental samples.

Duties and Responsibilities

1. Performing all organic chemical analyses in an accurate and efficient manner.
2. Maintenance of acceptable productivity.
3. Performing analyst and method certification as needed.
4. Carrying out all required QC procedures and make sure results fall within accepted limits.
5. Keeping all worksheets and calculations up-to-date.
6. Maintaining a complete lab notebook in an organized.
7. Troubleshoot problems with instrumentation/equipment.
8. Performing routine maintenance and care of laboratory equipment.
9. Keeping track of and meeting all hold times and due dates.
10. Following lab safety procedures.
11. Keeping lab neat and clean.
12. Developing and researching new and better procedures.
13. Assisting in the scheduling of projects as they come in.
14. Improving all aspects of job, while emphasizing quality and efficiency.
15. Performing any duties deemed appropriate by the supervisor.

3.5.2.7 Organic Extraction Chemist

Job Description

The extraction chemist will perform environmental sample extractions in preparation for the analysis of these samples for organic compounds. The chemist will be thoroughly familiar with all EPA SW 846 methods utilized by TriMatrix for the extraction of environmental samples. The chemist is responsible for conducting extractions, troubleshooting extraction problems and performing all quality control activities required by the methodologies. The chemist will establish a schedule for extractions that will allow all samples to be extracted within EPA hold times.

Background/Educational Requirements

The organic extraction chemist will possess a four year college degree in chemistry or related field. Work experience may include performing sample extractions on environmental samples.

Duties and Responsibilities

1. Performing all organic extractions in an accurate and efficient manner.
2. Maintenance of acceptable productivity.
3. Performing analyst and method certification as needed.
4. Carrying out all required QC procedures and make sure results fall within accepted limits.
5. Keeping all worksheets and calculations up-to-date.
6. Maintaining a complete lab notebook in an organized.
7. Troubleshoot problems with instrumentation/equipment.
8. Performing routine maintenance and care of laboratory equipment.
9. Keeping track of and meeting all hold times and due dates.
10. Following lab safety procedures.
11. Keeping lab neat and clean.
12. Developing and researching new and better procedures.
13. Assisting in the scheduling of projects as they come in.
14. Improving all aspects of job, while emphasizing quality and efficiency.
15. Performing any duties deemed appropriate by the supervisor.

3.5.2.8 Sample Coordinator

Job Description

The Project Technician is a support member to the Client Services staff. The Client Services area is responsible for providing highly-responsive and quality service to our clients. The Client Services area is the interface between our clients and our lab. The Project Technician is responsible for logging in all samples received in the laboratory into our LIMS system. This function entails receiving, sorting, identifying, and numbering samples received by the lab.

Background/Educational Background

Associates degree and/or Bachelors degree in the sciences or business. This person needs to be highly organized, innovative and motivated. A working knowledge of the EPA methods used in the laboratory is helpful.

Duties and Responsibilities

1. Performing all organic extractions in an accurate and efficient manner.
2. Maintenance of acceptable productivity.
3. Checking pH of all incoming samples.
4. Monitoring of integrity of all samples received in lab (hold times, broken samples).
5. Maintaining complete chain-of-custody of samples.
6. Numbering all incoming samples.
7. Providing all internal clients with logs of samples received in the lab.
8. Initiating some projects on LIMS.
9. Making up bottle orders for new projects.
10. Following lab safety procedures.
11. Keeping lab neat and clean.
12. Developing and researching new and better procedures.
13. Assisting in the scheduling of projects as they come in.
14. Improving all aspects of job, while emphasizing quality and efficiency.
15. Performing any duties deemed appropriate by the supervisor.

3.5.2.9 Project Technician Cooler Preparation

Job Description

The emphasis of the Project Technician is to be a support member to the Client Services staff. The Client Services area is responsible for providing highly responsive and quality service to our clients. The Client Services area is the interface between our clients and our lab. The Project Technician is responsible for preparing sample containers which are used in sampling sent out to our clients. This person must maintain an inventory of our bottles as well as integrity of all the sample coolers. This position reports to the Group Leader - Project Technician and Client Services Manager.

Background/Educational Background

High school diploma and an Associates degree in the sciences is preferable. This person needs to be highly organized, innovative and motivated.

Duties and Responsibilities

1. Maintaining acceptable productivity.
2. Maintaining high quality work product.
3. Ordering and maintaining an ample supply of sample containers and accessories.
4. Maintaining cooler inventory.
5. Maintaining cleanliness of coolers.
6. Keeping work area in a clean, functional environment.
7. Providing price comparisons on products ordered, to provide us with a competitive pricing on supplies ordered.
8. Providing support to the Project Chemists and sample login when needed.
9. Performing any duties deemed appropriate by the supervisor.

3.5.2.10 Data Entry Clerk

Job Description

The emphasis of the Data Entry Clerk is to input all data received from the lab. This will include all analytical data, quality control data and all necessary comments. The data entry clerk will be responsible for entering high quality (error free) data which will be used for client reports.

Background/Educational Requirements

High school diploma, good English and data entry skills. This person should be organized, motivated and have data entry background.

Duties and Responsibilities

1. Maintaining acceptable productivity.
2. Maintaining high quality work product.
3. Entering all benchsheet information (this includes entering and verifying data).
4. Continued training on LIMS.
5. Miscellaneous jobs such as field data, filing, etc.
6. Performing any duties deemed appropriate by the supervisor.

3.5.2.11 PROJECT CHEMIST

Job Description

The emphasis of the Project Chemist role is being the technical liaison between the client and the laboratory. The project chemist is responsible to provide our clients with prompt, courteous, and responsive service. The project chemist will be responsible for all of the client's technical and administrative needs and therefore will be evaluated on how he/she has satisfied those identified needs. This position is part of the Client Services group and reports to the Group Leader of Project Chemists and Client Services Manager.

Background/Educational Requirements

B.A. or B.S. degree in chemistry or related laboratory science and 1-2 years environmental lab testing or environmental related experience. A working knowledge of the methods used in the environmental testing field is required as well as good interpersonal skills. Must be able to communicate clearly and accurately.

Duties and Responsibilities

1. Maintaining acceptable productivity.
2. Maintaining high quality work product.
3. Consulting with clients on their needs and our abilities
4. Working with appropriate lab supervisor to schedule work.
5. Marketing of new clients via phone calls and follow-up literature.
6. Performing any duties deemed appropriate by the supervisor.

3.5.2.12 ADMINISTRATIVE ASSISTANT

Job Description

The emphasis of the Administrative Assistant is to provide support services to the client services area as well as the President and Vice President of the Environmental Laboratory Division. These duties include: word processing, work received log, proposal log, billings log, accounts receivable mailing, etc. The administrative assistant is a part of the client services and reports to the Client Services Supervisor.

Background/Educational Background

Associates Degree/and or Bachelors Degree in a business related field and 2-3 years word processing experience. This person needs to be highly organized, motivated and innovative. The person should have a good grasp on the English language and excellent word processing skills.

Duties and Responsibilities

1. Maintaining acceptable productivity.
2. Maintaining high quality work product.
3. Word processing
4. Maintaining work received log
5. Maintaining proposal log
6. Maintaining monthly billing logs
7. Maintaining accounts receivable log
8. Answering phones
9. Compiling marketing information
10. Performing any duties deemed appropriate by the supervisor.

3.5.2.13 LAB FIELD TECHNICIAN

Job Description

The emphasis of the Lab Field Technician is on being a support member to the client services staff. The lab field technician is responsible for taking water samples at homes, making deliveries, and doing sample pick ups for the lab. This position reports to the Client Services Manager.

Background/Educational Background

A drivers license and a good driving record. This person needs to be flexible with hours and be able to make trips on short notice.

Duties and Responsibilities

1. Taking samples in homes as a part of our water test program.
2. Making deliveries of coolers, bottles, quotes, etc. for the laboratory division.
3. Picking up samples on a regular basis at our Livonia office and other miscellaneous locations.
4. Performing any duties deemed appropriate by the supervisor.

3.5.2.14 Laboratory Computer Systems Analyst

Job Description

Provide technical review, guidance and training in all current and future laboratory computer applications.

Background/Education Requirements

Requires a degree in computer sciences with an emphasis in a chemistry or general science curriculum.

Duties and Responsibilities

1. Developing a complete understanding of the laboratory information management system.
2. Reviewing all laboratory computer applications and processes, including all instrument computer interfaces, data transmission/archiving processes and document control.
3. Providing database maintenance support activities for the laboratory LIMS system.
4. Providing technical direction and orchestrating implementation of an optical disk storage system for the laboratory.
5. Developing and implementing all Phase II instrument interface activities for each laboratory area.
6. Providing technical training of the laboratory staff in software applications and basic computer operational activities.
7. Performing any duties deemed appropriate by the supervisor.

3.5.2.15 LABORATORY COMPUTER TECHNICIAN

Job Description

Provide technical assistance and support in all current and future laboratory computer applications.

Background/Educational Requirements

Requires experience in computer application development and/or satisfactory progress towards a computer science degree.

Duties and Responsibilities

1. Developing a complete understanding of the Laboratory Information Management System (LIMS).
2. Providing database Maintenance support activities for LIMS.
3. Providing end user hardware and software support.
4. Performing maintenance programming within the LIMS system.
5. Performing any duties deemed appropriate by the supervisor.

3.5.2.16 LIMS DATA COORDINATOR

Job Description

The LIMS Data Coordinator has the responsibility of providing support and maintenance activities for the Laboratory Information Management System (LIMS). LIMS support activities will involve assisting the laboratory managers and staff members in what ever way possible. LIMS maintenance activity includes upkeep of the method, parameter and test tables as well as coordination of optical disk archiving activities.

The administrative assistant responsibilities include overall coordination of the laboratory potable water collection and analysis program while providing assistance to the laboratory manager with laboratory performance and scheduling activities.

Background/Education Requirements

The LIMS Data Coordinator will possess a minimum of high school diploma and two years of college in a related curriculum. Work experience will include a minimum of 3 years in the environmental laboratory business and some working knowledge of computer systems and software is required.

Duties and Responsibilities

1. Coordinating all activities involved with the laboratory potable water collection and analysis program.
2. Providing maintenance activities for the LIMS method, parameter and test tables.
3. Providing administrative assistance to the laboratory manager for LIMS related activities.
4. Coordinating archiving activities involved with the laboratory optical disk system.
5. Performing any duties deemed appropriate by the supervisor.

3.6 RESUMES-KEY STAFF MEMBERS

Laboratory Manager

Technical Director

Quality Assurance Manager

Laboratory Managers

Nonresponsive

Nonresponsive

Nonresponsive

Nonresponsive

Nonresponsive

Nonresponsive

Nonresponsive

Nonresponsive

Nonresponsive

3.7 APPROVED SIGNATORIES

Designated laboratory staff members have been assigned the responsibility of validating laboratory documents on behalf of the laboratory organization. The general categories or documents that require a valid signature are presented below.

3.7.1 Client/Invoice Reports

- All laboratory reports compiled and mailed contain at least one representative signature validating the contents of the laboratory report. Approved signatures for the client/invoice report include the laboratory director, client services manager, technical director, quality assurance manager, and the appropriate project chemist. Only these individuals are approved to perform this signatory approval.

3.7.2 Proposals, Price Quotations, and Laboratory Contracts

Proposals or price quotations for laboratory services contain at least one representative signature which validates the pricing, terms and conditions of the quotation. At least one representative signature is required. Approved signatures for proposals and price quotations included the laboratory director or manager, client services manager, project chemists and a sales or marketing representative.

In conjunction with many proposals and quotations, the laboratory may decide to include the laboratory Professional Services Agreement (PSA) in conjunction with the quotation. The PSA can only be signed by the laboratory director or manager.

Required signatures for laboratory contracts include the Laboratory Manger and a marketing representative.

3.7.3 Quality Assurance Project Plans (QAPjP)

Quality assurance project plans contain representative signatures of several responsible parties outside the laboratory. The only laboratory signature generally found on a QAPjP is that of the quality assurance supervisor. The QA manager has designated QA/QC responsibilities that are fully documented in the QAPjP documents. All QAPjP are signed prior to submission to a governing body or client.

The signatures on the QAPjP ensure that all procedures, materials, quality control practices and project reports meet the predefined goals of the plan.

3.7.4 Purchase Orders and Agreements

Because the laboratory spends a significant portion of it's annual budget on supplies and equipment, guidelines have been established to document and control the purchasing.

Purchasing of general supplies are handled through a contracted vendor within the budgetary guidelines established for each laboratory area.

For major purchases, equipment, service assessments, building renovations in excess of $500.00, purchase orders or agreements can be signed only by the laboratory manager or director.

3.7.5 Binding Statements - Laboratory Certification Documents or Accreditation

Certain certification or accreditation programs require the laboratory to provide details and statements regarding many details on the laboratory operations and its staff.

In some cases these statements must be presented to the certifying body accompanied by a binding signature of a corporate executive within the TriMatrix laboratory division.

3.8 Accreditation's, Certifications, and Proficiency Programs

3.8.1 TriMatrix maintains Federal, State and Independent certifications and accreditation's and participates in analytical proficiency studies at the federal, state and industrial level. These programs include the following:

3.8.1.1 Federal Programs

USEPA - State of Michigan Water Supply Certification

USEPA - State of Massachusetts Water Supply Certification

USEPA - Water Pollution Performance Evaluation Program

USEPA - DMR-QA Performance Evaluation Program

US Army - Corp. of Engineers Hazardous and Toxic Waste Analysis

US Air Force - AFCEE Program Approval (site specific)

3.8.1.2 State Programs

		Lab I.D.
Massachusetts	Department of Environmental Protection Chemical Analysis of Potable Water Chemical Analysis of Non-Potable Water	MI005
Michigan	Department of Public Health Chemical Analysis of Potable Water	0034
Minnesota	Department of Health Chemical Analysis of Environmental Samples	026-999-161
North Dakota	Department of Health/Consolidated Laboratories Chemical Analysis of Environmental Samples	R-095
Wisconsin	Department of Natural resources Chemical Analysis of Environmental Samples	000472650
Pending	California, Arizona, Florida	

3.8.1.3 Industrial Programs

Allied Signal
- Corporate Environmental Laboratory
- Chemical Analysis of Environmental Samples

3M Corporation
- Corporate Environmental Laboratory
- Chemical Analysis of Environmental Samples

CSX Railroad
- Safety, Quality & Environment Division
- Chemical Analysis of Environmental Samples

Dow Chemical Corporation
- Corporate Environmental Division
- Chemical Analysis of Non-Potable Water

E.I. Dupont
- Environmental Services Division
- Chemical Analysis of Environmental Samples

Ford Motor Corporation
Office of Environmental Quality
National Contract Laboratory program

Monsanto Corporation
Chemical Analysis of Environmental Samples

Occidental Chemical Corporation
Chemical Analysis of Environmental Samples

3.8.2 Method Certification

All methods of analysis utilized by TriMatrix are certified or validated prior to their use, whether newly employed or as a replacement for a current methodology. Method certification is analogous with analyst certification, and essentially requires the same steps in order to establish detection limits, reporting limits, and criteria for control limits.

Certifications are performed in three distinct categories:

1). When the analytical method specifies how the analyst and method are certified.

2). In the absence of method certification instructions in the test method.

3). In the absence of analyst certification instructions in the test method.

All certifications are documented, reviewed, and validated in each analyst's employee file in accordance to the procedures outlined in the TriMatrix SOP for analyst training.

Method/analyst certifications for the TriMatrix laboratory are divided into two distinct categories: method specific and non-method specific.

3.8.2.1 Certification of the Method and the Analyst According to Instructions Contained in the Analytical Method

Method and analyst certifications for most USEPA organic methods are performed as outlined in each of the analytical methods. All certifications

are documented, reviewed, and validated in each analyst's employee file. An example of this certification record is presented in Figure 7.

In conjunction to this procedure, a Method Detection Limit (MDL) study is performed in accordance with 40 CFR; Part 16; Appendix B. Results of each study are reviewed by the appropriate lab area manager and the QA department. All MDL studies are performed on reagent water and updated annually or whenever major changes are made in an analytical procedure.

3.8.2.2 Method Certification, Non-Method Specific (In the absence of certification instructions in the Test Method)

All methods used by TriMatrix which were not developed by TriMatrix and for which there is not an EPA or compendia certification requirement will be certified according to the steps below. Method Certification is contiguous with the certification of the analyst and requires essentially the same analytical program. Method certification is necessary in order to establish detection limits, method application limits, and criteria for control limits. In most cases detection limits and recoveries stated in a method are obtained under ideal conditions and do not reflect real world solutions, i.e.. silty well water and industrial effluent versus a drinking water supply. Method certification falls into two categories: 1) Methods being employed for the first time and 2) Methods which are to replace currently certified methods (replacement methods). In either case, analysis of client sample may not proceed until certification has occurred.

A). Linear Range

The first step in certifying a method is to establish the linear range (operating range) of the method. A method may be used only over the range in which it is linear. Some methods do not have linear ranges but curves from which results are calculated. For the moment we will ignore methods with curves. A linear

range must be established independent of the method data since instruments can effect the range. Standards and multiple detections will be used for establishing the linear range. For example, a range of 1 to 1000 has 3 decades (3 orders of magnitude). Therefore, a range of 1 to 1000 requires 11 levels of test standards (.5, 1, 2, 5, 10, 20, 50, 100, 200, 500, 1000). Notice that each decade follows the 0.5x to 10x rule, i.e. the area 10 to 100 is covered by 5, 10, 20, 50 and 100. The range to be attempted is dependent on the method, the instrument and the analytical supervisor. If the responses show linearity, the range has been established. If, however, a curve develops or there appear to be two linear ranges, the standards must be repeated including additional levels to verify the status of the questionable area.

VOLATILE METHOD 8240 ANALYST CERTIFICATION FOR JERRY HOLYCROSS
ION TRAP #2
STUDY BASED ON NON-HEATED PURGING OF 5 ml WATER
ANALYZED May 17, 1994

TARGET	AMT SPK ug/l	#1 AMT FND ug/l	#2 AMT FND ug/l	#3 AMT FND ug/l	#4 AMT FND ug/l	AVG REC ug/l	TABLE 6 RECOVERY RANGE in ug/l	PASS/ FAIL REC	STD DEV	STD DEV LIMIT	STD DEV PASS/ FAIL	OVERALL PASS/FAIL
Benzene	20.0	19.39	19.76	19.34	19.36	19.46	15.2 -26.0	PASS	0.20	6.9	PASS	PASS
Bromodichloromethane	20.0	20.21	20.25	20.49	20.2	20.29	10.1 -28.0	PASS	0.14	6.4	PASS	PASS
Bromoform	20.0	21.11	20.01	21.17	20.67	20.74	11.4 -31.1	PASS	0.54	5.4	PASS	PASS
Bromomethane	20.0	15.39	16.44	15.04	15.7	15.64	0.0 -41.2	PASS	0.60	17.9	PASS	PASS
Carbon Tetrachloride	20.0	19.11	19.35	18.66	18.22	18.84	17.2 -23.5	PASS	0.50	5.2	PASS	PASS
Chlorobenzene	20.0	19.14	19.49	19.36	19.01	19.25	16.4 -27.4	PASS	0.22	6.3	PASS	PASS
Chloroethane	20.0	18.19	19.01	17.71	16.86	17.94	8.4 -40.4	PASS	0.90	11.4	PASS	PASS
2-Chloroethyl Vinyl Ether	20.0	20.62	20.98	20.76	20.88	20.81	0.0 -50.4	PASS	0.16	25.9	PASS	PASS
Chloroform	20.0	20.54	21.28	20.52	20.01	20.59	13.7 -24.2	PASS	0.52	6.1	PASS	PASS
Chloromethane	20.0	17.43	18.13	16.9	16.41	17.22	0.0 -45.9	PASS	0.74	19.8	PASS	PASS
Dibromochloromethane	20.0	20.24	19.68	20.33	20.27	20.13	13.8 -26.6	PASS	0.30	6.1	PASS	PASS
Dichlorobenzene,1,2-	20.0	19.68	20.1	19.86	19.55	19.80	11.8 -34.7	PASS	0.24	7.1	PASS	PASS
Dichlorobenzene,1,3-	20.0	19.12	19.63	19.55	19.28	19.40	17.0 -28.8	PASS	0.24	5.5	PASS	PASS
Dichlorobenzene,1,4-	20.0	19.12	19.93	19.28	19.05	19.35	11.8 -34.7	PASS	0.40	7.1	PASS	PASS
Dichloroethane,1,1-	20.0	19.86	22.67	18.57	20.2	20.33	14.2 -28.5	PASS	1.71	5.1	PASS	PASS
Dichloroethane,1,2-	20.0	22.31	22.46	22.32	22.49	22.40	14.3 -27.4	PASS	0.09	6.0	PASS	PASS
Dichloroethylene, (trans)-1,2-	20.0	20.18	20.12	18.75	18.69	19.44	13.6 -28.5	PASS	0.83	5.7	PASS	PASS
Dichloroethylene,1,1-	20.0	19.44	20.63	18.57	18.09	19.18	3.7 -42.3	PASS	1.12	9.1	PASS	PASS
Dichloropropane,1,2-	20.0	20.92	20.92	20.94	20.64	20.86	3.8 -36.2	PASS	0.14	13.8	PASS	PASS
Dichloropropylene, (cis)-1,3-	20.0	20.58	20.84	20.98	20.39	20.70	1.0 -39.0	PASS	0.26	15.8	PASS	PASS
Dichloropropylene, (trans)-1,3-	20.0	21.15	21.2	21.76	20.92	21.26	7.6 -32.4	PASS	0.36	10.4	PASS	PASS
Ethylbenzene	20.0	19.4	19.96	19.39	18.82	19.39	17.4 -26.7	PASS	0.47	7.5	PASS	PASS
Methylene Chloride	20.0	15.28	15.77	15.15	14.87	15.27	0.0 -41.0	PASS	0.38	7.4	PASS	PASS
Tetrachloroethane,1,1,2,2-	20.0	20.86	21.09	21.65	20.35	20.99	13.5 -27.2	PASS	0.54	7.4	PASS	PASS
Tetrachloroethylene	20.0	18.76	19.16	18.43	17.7	18.51	17.0 -26.6	PASS	0.62	5.0	PASS	PASS
Toluene	20.0	19.95	20.32	19.9	19.8	19.99	16.6 -26.7	PASS	0.23	4.8	PASS	PASS
Trichloroethane,1,1,1-	20.0	18.88	19.48	18.02	17.49	18.47	13.7 -30.1	PASS	0.89	4.6	PASS	PASS
Trichloroethane,1,1,2-	20.0	21.44	21.75	21.59	21.65	21.61	14.3 -27.1	PASS	0.13	5.5	PASS	PASS
Trichloroethylene	20.0	19.62	20	19.36	19.19	19.54	18.6 -27.6	PASS	0.35	6.6	PASS	PASS
Trichlorofluoromethane	20.0	17.24	17.92	16.46	15.75	16.84	8.9 -31.5	PASS	0.94	10.0	PASS	PASS
Vinyl Chloride	20.0	16.7	17.45	15.97	15.45	16.39	0.0 -43.5	PASS	0.87	20.0	PASS	PASS

Figure 7

B). Working Curves

Some methods operate from a curve response, i.e. sodium by emission spectroscopy. The method will indicate the working curve which must be verified. The method with working curves requires a full curve each time an analysis is to be performed.

C). The Generation of the Method Detection Limit

The method detection limit (MDL) is defined as the minimum concentration of a substance that can be identified, measured and reported with 99% confidence that the analyte concentration is greater than zero and determined from analysis of a sample in a given matrix containing analyte.

SCOPE AND APPLICATION

This procedure is designed for applicability to a wide variety of sample types ranging from reagent (blank) water containing analyte to wastewater containing analyte. The MDL for an analytical procedure may vary as a function of sample type. The procedure requires a complete , specific and well defined analytical method. It is essential that all sample processing steps of the analytical method be included in the determination of the method detection limit.

The MDL obtained by this procedure is used to judge the significance of single measurement of a future sample.

The MDL procedure was designed for applicability to a broad variety of physical and chemical methods. To accomplish this, the procedure was made device or instrument independent.

D). Procedure

1. Make an estimate of the detection limit using one of the following:

   - The concentration value that corresponds to an instrument signal/noise ratio in the range of 2.5 to 5. If the criteria for qualitative identification of the analyte is based upon pattern recognition techniques such as PCB analysis, the least abundant signal necessary to achieve identification must be considered in making the estimate.

   - The concentration value that corresponds to three times the standard deviation of replicate instrumental measurements for the analyte in reagent water.

- The concentration value that corresponds to the region of the standard curve where there is a significant change in sensitivity at low analyte concentrations i.e. a break in the slope of the standard curve.

- The concentration value that corresponds to known instrumental limitations.

It is recognized that the experience of the analyst is important to this process. However, the analyst must include the above considerations in the estimate of the detection limit.

2. Prepare reagent (blank) water that is as free of analyte as possible. Reagent or interference free water is defined as a water sample in which analyte and interfering concentrations are not detected at the method detection limit of each analyte of interest. Interferences are defined as systematic errors in the measured analytical signal of an established procedure caused by the presence of interfering species (interferent). The interferent concentration is presupposed to be normally distributed in representative samples of a given matrix.

3. - If the MDL is to be determined in reagent water (blank) prepare a laboratory standard (analyte in reagent water) at a concentration which is at least equal to or in the same concentration range as the estimated MDL (Recommend between 1 and 5 times the estimated MDL) proceed to Step 4.

   - If the MDL is to be determined in another sample matrix, analyze the sample. If the measured level of the analyte is in the recommended range of one to five times the estimated MDL proceed to Step 4.

     If the measured level of analyte is less than five times the estimated MDL, add a known amount of analyte to bring the concentration of analyte to between one and five times the MDL in the case where an interference is co-analyzed with the analyte.

If the measured level of analyte is greater than five times the estimated MDL there are two options:

- Obtain another sample of lower level of analyte in same matrix if possible.

- The sample may be used "as is" for determining the MDL if the analyte level does not exceed 10 times the MDL of the analyte in reagent water. The variance of the analytical method changes when the analyte concentration increases above the MDL, hence the MDL determined under these circumstances may not truly reflect method variance at lower analyte concentrations.

4. - Take a minimum of seven aliquots of the sample to be used to calculate the MDL and process each through the entire analytical method. Make all computations according to the defined method with final results in the method reporting units. If blank measurements are required to calculate the measured level of analyte, obtain separate blank measurements for each sample aliquot analyzed. The average blank measurement is subtracted from the respective sample measurements.

- It may be economically and technically desirable to evaluate the estimated MDL before proceeding with analysis of seven aliquots as described above. This will: (1) prevent repeating this entire procedure when the costs of analyses are high and (2) insure that the procedure is being conducted at the correct concentration. It is quite possible that an incorrect MDL can be calculated from data obtained at many times the real MDL even though the background concentration of analyte is less than five times the estimated MDL. To insure that the estimate of the MDL is a good estimate, it is necessary to determine that a lower concentration of analyte will not result in a significantly lower MDL. Take two aliquots of the sample to be used to calculate

the MDL and process each through the entire method, including blank measurements as described in section d above. Evaluate these data:

- If these measurements indicate the sample is in the desirable range for determining the MDL, take five additional aliquots and proceed. Use all seven measurements to calculate the MDL.

- If these measurements indicate the sample is not in the correct range, re-estimate the MDL, obtain new sample as in section d above and repeat steps listed.

5. Calculate the variance (S^2) and standard deviation (S) of the replicate measurements, as follows:

$$S^2 = \frac{1}{n-1} \left[\Sigma(x_1)^2 - (\Sigma x_1)2/n \right]$$

where the X1; i = 1 to n are the analytical results in the final method reporting units obtained from the n sample aliquots and Σ refers to the sum of the X values from i = 1 to n.

6. - Compute the MDL as follows:

$$MDL = t(n-1, 1-d = 0.99)\ (S)$$

where:

MDL - the method detection

$t(n-1,1-d = .99)$ = the students' t value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom. See Table.

S = standard deviation of the replicate analyses.

- The 95% confidence limits for the MDL derived in step f are computed according to the following equations derived from percentiles of the chi square over degrees of freedom distribution (X2/df) and calculated as follows:

  MDLlcl = 0.64 MDL

  MDLucl = 2.20 MDL

  where MDLlcl and MDLucl are the lower and upper 95% confidence limits respectively based on seven aliquots.

7. Optional iterative procedure to verify the reasonableness of the estimated MDL and calculated MDL of subsequent MDL determinations.

   - If this is the initial attempt to compute MDL based on the estimated MDL in step 3, take the MDL as calculated in step 6, spike in the matrix at the calculated MDL and proceed through the procedure starting with step 4.

   - If the current MDL determination is an iteration of the MDL procedure for which the spiking level does not permit qualitative identification, report the MDL as that concentration between the current spike level and the previous spike level which allows qualitative identification.

   - If the current MDL determination is an iteration of the MDL procedure and the spiking level allows qualitative identification, use S2 from the current MDL calculation and S2 from the previous MDL calculation to compute the F ratio.

     if $S^2A/S^2B < 3.05$

     then compute the pooled standard deviation by the following equation:

     $$\text{S-pooled} = [\frac{6S2A + 6S2B}{12}]\ 1/2$$

if S^2A/S^2B >3.05, respike at the last calculated MDL and process the samples through the procedure starting with step 4.

- Use the S-pooled as calculated in step 6 to compute the final MDL according to the following equation:

  MDL = 2.681 (S-pooled)

  where 2.681 is equal to t(12,1-a = .99)

- The 95% confidence limits for MDL derived in step 6 are computed according to the following equations derived from percentiles of the chi squared over degrees of freedom distribution.

  MDLlcl = 0.72 MDL

  MDLucl = 1.65 MDL

  where LCL and UCL are the lower and upper 95% confidence limits respectively based on 14 aliquots.

E). REPORTING

The analytical method used must be specifically identified by number or title and the MDL for each analyte expressed in the appropriate method reporting units; if the analytical method permits options which affect the method detection limit, these conditions must be specified with the MDL value. The sample matrix used to determine the MDL must also be identified with the MDL value. Report the mean analyte level with the MDL if a laboratory standard or a sample that contained a known amount of analyte was used for this determination. Report the mean recovery, and indicate if the MDL determination was iterated.

If the level of the analyte in the sample matrix exceeds 10 times the MDL of the analyte in reagent water, do not report a value for the MDL

REFERENCE

40 CFR Part 136 Appendix B, USEPA.

Table of Students' t Values at the 99 Percent Confidence Level

Number of Replicates	Degrees of Freedom (n-1)	Students' t Value
7	6	3.143
8	7	2.998
9	8	2.896
10	9	2.821
11	10	2.764
16	15	2.602
21	20	2.528
26	25	2.485
31	30	2.457
61	60	2.390
		2.326

F). Laboratory Fortified Blanks (LFB)

Laboratory Fortified Blanks spikes will be carried out over 2 separate days at the specified levels including blanks and calibration standards. The data obtained at the 2x or 5x level (for each certified range) will be used to develop an estimated mean and standard deviation for initial control charts. Once this data has been generated and approved by the QA Manager, the method has preliminary certification and is ready for application to real world samples. These control limits will be updated with every batch of samples until 30 numbers have been developed to establish reliable control limits. After the initial 30 data points, updated control limits will be generated at a specified time period (current-quarterly).

3.8.2.2 Analyst Certification Criteria - Non Method Specific (In the Absence of Analyst Certification Instructions in the Test Method)

Non-Method specific certifications are performed in accordance to the procedures developed by TriMatrix. This process involves the analysis of four standard solutions. Calculate the mean and standard deviation (s) and compare with method specifications. If accuracy and precision are outside method specifications, trouble-shoot the procedure and repeat the analysis of four replicates. When method accuracy and precision information is not available, results of the 4 determinations are evaluated against either laboratory established windows or a 70-130% accuracy and ≤20% RPD precision window. Final review and approval is performed by the lab area manager and the QA Manager.

In conjunction to this procedure, a Method Detection Limit (MDL) study is performed in accordance to 40 CFR; Part 16; Appendix B. Results of each study are reviewed by the appropriate lab area supervisor and the QA Supervisor. All MDL studies are performed on reagent-grade water and updated annually.

3.8.3 Training

The proper training of laboratory personnel is an essential part of the overall development of staff capabilities. The documentation of these training procedures will not only provide a record of training activities completed, but will also serve as guideline for the continual development of staff capabilities. This record will also be useful in the guiding of retraining.

All training documents are contained in a personnel training file, and are under direct management of the Quality Assurance Manager.

The personnel training file is a compendium of documents related to the development of each laboratory employee. Contained within this file are all in-

house training documents, copies of academic transcripts or degrees, job descriptions, resumes, external training program certificates, safety training records and all other materials related to an individual employee.

3.8.3.1 Initiation of Training Documents

All laboratory staff members have a set of training documents provided on the data of hire. These documents are developed and maintained throughout the entire employment period,. All documents are initiated by the Laboratory Quality Assurance Manager. All training documents are presented in the attached Appendix A.

- General information located on Page 1 of the personnel training record are initiated and maintained by the Laboratory QA Supervisor. This information includes: employee name, initial laboratory position, employee number, date of hire, laboratory area and a detail description of initial primary responsibilities. (See example in Appendix A).

- Position changes are also recorded on page 1 of the personnel training record. Position changes are generally limited to the movement of personnel from one lab to another, or one area of interest to another within the same lab area. (i.e., GC/MS volatiles to GC/MS semi-volatiles).

3.8.3.2 General Training

General training requirements include the following: laboratory introduction and walk-through, company benefits review, safety and chemical hygiene plan, safety exam, safety walk/safety equipment review computer network/email and review and initial training of the Laboratory Information Management System (LIMS).

The computer network and LIMS review requires initialization process whereby the new user is added to both systems and assigned network passwords and codes. The laboratory computing staff perform the network assignments.

3.8.3.3 Training-Quality Assurance

- Quality Assurance training includes all items depicted on Page 3 of the attached example. Each item listed will be discussed in detail.

- Presented to each trainee: Completed benchsheets from their newly assigned lab area, QA memo on QC type descriptions, copy(s) of completed stock standard records, copies of instrument maintenance log sheets, analyst notebook record keeping guidelines and all published Quality Assurance operational memorandums. Area specific forms and procedures will also be discussed and presented at this time. Examples of the presented items can be found in Appendix A.

3.8.3.4 Training-Laboratory Specific

- Laboratory Specific training is generally performed in the employee's newly assigned laboratory area and will cover the following items: introduction to apparatus and equipment, a description and demonstration of paperwork flow, including LIMS paperwork and reporting requirements, a review of the standard formats that are used for the writing of laboratory SOPs scheduled for use by the trainee.

- Training of each method will include: a complete understanding of the SOP, equipment, documentation and QA objectives for a procedure. Once the analyst has a complete understanding of all aspects of the procedure, both the trainee and trainer will document the completion.

3.8.3.5 Training-Analyst Certification

- Analyst/Method certifications will be performed in accordance to method specific or QA manual protocols. The protocol depicted in the QA manual should only be used in the absence of a method specific procedure.

3.8.3.6 Quality Assurance

- Quality Assurance activities involved in the training process are an important part of analyst training. These activities include: proper documentation of all training events as displayed in the attached example, maintenance of the training document to keep it current, and most important, adherence to the Quality Assurance procedures and directives as presented in the method protocols.

3.8.3.7 Responsibilities

- Responsibilities for the training process are defined in the following Table 1.

TABLE 1
PERSONNEL TRAINING RECORD
TRAINING RESPONSIBILITIES

Training Activity/Event	Person/Dept. Responsible
Initiation of Training Records	Quality Assurance Group Rep.
Description of Primary Responsibilities	Lab Area Manager
Laboratory Introduction/Walk-Through	Lab Area Manager/Group Leader
Company Benefits Review	Human Resources
Safety-Chemical Hygiene Plans	Safety Coordinator
Safety Exam (implementation & review)	Safety Coordinator
Safety Walk/Safety Equipment Review	Safety Coordinator
Computer Network/E-Mail	Laboratory Computer Group Rep.
Laboratory Information Management System (LIMS)	Laboratory Computer Group Rep.
QA Manual Review	Quality Assurance Manager
General QA Objectives	Quality Assurance Manager
Benchsheets/Control Windows/Qualifications	Quality Assurance Manager
Chemical Inventory Program	Quality Assurance Manager
Stock Standard Record Procedures	Quality Assurance Manager
Instrument Maintenance Logs	Quality Assurance Manager
Instrument Run Logs	Quality Assurance Manager
Analyst Notebook & Procedures	Quality Assurance Manager
Data Recording & Changes	Quality Assurance Manager
QA Operational Memorandums	Quality Assurance Group Rep.
Data Review & Documentation	Lab Area Manager/Group Leader
Introduction to Apparatus & Equipment	Lab Area Manager/Group Leader
Paperwork Flow-LIMS Training	Lab Area Manager/Group Leader
SOP Review-General Format	Lab Area Manager/Group Leader
SOP Review-Method Specific	Lab Area Manager/Group Leader
Analyst Certifications	Lab Area Manager/Group Leader

3.8.3.8 Continuing Training and Education

TriMatrix is committed to education and training on a continuing basis for employees of the laboratory division. Among the various ways in which continuing training occurs are:

- seminars
- cross-training for additional job responsibilities
- retraining
- method and technology updates

3.8.4 Annual Recertification of Analysts

Recertification for all analysts is performed on an annual basis. This process is performed by means of two steps: The first involves the generation of a LIMS report that displays LCS recoveries for a specified period which compares each recovery to the current LIMS generated laboratory established control windows. This report is reviewed and validated by the appropriate lab area manager and the QA manager. All records are then filed in the employee's personnel file. An example of this document is presented in Figure 8. The second step of the recertification process involves a review of the analytical methods and laboratory SOPs for all test performed by an analyst with their lab area manager or designate. Each method review is documented and placed in the employee's personnel file.

TRIMATRIX LABORATORIES, INC. - GRR
ANALYST CERTIFICATION SUMMARY REPORT

Analyst: David W. Johnson
Parameter: Lead, Total

Method: Atomic Absorption-Flame, Lead
Reference Citation: USEPA-7420
Application: WATER
Dates Surveyed: 01-JAN-1995 to 31-DEC-1995

LCS Control Limits: lower: 76 upper: 125

Date of Analysis	Percent Recovery
14-DEC-95	107
21-NOV-95	90
24-OCT-95	110
24-OCT-95	108
16-OCT-95	103
27-SEP-95	103
21-SEP-95	103
18-SEP-95	106
13-SEP-95	111
11-SEP-95	101
11-SEP-95	106
22-AUG-95	105
10-AUG-95	106
08-AUG-95	108
30-JUN-95	112
26-JUN-95	100
26-JUN-95	101
18-MAY-95	105
10-MAY-95	101
20-FEB-95	103
20-FEB-95	107
07-FEB-95	107
07-FEB-95	106
07-FEB-95	97
07-FEB-95	105
06-JAN-95	83
06-JAN-95	109
03-JAN-95	101
03-JAN-95	113

Total Number of Data Points = 29 Average Recovery = 104.03

Reviewed By

Area Supervisor: _____ QA/QC Supervisor: _____

Figu

3.9 LABORATORY SCOPE OF SERVICES

3.9.1 Method and Matrix Capabilities/Analytical Methodologies

Matrix Capabilities

Common matrices tested include surface water, wastewater, soil, groundwater, solid wastes, and sludges. In addition, analyses have been performed on fish, biota, and air samples on a project basis.

Analytical Methodologies

TriMatrix uses written standard operating procedures (SOPs) which are derived from the current revision of methods specified by the United States Environmental Protection Agency, other federal and state agencies, and professional compendia as listed below:

"Test Methods for Evaluating Solid Wastes" (SW-846) Office of Solid Waste and Emergency Response, U.S. EPA.

Current EPA Contract Laboratory Program (CLP) Protocols for the Analysis of Organic and Inorganic Hazardous Substances.

"Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," EPA-600/4-82-057.

"Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act," 40 CFR, Part 136.

"Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water," USEPA, EMSL-Cincinnati.

"Annual Book of ASTM Standard," Volumes 11.01 and 11.02, ASTM, Philadelphia, PA.

"Techniques of Water Resources Investigations of the United States Geological Survey, Book 5, Laboratory Analysis," USGS, Washington, D.C.

"Standard Methods for the Examination of Water and Wastewater," APHA, AWWA, WPCF, Washington, DC.

"Official Methods of Analysis," AOAC, Arlington, VA.

"Methods for Chemical Analysis of Water and Wastes,' EPA-600/4-79-020.

HAZWRAP; Hazardous Waste Remedial Action Program; U.S. Department of Energy, Oak Ridge, TN Operations Office.

3.9.2 Detection Limits

The process of quantifying an analyte in an environmental matrix using specific analytical methods must use detection limits as points of reference. The four regions of analyte signal as generated by an instrument are separated by detection limits as described below.

3.9.2.1 Instrument Detection Limit - IDL

The IDL separates the region of no analyte detection from the region of signal detection. The IDL is defined as the smallest signal above background noise that an instrument can detect reliably. The IDL is measured by analyzing replicate standard solutions using reagent grade water as the test matrix. Seven consecutive measurements of standards are performed at 3-5 times the required detection limit concentrations on three non-consecutive days. IDL is determined by multiplying by three the average of the standard deviations of the measured values. The IDL will vary from one instrument to another and should not be used as a

reportable detection limit. (Refer to Figure 9 below.) Determine the IDL once per year for trace metals.

3.9.2.2 Method Detection Limit - MDL

The MDL separates the region of signal detection from the region of qualitative (semi-quantitative) determination. The MDL is defined as the minimum concentration of a substance that can be qualitatively measured and reported with 99% confidence that the analyte concentration is greater than zero. The MDL also can be described as the minimum concentration of an analyte that the method can detect in a blank or sample matrix. The MDL is generated by analyzing a low concentration of an analyte, usually at one to five times the expected MDL, in reagent grade water. The analysis is performed seven times, and the MDL is calculated by multiplying the standard deviation times the student "t" value at the 99% confidence level. (Refer to Figure 9 below.) Determine the MDL once per year for each analyte.

3.9.2.3 Reporting Detection Limit - RDL

The RDL separates the region of qualitative (semi-quantitative) determination from the region of quantitative determination. The RDL is defined as the minimum concentration of an analyte that can be reliably detected within specified limits of precision and accuracy during normal laboratory operating conditions. The RDL for an analyte is the MDL multiplied by a factor which varies, depending on the test matrix. A factor of three to five is frequently used. (Refer to Figure 9 below.)

Regions of Analyte Signal

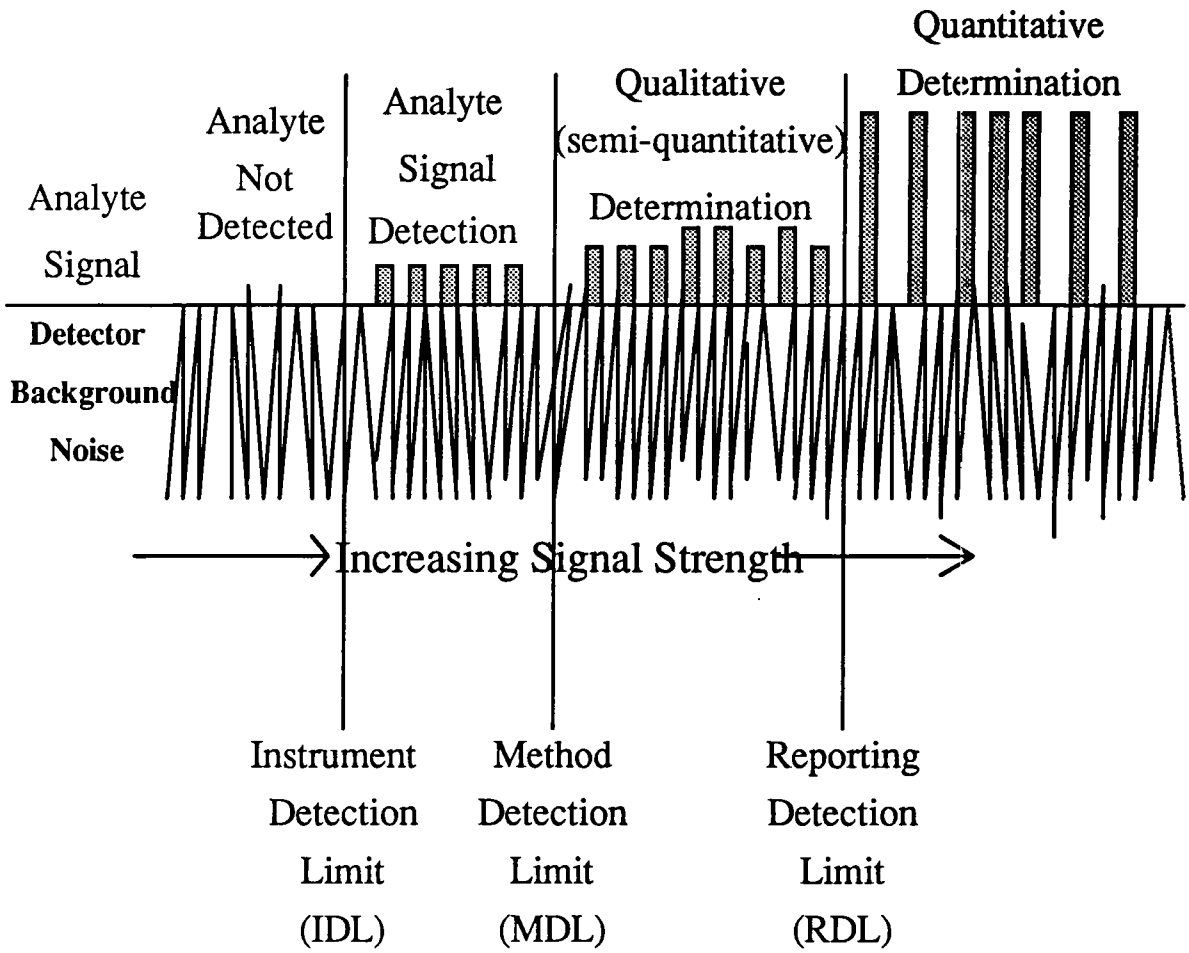


Figure 9

3.9.3 Procedures for Accepting New Work/Tests

3.9.3.1 New Test Requests

Client Services will forward a request for new analyses to the methods development group within each laboratory area where the request will be formally processed. Evaluation of the request will include the suitability of the analyte for quantitation, availability of existing test methods, instrumentation, standard materials, etc. The methods development group will provide a prompt response to client services to ensure that client needs can be addressed.

All newly developed methods are reviewed by the laboratory technical director and must comply with all requirements outlined in sections 3.8.2.1 and 3.8.2.2 of this manual.

3.9.3.2 Methods Development and Approval

A brief summary of Development Steps is as follows:
The linearity of analytical response must be demonstrated in the range of interest to the client. For organics, the suitability of a compound for chromatography must be determined. If extraction must be performed, the efficiency of that process for a given analyte must be demonstrated. Instrument detection limits (IDL's) must be arrived at, and method detection limit (MDL) studies must be performed. A check for interferences from other analytes must be done. Finally, formal approval must be obtained by laboratory management and by regulatory agencies involved.

3.10 LABORATORY FACILITIES, EQUIPMENT, AND SUPPLIES

3.10.1 Physical Plant

3.10.1.1 Laboratory Demographics

The TriMatrix Grand Rapids laboratory is located at 5555 Glenwood Hills Parkway, SE, Grand Rapids, Michigan. The laboratory was constructed in 1988 and was designed to accommodate the strict analytical testing requirements in today's marketplace.

The 12,900 square foot facility was designed by the TriMatrix laboratory staff in correlation with our own design architects. (see attached Figure 10). Special attention was paid to sample preparation areas and in the segregation of non-compatible areas such as GC/MS semi-volatiles and volatile organics. A breakdown of each general area of analysis and the space allocated is as follows:

Analysis	Space Allotted, Ft^2
Wet Chemistry/Microbiology	Approx. 2000
Atomic Absorption/Emission	Approx. 2000
Volatile Organics	Approx. 2400
Semi-Volatile Organics	Approx. 1500
Sample Processing & Storage	Approx. 1500
Administrative Offices	Approx. 2500
Organic Pretreatment	Approx. 1000

Sample storage areas include a large walk-in cooler with satellite commercial storage refrigerators for the segregation of volatile organic samples.

Managers, Group Leaders, Chemists, Project Chemists and the General Staff utilize quiet office areas for data reporting, validation and reporting.

The TriMatrix laboratory is equipped with a complete Laboratory Information Management System (LIMS) which was specially developed in-house to accommodate the specific needs of the laboratory and our clients.

Under the direction of the Laboratory Director, the Grand Rapids TriMatrix laboratory is organized into the following operating areas and support services.

Administrative and Management Operations

Laboratory Administration
Client Services
Marketing/Sales
Project Management
Health and Safety
Quality Assurance
Computer Services

Analytical Operations
Inorganic Laboratory
Metals Laboratory
Semi-Volatile Organics Laboratory
Volatile Organics Laboratory
Organic Extraction Laboratory

(Refer to Section 3.3.6.2 for Laboratory Organization Chart)

3.10.1.2 Reagent Water Systems

The TriMatrix Grand Rapids Laboratory utilizes the series of water treatment systems to obtain both ASTM Type I and Type II quality water.

The system begins with a supply line from the Grand Rapids Potable Water Distribution System. This source water is then passed through

an activated carbon bed filter (to remove residual chlorine) softened prior to introduction to a reverse osmosis system. The reverse osmosis process removes approximately 90% of the dissolved constituents. After the RO process, the treated water is stored in a 120 gallon storage tank. This capacity tank provides an ample supply of water for a full day of laboratory operations. The RO water is then distributed to the laboratory through a mechanical pump will pass through two mixed bed deionizing canisters. This supply now meets the requirements of ASTM Type II, and is utilized for glassware cleaning and as a feed water to a variety of polishing systems.

The polishing systems in place are comprised of several distillation units and a Milli-Q 4 Bowl System. Distilled RO-Deionized water is used primarily for BOD and metals analyses. Mill-Q water, which is equivalent to an ASTM Type I designation is used primarily for the preparation of standard solutions and reagents.

Each water system is monitored on a daily basis, checked against predefined acceptance criteria and recorded for documentation purposes.

Responsibility for monitoring the TriMatrix reagent water systems distributed between each laboratory area as coordinated through the Quality Assurance Department.

3.10.1.3 Glassware

For an analysis, glassware is selected which will provide the accuracy for that particular analytical procedure. TriMatrix purchases pipets, burets, and volumetric flasks, usually Class A, to meet the required accuracy. A standard operating procedure for cleaning glassware for each type of analysis is to be followed. Cleaning of glassware is performed according to the analysis being conducted and the sample matrix involved but certain general rules do apply. Use hot water to

wash water-soluble substances. Use detergent, dichromate solution, organic solvent, nitric acid, or aqua regia to remove other materials according to the specific glassware cleaning procedures. Avoid using detergents on glassware to be used for phosphate determinations. Use ammonia-free water for ammonia and kjeldahl nitrogen analyses. In all analyses, it is advisable to rinse glassware with tap water followed by deionized water immediately after use; matrix materials which are allowed to dry on glassware are more difficult to remove by washing.

3.10.1.4 Compressed Air

Compressed air must be free of dirt, water, and oil. For compressed air purchased from vendors, specification shall be high purity grade (breathing air). For compressed air produced in the laboratory, use filters at the compressor to keep water from moving into the compressed air delivery system. For certain instruments, such as gas chromatographs and atomic absorption spectrophotometers, install filters at the instrument to remove oil from the compressed air supply.

3.10.1.5 Ventilation Systems

Each laboratory operating area has its own separate air-handling system. In addition, the organics area has separate systems for the volatiles and semi-volatiles instrument rooms. Positive pressure is maintained on the instrument rooms at all times. The air-handling systems, which control heating, cooling and humidity, also maintain maximum cfm air turnover. There are four air conditioning/heating units and associated dust filters in the front building. The rear building has three units. The volatile organic lab utilizes charcoal filters.

3.10.1.6 Electrical Services

The electrical system at the TriMatrix Laboratory was designed and installed specifically for use in a laboratory environment. Special attention was paid to volatile requirements and the isolation of separate lines for critical applications like GC, GC/MS, atomic absorption and automated analyzers.

All laboratory bench benches, hoods and work areas were designed to accommodate a large number of laboratory applications, such as distillations, digestions and extractions.

Volatile surge-protection devices are in place for all laboratory computing equipment. The main Laboratory Information Management System is also projected by a programmable uninterrupted power supply (UPS) device. This UPS allows for a sequence shut-down of the LIMS system during a power failure. This sequenced shut-down provides excellent protection of the LIMS database during a power outage.

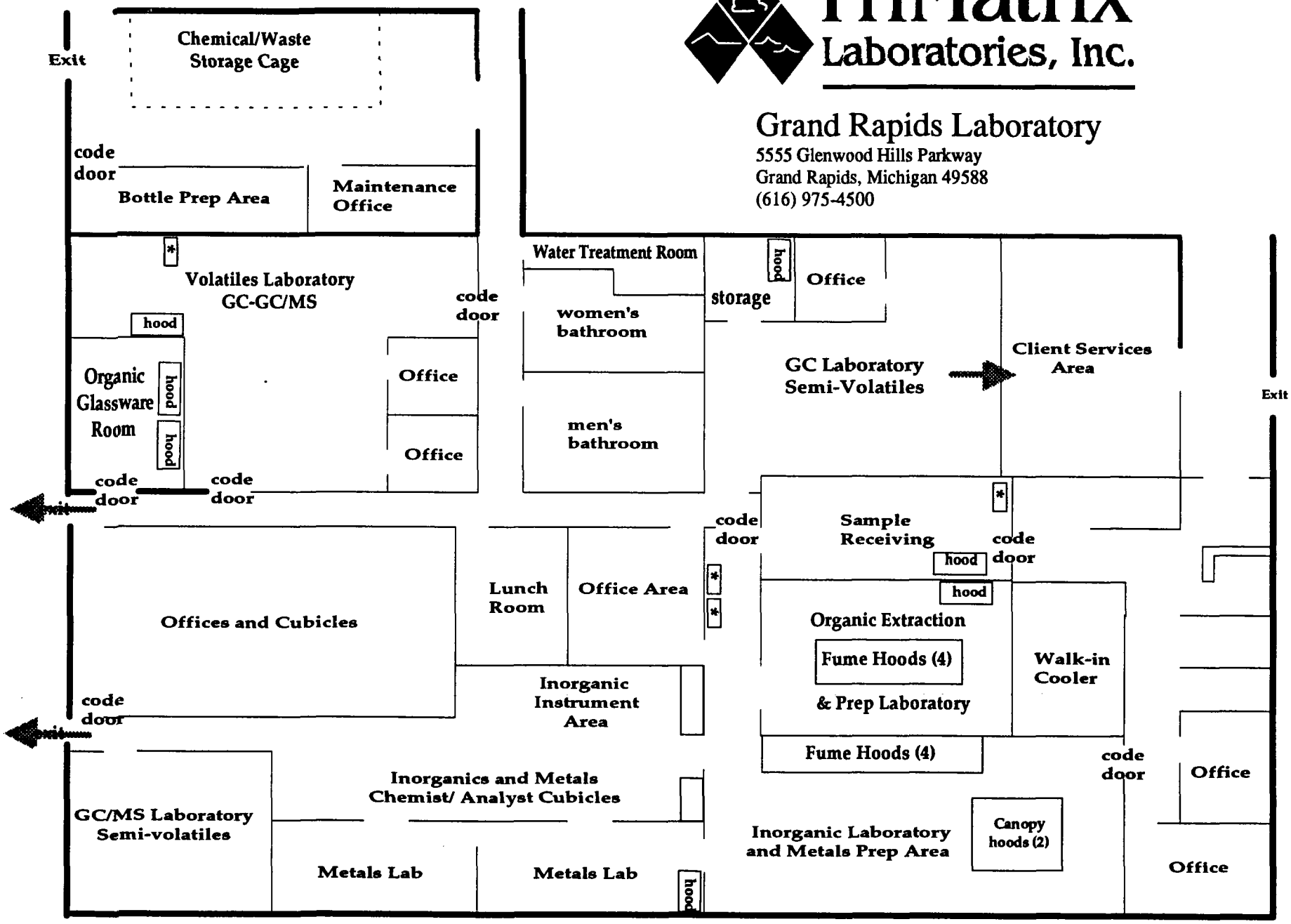
3.10.1.7 Laboratory Layout/Diagram

(Refer to Attached Floor Plan Figure 10)

TriMatrix Laboratories, Inc.

Grand Rapids Laboratory

5555 Glenwood Hills Parkway
Grand Rapids, Michigan 49588
(616) 975-4500



*Volatile Sample Storage Refrigerator

Figure 10

3.10.2 Equipment Procurement

For an environmental testing laboratory where trace analyses are routinely performed, certain specifications for laboratory equipment are critical to quality. Instrumentation, balances, glassware, water baths, etc. must have the accuracy required for particular analytical procedures. The laboratory area manager in conjunction with the laboratory manager and the technical director are responsible for determining the required specifications before equipment is procured. The analytical specifications are based on a detailed review of the test methods.

3.10.3 Equipment Management/Maintenance/Inventory

Adequacy of equipment for its intended purpose must be verified before use. An sufficient inventory of equipment is to be maintained so that testing delays are not incurred due to shortages. Keep a stock count on each item that automatically triggers a reorder point and avoids expensive express charges for rush orders. Perform service on equipment on a scheduled basis. Maintain a stock of critical equipment spare parts which are known to wear out regularly.

Keep maintenance log books so that the maintenance requirements of each major equipment item can be determined over a time interval.

A complete listing of Laboratory Equipment is presented in Appendix B of this manual.

3.10.4 Chemical Procurement and Inventory

3.10.4.1 Reagents, Solvents, and Gases

The purchasing of reagents, solvents, and gases must be carefully controlled through the purchase order system so that a minimum quality level is maintained for these raw materials in the testing process. The managers of each laboratory operating area along with the quality assurance manager will define the suitable grades of materials. The

area manager, or his designate will verify upon receipt that the incoming materials meet requirements. Each container of incoming reagents, solvents, and gases is to be assigned an identification number for traceability in laboratory testing records (Note: the manufacturer's lot number may be used if it meets the traceability requirements and is pre-printed on each container label.) Material certificates of analysis are to be provided by the vendor and stored in laboratory files. The areas supervisor, or his designate, is to oversee proper storage and removal of reagents, solvents, and gases when their shelf-life has expired.

Reagents, solvents, and gases are available from vendors in a broad range of purity - from technical to ultrapure grade. The type of analysis, as well as the sensitivity and specificity of the method must be considered in choosing a grade of material. The analytical reagent (AR) grade is suitable for most inorganic analyses. Trace organic analyses frequently require a special ultrapure grade. AR grade is the minimum for reagents and solvents used in organic analysis. The absence of certain impurities is required for some GC detectors - notably sulfur and phosphorus in the FID detector. Trace metals analyses including atomic emission and atomic absorption spectroscopy usually require spectro-quality reagents and solvents, although AR grade may be suitable in some cases. In sample cleanup procedures involving florisil, silica gel, and alumina as absorbents, these substances must be checked for interfering components when preactivated according to the analytical method. Compressed gases are available in various purities, usually expressed as a percent (e.g. 99.999) along with a certificate of analysis showing the maximum contaminant level. Gases should be filtered in the laboratory delivery lines to remove moisture, oil, and other contaminants. Refer to the analytical methods and the instrument manufacturer's operating manual for gas purity requirements. In the use of all reagents, solvents, and gases the analyst must verify the purity requirements as well as the grade of the material on hand before beginning an analysis.

Shelf life of chemicals purchased from vendors is based on the following guidelines (unless otherwise specified by the manufacturer or derived from other information):

Inorganics
- Liquids - 5 years
- Solids - 5 years
- Compressed Gases - 6 months

Organics
- Liquids - 2 years
- Solids - 5 years
- Compressed Gases - 6 months

Ethers generally are to have an expiration date of 34 days due to the potential for peroxide formation.

3.10.4.2 Certified Standards

The purity and traceability of standards used in analytical processes is crucial to the quality of data being generated. Only high quality standards certified by established vendors are to be utilized. Calibration reference standards must be of the designated purity required for a particular analysis. Obtain primary reference standards and standard solutions from the National Institute of Standards and Technology (NIST), the USEPA Repository, or other high-quality commercial sources.

Chemical reference standards obtained from established commercial vendors should be traceable to NIST. Maintain a log of all standards and reference solutions received from vendors. Identify the supplier, lot number, concentration, date received, and any dilution or preparation performed after receipt. Write the date received on the standard container label. Each container of incoming standards is to be assigned an identification number for traceability in laboratory records (Note:

the manufacturer's lot number may be used if it meets the traceability requirements and is pre-printed on each container label).

Stock and working standards must have a label describing the compound name, concentration, date prepared, name of preparer, and expiration date.

Validate all standards prior to use by checking the purity against a standard obtained from a different commercial source. Evaluate stock and working standards periodically for signs of deterioration (i.e., precipitates, change in color, change in concentration).

During analytical operations, use standards from different vendors to cross-check each other. For example, perform an initial calibration with a standard from one commercial source and the continuing calibration verification standard from a different vendor.

In a situation where standard reference materials are not commercially available for an analysis, use compounds of certified high purity to prepare calibration standards and thoroughly document the procedure.

Utilize a computer database to maintain records of standards, showing the information in the receiving log described above as well as expiration dates, stock and working standards prepared from a particular vendor shipment, and other pertinent information for traceability and reordering.

Vendor expiration dates for purchased stock standards are not to be exceeded. Establish expiration dates for working standards based on guidelines in the analytical method.

4.0 QUALITY CONTROL

4.1 DOCUMENT CONTROL AND MAINTENANCE

4.1.1 Traceability of Measurements/Documentation Requirements

The purpose of a properly designed and implemented documentation protocol is to assure that after the issuance of an analytical report, all information presented can be fully traced back to its point of origin. This documentation system must also provide for traceability of non-reported information that provides supporting value to the analytical test results. These items include but are not limited to: stock standard records, test calibration records, data reduction and validation activities, sample custody, facilities monitoring and final data reporting.

A more detailed review of the documentation procedure and traceability of information is presented below.

4.1.2 Paperwork/Information Flow

As displayed in Figure 11, the flow of documents is the same for general routine work as it is for samples under strict chain-of-custody (COC). The general axiom is that a COC procedure will fail without a pre-existing scheme of rigid documentation control available as a routine measure. The records trace can provide for the following:

- Answers to questions of analytical integrity for results which have been reported for 2 days or 2 years.
- Assistance in finding and solving random and systematic problems.
- Assistance in preventing long term degradation of the analytical process.
- Assistance in ensuring continuity of analytical effort despite personnel and mechanical changes.

The following subsections identifies and describes the procedures and any corresponding documents that are generated during the course of any project/submittal through the laboratory.

4.1.2.1 Project Initiation

All samples or sample groups which enter into the TriMatrix analytical process, must be accompanied by the appropriate documentation. This documentation is necessary to define the analytical goals and project objectives. These documents will include one of the following: for larger projects with federal or state oversight, a quality assurance project plan-QAPjP is written; an TriMatrix laboratory project request form. In conjunction with a QAPjP or an TriMatrix Project Initiation Form, an inventory of required sample containers must be prepared for each sampling event. This inventory is prepared on an TriMatrix master bottle packing list. Examples of the TriMatrix forms are presented in Figures 12 and 13.

The TriMatrix project request form is utilized for both the development of project objectives and in the creation of laboratory price quotations.

The TriMatrix laboratory project initiation form is completed to assist the implementation of the project initiation step within the TriMatrix LIMS system.

All projects initiated or developed within LIMS, are validated by means of a project report (see Figure 14). This report presents all project information including tests requested, methods, custom fraction lists, special reporting limits and special quality control limits if required. All information depicted on this report is validated by the appropriate project chemist prior to sample login. Modifications to project information can be accomplished after login through the project maintenance module in LIMS.

All documents created during the project initiation phase are maintained and archived to the client filing system.

4.1.2.2 Sample Receipt/Examination

Immediately upon receipt of a sample shipment or delivery group at the TriMatrix laboratory, the sample coordinator (SC) will examine the shipping container to ascertain and document the condition of the samples. This examination is performed and documented on three different TriMatrix reports. These three reports are designed to communicate not only the conditions of the shipping containers during sample receipt, but also any problems associated with a particular sample delivery group.

When all samples from a sample delivery group have been removed from the shipping containers and examined against the external QC forms, only then will the SC sign-off for receipt the laboratory. In many cases, COC form is presented to the sample courier for their record of sample delivery to the laboratory.

The "Cooler Receipt Form" (see attached Figure 15, is utilized for all internal laboratory chain-of-custody projects as well as all projects requiring reporting levels of 4, 5, or 6.

The SC will perform a series of measurements to check and document each coolers temperature, and the pH of all chemically preserved sample containers with the exception of solid matrices. Measurements performed during these steps are recorded on the TriMatrix "'Sample Preservation Log Form" (see attached example in Figure 16).

The third form or the "Problem Submittal Report (see attached figure 17) is issued for all sample delivery groups that have cited deficiencies or non-conformance's from stated sample delivery, preservation or custody policies.

If a problem is encountered with a sample delivery group, an TriMatrix Nonconformance Report is issued with the problem submittal report to the appropriate project chemist for corrective actions.

The sample coordinator, having opened the shipping containers and examined all the samples, will next verify the existence of an initiated project within the TriMatrix LIMS system. In most cases, the representative project chemist will provide the sample coordinator with a "project report", detailing the project information including the tests required for all samples. Any discrepancies in the requested tests and the sample containers received is forwarded to the project chemist for corrective actions.

TriMatrix Laboratories, Inc.
Document - Benchsheets/Client Report
Flow Diagram

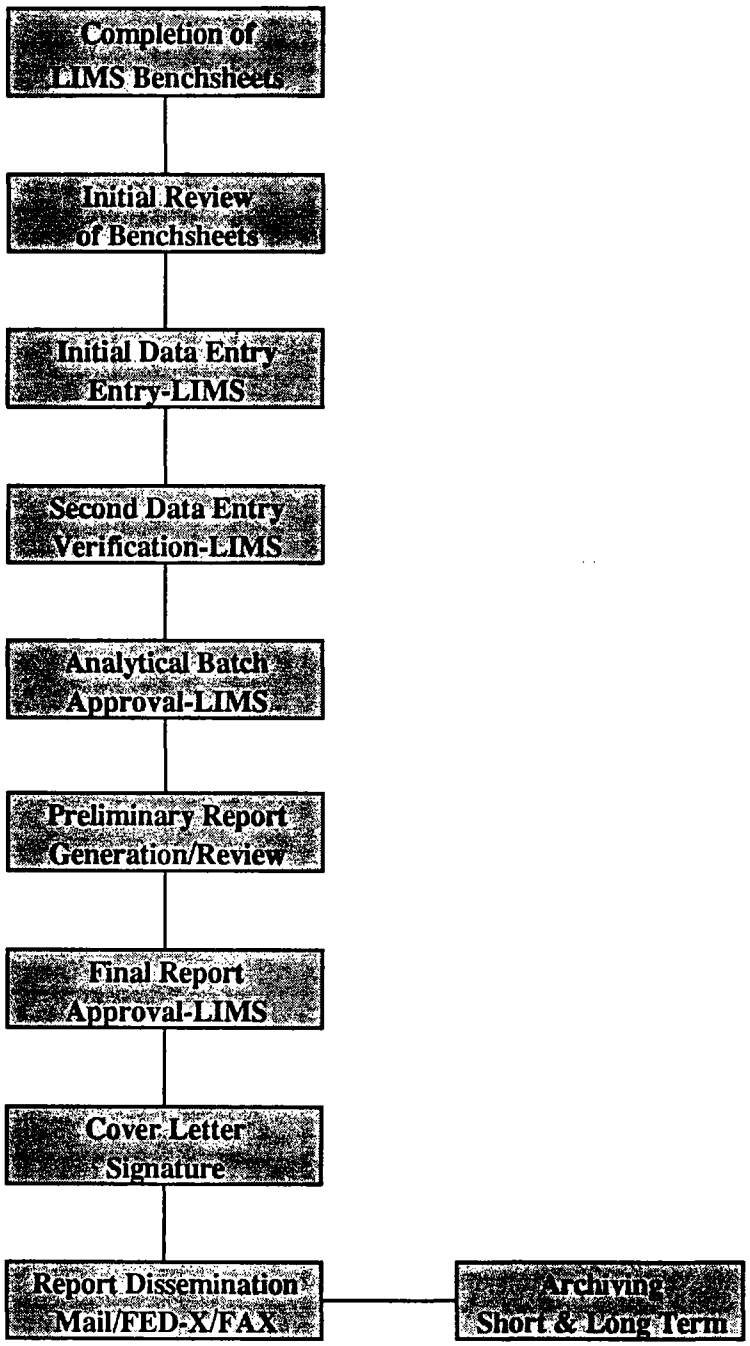


FIGURE11.XLS

Figure 11

TriMatrix Laboratories, Inc.

PROJECT INFORMATION FORM

REQUEST FOR: ___WORK ____QUOTATION
TODAY'S DATE: _____/_____/_____
DATE NEEDED: _____/_____/_____

Client Information:

1. Client Name:_____
2. Project Name:(as it is to appear on the report):_____

3. TriMatrix Project Number:_____

3a. TriMatrix Project Manager:_____ TriMatrix Contact:_____
TriMatrix Office:_____ TriMatrix Office:_____
Telephone Number:_____ Telephone Number:_____
FAX Number:_____ FAX Number:_____

Project Information:

1. Expected Date of Sampling:___/___/___ Bottles needed by:___/___/___
_____ to be picked up by TriMatrix Personnel.
_____ to be shipped to: _____
_____
_____

1b. Special Instructions for Sample bottle and cooler preparation:
_____

2. Project Frequency:
_____ One Time Event _____ Weekly Event _____ Semi-Annual Event
_____ Monthly Event _____ Quarterly Event _____ Annual Event
_____ Other - (Please explain):_____
3. Projected date samples would arrive in the laboratory:____/_____/_____
4. Number of Samples: _____Matrix Type(s):_____

4a. Parameters Required/Detection Limits are:(attach separate sheet if needed)

Parameter (s)	Detection Limit/units

Figure 12

TriMatrix Laboratories, Inc.

4b. Special Methods Required and/or program (permit) requirements:

_____

_____

_____

_____

5. Will there be any field blanks? _____ YES _____ NO
(Please indicate in Section 4a (above) what parameters are to be analyzed.)

6. Will there be any trip blanks needed? _____ YES _____ NO
(Please indicate in Section 4a (above) what parameters are to be analyzed.)

7. Potential Hazards associated with the samples are:_____

8. Has the client that any hazardous samples will be returned to them?
_____ YES_____ NO

9. Disposal of non-hazardous samples will take place thirty (30) days after the report mailing unless otherwise requested. The cost for storage past this time is $??.?? per sample.

10. Is Strict Chain of Custody needed for this project?
_____ YES Please Specify special needs:_____
_____ NO (The laboratory will use its standard protocol.)

11. Analytical turnaround required:
_____ Laboratory Standard (3 Weeks) _____ Two (2) weeks
_____ One (1) week _____ Other:(Specify)_____

Reporting Information

1. Please indicate below the type of Quality Control Reporting that you will need for your project:

Level of QC Reporting	**Type of Information you will receive**
_____ Level 1	Cover Letter, Invoice, Report and SDQ*
_____ Level 2	Level 1 + Batch Method Quality Control Data
_____ Level 3	Level 2 + Matrix Specific Quality Control Data
_____ Level 4	Level 3+ Raw Data Package
_____ Level 5	Level 3 + CLP Forms Package
_____ Level 6	IRPIMS Electronic Deliverables Package

*Statement of Data Qualifications Report

2. Please indicate any special reporting format(s) that are needed for this project.

_____

3. Are disk deliverables needed? _____ YES _____ NO

3a. If disk deliverables are needed, what type of format? (i.e.:Lotus, Excel, etc.) Please specify:_____

4. Please indicate the report distribution of the final report:_____

5. Other Information the laboratory needs:_____

Please sign and date below and return to the appropriate project chemist for this project. Please keep a copy for your records.

Project Manager: _____

Date: _____/_____/_____

Figure 12

TriMatrix Laboratories, Inc.

5555 Glenwood Hills Parkway SE • PO Box 888692 • Grand Rapids, MI 49588-8692 (616) 975-4500

Client: _____

Project: _____

Project Manager: _____ Contact: _____ Project No.: _____

Bottles Requested on: _____ Date Due to Client: _____ Time Due: _____

Bottles will be Shipped / Picked Up _____

If Shipped: ☐ Overnight ☐ 2nd Day Air ☐ Standard ☐ Best Way

☐ Other _____

Ship Bottles to: _____

Frequency: ☐ One Time ☐ Quarterly ☐ Others _____

☐ Weekly ☐ Semi Annual

☐ Monthly ☐ Annual

Prepare Bottles for:

Months ☐ Jan ☐ Feb ☐ Mar ☐ April ☐ May ☐ June

☐ July ☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec

Weeks: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Day: ☐ M ☐ T ☐ W ☐ TH ☐ F

Expiration Date: _____

COMMENTS

_____

Bottle Prep Use Only _____ **Date Shipped:** _____

Coolers Assigned _____ **Tracking No.:** _____

Courier ID: _____

Figure 13

Client Name: _____

For any questions regarding these bottles, contact Barry Huizenga, the Project Chemist for this submittal.

Sample Inventory and Master Bottle Packing List

Sample Locations	Sample Sub-Portions-Preservative and Tagging Codes																								
	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
Field Filtering Required Yes / No																									

	NO.	DESCRIPTION	PRESERVATIVE	TAG COLOR
		Water		
WATER SAMPLING	1a	40 ml Vial for Purgeable Organics	1+1 HCL Cool to 4° C	Yellow
	1b	40 ml Vial for Purgeable Organics	Cool to 4° C	Yellow & Black Stripe
	2	1000 ml Amber Glass Non Purgeable Organics	Cool to 4° C	Salmon
	3	125 250 500 1000 ml Plastic - Non Preserved	Cool to 4° C	Green
	4	125 250 500 1000 ml Plastic - Nutrients	pH < 2.0 w/H_2SO_4	Dark Blue
	5	500 1000 ml Amber Plastic - Cyanides	pH to > 12 w/NaOH	Light Blue
	6	125 250 500 1000 ml Plastic - Metals	pH to <2 w/HNO_3	Red
	7	1000 ml Glass - Oil & Grease / TPH	pH to <2 w/H_2SO_4	Dark Blue
	8	125 ml Bottle Bacteria	Cool to 4° C	White Label
	9	500 ml Glass - Sulfide	0.5 ml Zinc Acetate + 0.5 ml NaOH to pH >9	Light Green
	10	500 ml Amber Glass - TOX	pH to < 2 w/H_2SO_4 Cool to 4° C	Lilac
	11	40 ml Amber Glass - TOC	pH to < 2 w/H_2SO_4 Cool to 4° C	Pink
	12	2000 ml Plastic - Radiological	pH to < 2 w/HNO_3	Gray
	13	500 ml Amber Glass - Phenols	pH to < 2 w/H_2SO_4	Brown
	14	250 ml Amber Glass - Formaldehyde	Cool to 4° C	Orange
	15	125 250 500 1000 ml Plastic - Dissolved Metals	pH to < 2 w/HNO_3	Red & White Stripe
		Soil / Non-Aqueous		
SOIL SAMPLING	16	125 250 500 1000 ml Wide Mouth Plastic	Cool to 4° C	White
	17	125 250 500 1000 ml Wide Mouth Amber Glass	Cool to 4° C	Manilla
	18	125 ml Vial for Purgeable Organics in Soil	Cool to 4° C	Light Yellow
	19	125 ml Vial for TCLP Volatiles	Cool to 4° C	Yellow & Black Stripe
	20	125 ml Wide Mouth Plastic - % Solids	Cool to 4° C	Yellow & White Stripe
		Other Water / Soil / Non-Aqueous		
	21			
	22			

Figure 13

01-MAR-1995 PROJECT REPORT - ONE

NUMBER 29454
DESCRIPTION Water Pollution Study Semi-Annual PE
CLIENT 29454
PROJ. CHEMIST 1991
CONTACT Kriscunas, Douglas
PHONE (616) 942-9600 EXT.
ENTERED BY DEK
ENTERED ON 05-SEP-1991
TURN AROUND 21 DAYS
CHAIN OF CUSTODY E
QC REPORTING H
CASE NARR FLAG Y
BOTTLE HANDLING 3
BOTTLE CARRIER DEK
HOLD DAYS NON HAZARDOUS LAB DISPOSAL
DISPOSAL 1

HAZARDS: 1- FLAMMABILITY; 1- REACTIVITY; 1- CONTACT; - HEALTH

SAFETY
CCS NUMBER CCS MANAGER
PO NUMBER CONTRACT 05-SEP-199
EXPIRATION DATE 180
SUBMITAL FREQUENCY 2 DAYS SUBMITTALS PER YEAR 20
FACTOR %U SAMPLES PER SUBMITTAL Water
PRICE CODE Y

BUSINESS OFFICE PROJECT NAME Qc Rept Flag Y

NARRATIVE:

Figure 14

NUMBER 29454
DESCRIPTION Water Pollution Study Semi-Annual PE
CLIENT 29454

	QTY	ACTIVATE	INACTIVATE
PCB'S in Oil 1 & 2	2		

PCB'S USEPA-8080 SCAN GC/ECD/P&P/WST USEPA-8080 WASTE ----- N mg/kg N

		Common Name	Detect Limit	Parm Num	Parm Var	Meth Num	Meth Var
GC/ECD/P&P/WST	-----	PCB-1016	0.5	502	1	39	25
GC/ECD/P&P/WST	-----	PCB-1016	0.5	502	1	39	25
GC/ECD/P&P/WST	-----	PCB-1221	0.5	502	1	39	25
GC/ECD/P&P/WST	-----	PCB-1221	0.5	502	1	39	25
GC/ECD/P&P/WST	-----	PCB-1232	0.5	502	1	39	25
GC/ECD/P&P/WST	-----	PCB-1232	0.5	502	1	39	25
GC/ECD/P&P/WST	-----	PCB-1242	0.5	502	1	39	25
GC/ECD/P&P/WST	-----	PCB-1242	0.5	502	1	39	25
GC/ECD/P&P/WST	-----	PCB-1248	0.5	502	1	39	25
GC/ECD/P&P/WST	-----	PCB-1248	0.5	502	1	39	25
GC/ECD/P&P/WST	-----	PCB-1254	0.5	502	1	39	25
GC/ECD/P&P/WST	-----	PCB-1254	0.5	502	1	39	25
GC/ECD/P&P/WST	-----	PCB-1260	0.5	502	1	39	25
GC/ECD/P&P/WST	-----	PCB-1260	0.5	502	1	39	25

Pesticides 1 & 2 2

PEST-608 USEPA PE'S GC/ECD/P&P/WTR USEPA-608 WTR 1.0 N ug/l N

		Common Name	Detect Limit	Parm Num	Parm Var	Meth Num	Meth Var
GC/ECD/P&P/WTR	1.0	ALDRIN	0.01	503	5	39	11
GC/ECD/P&P/WTR	1.0	ALDRIN	0.01	503	5	39	11
GC/ECD/P&P/WTR	1.0	4,4'-DDD	0.02	503	5	39	11
GC/ECD/P&P/WTR	1.0	4,4'-DDD	0.02	503	5	39	11
GC/ECD/P&P/WTR	1.0	4,4'-DDE	0.02	503	5	39	11
GC/ECD/P&P/WTR	1.0	4,4'-DDE	0.02	503	5	39	11
GC/ECD/P&P/WTR	1.0	4,4'-DDT	0.02	503	5	39	11
GC/ECD/P&P/WTR	1.0	4,4'-DDT	0.02	503	5	39	11
GC/ECD/P&P/WTR	1.0	DIELDRIN	0.01	503	5	39	11
GC/ECD/P&P/WTR	1.0	DIELDRIN	0.01	503	5	39	11
GC/ECD/P&P/WTR	1.0	HEPTACHLOR	0.01	503	5	39	11
GC/ECD/P&P/WTR	1.0	HEPTACHLOR	0.01	503	5	39	11
GC/ECD/P&P/WTR	1.0	HEPTACHLOR EPOXIDE	0.01	503	5	39	11
GC/ECD/P&P/WTR	1.0	HEPTACHLOR EPOXIDE	0.01	503	5	39	11

Figure 14

TriMatrix Laboratories, Inc.

Cooler Receipt Form
Part 1

Cooler #_____

Project: _____ Date Received: _____ Project Submittal No. _____

Use other side of this form to note further details concerning check-in problems and to specify and describe any action(s) regarding the resolution(s) of problems. If shipment was accepted and if requested. Note on back the address where the empty cooler was returned and likewise if the shipment was rejected.

A. **Preliminary Examination Phase:** Date cooler was opened: _____

by (print) _____ (sign) _____

1. Were custody seals on outside of cooler?.....YES NO

   If YES, how many & where: _____

   Date & Signature correct? If YES, seal date: _____, name:_____.....YES NO

2. Were custody seals unbroken and intact at the date and time of arrival?.....YES NO

3. Were custody papers sealed in a plastic bag and taped inside to the lid?.....YES NO

4. Was project identifiable from custody papers? If YES, enter project name at the top of this form.....YES NO

5. Were custody papers filled out properly (ink, signed, etc)?.....YES NO

6. Did you sign custody papers in the appropriate place?.....YES NO

7. Did cooler come with a shipping slip (air bill, etc.)?.....YES NO

   If YES, attach & enter air bill or invoice number here:_____

8. Have designated person initial here to acknowledge receipt of cooler: _____ (date) _____

TriMatrix Laboratories, Inc.

Cooler Receipt Form
Part 2

B. **Log-In Phase**: Date samples were logged-in: _____

by (print) _____ (sign) _____

9. Describe packing: _____

10. If required, was enough ice used? (temperature = _____) ..... YES NO

11. Were all bottles sealed in separate plastic bags? ..... YES NO

12. Did all bottles arrive unbroken and in good condition? ..... YES NO

13. Were all bottle labels complete (ID, date, time, signature, preservative, etc)? ..... YES NO

14. Did all bottle labels agree with custody papers? If NO, indicate discrepancies on back ..... YES NO

15. Were correct containers used for tests indicated? ..... YES NO

16. Were correct preservatives used when required? ..... YES NO

17. Was a sufficient amount of sample sent for tests indicated? ..... YES NO

18. Bubbles absent in VOA vials? If NO, list exceptions _____ ..... YES NO

19. Were the samples accepted for QA/QC testing? If NO, detail as instructed at top of this form ..... YES NO

20. Have designated person initial here to authorize further processing: _____ (date) _____

Figure 15

TriMatrix Laboratories, Inc.

5555 Glenwood Hills Parkway SE • PO Box 888692 • Grand Rapids, MI 49588-8692

Sample Log-In Log

Analysis Type (Preservation)	Container Description	Tag Color	Bottle #	pH Should be							
VOC'S (wtr.) (1+1 HCL)	40 ml vial glass	Yellow	1	<2*							
SVOC'S (wtr.) (Non-Pres.)	N.M. amber glass	Salmon	2	~7							
Inorganic (Non Pres.)	N.M. plastic	Green	3	~7							
Nutrients (H_2SO_4 Pres.)	N.M. plastic	Blue	4	<2							
Cyanides (NaOH Pres.)	N.M. plastic	Lt. Blue	5	>12							
Metals (HNO_3 Pres.)	N.M. plastic	Red	6	<2							
Oil & Grease (H_2SO_4 Pres.)	W.M. clear glass	Dk. Blue	7	<2							
Bacteria (Non-Pres.)	125 ml. bottle/bag	Brown	8	~7*							
Sulfide (NaOH + Zn Acetate Pres.)	N.M. amber glass	Lt. Green	9	>9							
TOX (H_2SO_4 Pres.)	N.W. amber glass	Lilac	10	<2*							
TOC (H_2SO_4 Pres.)	40 ml amber vial glass	Pink	11	<2*							
Radiological (HNO_3)	W.M. plastic	Gray	12	<2							
Phenols (H_2SO_4 Pres.)	N.M. amber glass	Brown	13	<2							
Formaldehyde (Non-Pres.)	N.M. amber glass	Orange	14	~7*							
Other Water	Other	-	15	*							
Soils (Non-Pres.)	W.M. plastic	White	16	*							
Soils (Non-Pres.)	W.M. amber glass	Manilla	17	-							
VOA's (Soil) (Non-Pres.)	125 ml. soil vial	Lt. Yellow	18	*							
TCLP VOA (Soil) (Non-Pres.)	125 ml. soil vial	Yellow & Black Stripe	19	*							
% Solids (Soil) (Non-Pres.)	125 ml. W.M. plastic	Yellow & White Stripe	20	*							
Other Soil/Non-Aqueous	Other	-	21	*							
			All Bottle Types Received (Y/N)								

Coolers Dropoff:

Cooler # _____	Temp. at receipt	°F	°C	Cooler # _____	Temp. at receipt	°F	°C
Cooler # _____	Temp. at receipt	°F	°C	Cooler # _____	Temp. at receipt	°F	°C
Cooler # _____	Temp. at receipt	°F	°C	Cooler # _____	Temp. at receipt	°F	°C
Cooler # _____	Temp. at receipt	°F	°C	Cooler # _____	Temp. at receipt	°F	°C

* Do not check pH at log-in
N.M. - Narrow mouth bottle type
W.M. - Wide mouth bottle type

Comments:

0018

Figure 1

TriMatrix Laboratories, Inc.

LABORATORY
PROBLEM SUBMITTAL REPORT

CLIENT: _____

RECEIPT: DATE:_____ TIME:_____ BY:_____

DEFICIENCIES CITED: NONE:_____

____ CUSTODY SEALS - ABSENT / NOT INTACT (IF REQUIRED)

____ SAMPLES RECEIVED - WITHOUT COOLANT.

____ CHAIN-OF-CUSTODY - ABSENT/INCOMPLETE

____ SAMPLES ABSENT - QUANTITY DOES NOT MATCH COC FORM

____ CHAIN-OF-CUSTODY - DOES NOT MATCH SAMPLE TAGS

____ SAMPLE TAGS / ABSENT

____ SAMPLE BOTTLES - BROKEN

____ SAMPLE BOTTLES - TYPES & QUANTITY DO NOT MATCH ANALYTICAL REQUIREMENTS.

____ SAMPLE PRESERVATIVES - INCORRECT FOR ANALYSIS

____ SAMPLE VOLUMES ____ INCORRECT FOR ANALYSIS ____ HEADSPACE IN VIALS

____ CORRECTIVE ACTIONS TAKEN AT LOGIN-SAMPLES WILL BE PROCESSED AS IS

_____

_____

____ SAMPLES PLACED ON HOLD UNTIL CORRECTIVE ACTIONS ARE ISSUED
DATE: _____ TIME: _____ BY: _____

____ CORRECTIVE ACTIONS REQUIRED:

_____

_____

DATE: _____ TIME: _____ BY: _____

ADDITIONAL COMMENTS:

_____

_____

Figure 17

4.1.2.3 Sample Log-In

During the sample log-in process, a series of documents and computer entry functions are completed and performed in an effort to document and validate this process. Entries are made on these documents and electronic forms to facilitate the log-in process. Documents and forms requiring entries from the sample coordinator include: the sample receiving log, LIMS sample receiving module, external COC forms, and the LIMS sample log-in module. In concert with these entry/documentation activities, several reports and logs as well as sample bottle tags are produced to validate the log-in activities. Examples of an Arrival Log and a LIMS generated sample bottle tag are presented in Figures 18 and 19.

Entries both in writing or electronic are validated by the recording or storage of the sample coordinator (SC) initials and date. Modifications to any entry is also documented, initialed and dated both on paper and within the TriMatrix LIMS system.

The exact protocols and operational conditions utilized for the sample log-in process can be found in the TriMatrix SOP for sample receiving/sample log-in. .

The SC will initiate a project or submittal file for each sample delivery group received. This file is labeled with the LIMS system generated project-submittal sequence, and will contain all documents associated with the sample receiving, sample log-in process. These documents will include: all external chain-of-custody forms, sample preservation records, shipping records, any client correspondence and a copy of the actual log for each submittal. Upon completion of the analytical process, the project file becomes part of the permanent record of each project.

UNCOMPLETED ANALYSIS WITH A SAMPLE LOGIN DATE > OR = 03-Mar-1995 AND < OR = 03-Mar-1995

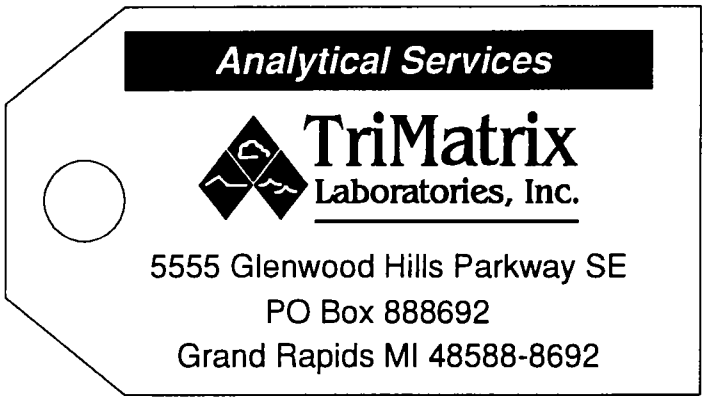
```
MDNR-Gaylord District                    TURNAROUND DAYS: 21    PROJECT CHEMIST: NBK   QC TYPE: LV3   COC: I
     31914-10                          PROJECT MANAGER:                         LAB DUE DATE:     21-MAR-1995 (TUE)
     MDNR Case #1585          Dockside                 March 3, 1995 Submittal   CLIENT DUE DATE: 24-MAR-1995 (FRI)

          SAMPLE #: 111724     Before     Resin                                  SAMPLED DATE:     01-MAR-1994 (TUE)
                    LEAD, TOTAL              USEPA-7421      WTR   0  !

          SAMPLE #: 111725     After      Resin                                  SAMPLED DATE:     01-MAR-1994 (TUE)
                    LEAD, TOTAL              USEPA-7421      WTR   0  !

          SAMPLE #: 111726     Influent                                          SAMPLED DATE:     01-MAR-1994 (TUE)
                    VOL'S BY 8021/SCAN-2 LIST USEPA-8021      WTR   0  !

          SAMPLE #: 111727     Between                                           SAMPLED DATE:     01-MAR-1994 (TUE)
                    VOL'S BY 8021/SCAN-2 LIST USEPA-8021      WTR   0  !

          SAMPLE #: 111728     Effluent                                          SAMPLED DATE:     01-MAR-1994 (TUE)
                    VOL'S BY 8021/SCAN-2 LIST USEPA-8021      WTR   0  !

          SAMPLE #: 111729     Trip Blank                                        SAMPLED DATE:     03-MAR-1995 (FRI)
                    VOL'S BY 8021/SCAN-2 LIST USEPA-8021      WTR   0  !
     SUBMITTAL NARRATIVES:    VOA's in rack #489-W-14
     PROJECT NARRATIVES:      **  known as Case #1287 in October 1993.
                              **  (was Dave Lindsay's project)
                              *The new LOE is McNamee Operational Services.  Please send a
                              *copy of all reports to : McNamee Operational Services
                              *                         Attn. Mr. Jerry Randall
                              *                         3131 S. State St.
                              *                         Ann Arbor, MI   48108
                              *THIS IS A 10TH OF THE MONTH PROJECT!!!
CLIENT NARRATIVES:    **  always 307 detection limits unless
                      **  the submittal or sample narratives state differently.
                      **  this client narrative will always show up
```

Figure 18

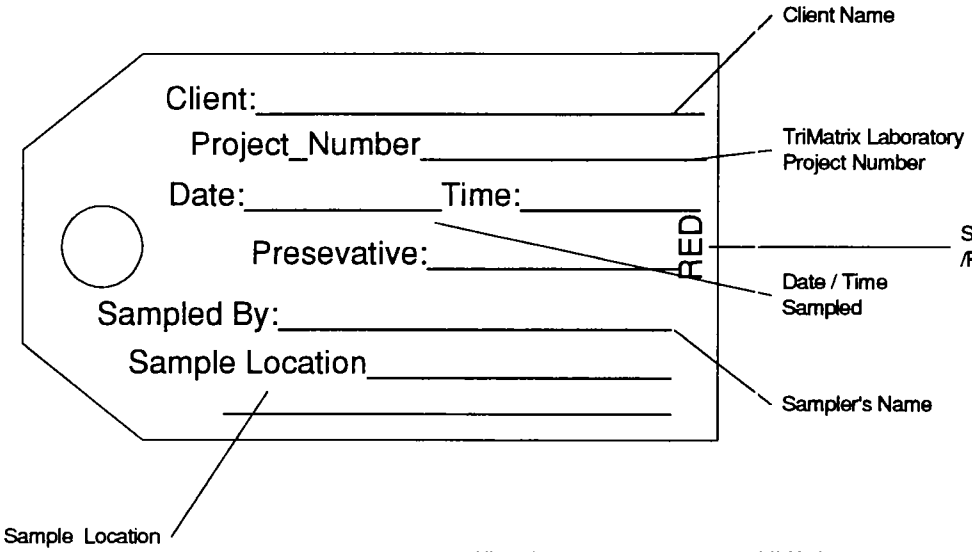
TriMatrix Laboratories, Inc.

Sample Bottle Tagging System

Tag Face



Tag Back



Tag Face with LIMS Generated Log-In I.D. Lable

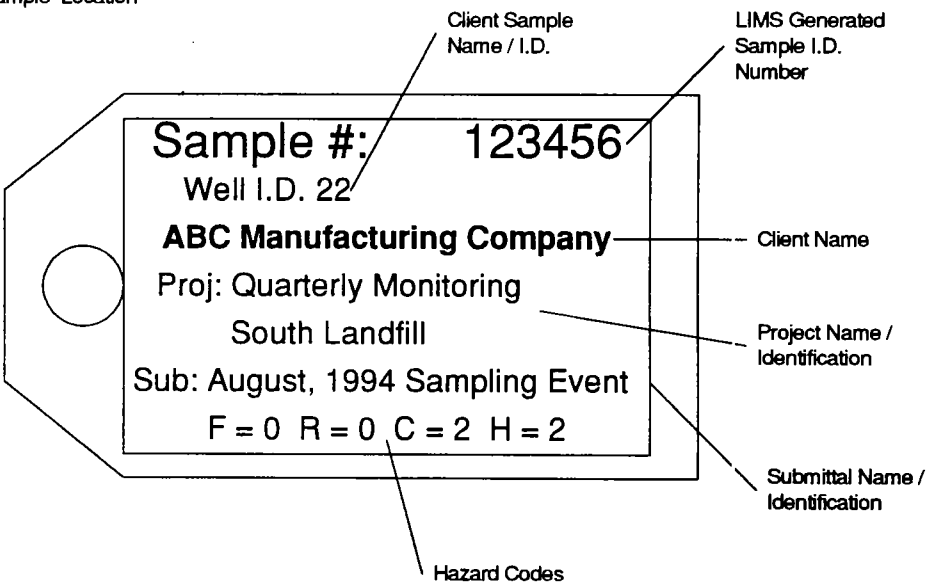


Figure 19

Parameter: NITROGEN, NITRATE (403.1) Method: NO3/AUTOAN/WTR (264.1) Ref. Cit.: USEPA-353.2 ODL: 0.05 Unit: mg/l

Client	Project / Submittal	QC	COC	Sample Description	First Sample	Sample Count	Anal hours	Hold-time exp. date	Lab date
USEPA Performance Evaluat	29063 Water Supply Analysis	LV2*		Ampul	105720	1	0.1	11-DEC 08:00	24-JAN
	8 WS Study-35								

Narratives	Entered	User	Text
Project:	24-OCT-90	DEK	****STUDY NOTES****
	24-OCT-90	DEK	(ORGANICS)
	24-OCT-90	DEK	SAMPLE #1 CONTAINS THE EIGHT REGULATED VOLATILE ORGANICS
	24-OCT-90	DEK	SAMPLE #2 CONTAINS NEW ADDITIONAL REGULATED VOLATILES.
	24-OCT-90	DEK	SAMPLE #3 CONTAINS UNKNOWN VOLATILE COMPOUNDS
	24-OCT-90	DEK	(METALS)
	24-OCT-90	DEK	THE CONCENTRATIONS IN SOME OF THE SAMPLES MAY BE BELOW OUR
	24-OCT-90	DEK	NORMAL FLAME/ICP LEVELS. FURNACE IS PREFERRED.
	24-OCT-90	DEK	.
	24-OCT-90	DEK	(GENERAL)
	24-OCT-90	DEK	ALL PROCEDURES USED IN PREPARING THE SAMPLES MUST BE ENTERED
	24-OCT-90	DEK	INTO THE QC PREP BOOK.
	24-OCT-90	DEK	IT IS VERY IMPORTANT THAT YOU READ "ALL" THE INFORMATION
	24-OCT-90	DEK	THAT IS SUPPLIED WITH THE AMPULS. THIS INFORMATION WILL IN
	24-OCT-90	DEK	MANY CAUSES PROVIDE YOU WITH THE ANALYTICAL RANGE OF THE
	24-OCT-90	DEK	CONCENTRATES.
	24-OCT-90	DEK	ALWAYS PREPARE AND ANALYZE A MPB = METHOD PREPARATION BLANK
	24-OCT-90	DEK	WITH EACH SET OF CONCENTRATES PREPARED.

Keebler Company	29922 Mixing Water	LV1		3,8	108211	2	0.2	12-JAN 12:00	16-JAN
	8 January 1995 Samples								

Narratives	Entered	User	Text
Project:	27-DEC-91	RWH	LOG-IN: Please adjust due dates for each submittal to
	27-DEC-91	RWH	reflect a 5 working day turnaround to the client.
	27-DEC-91	RWH	The project is set up for 21 days so that no
	27-DEC-91	RWH	surcharge is automatically applied.

Figure 20

4.1.2.4 Worklists/Benchsheets

Upon completion of the sample receiving/sample log-in process, a series of worklists and selected benchsheets, are automatically printed for the new samples and analyses.

In the case of labile or short hold time parameter types, worklists are generated automatically each evening. These worklists are utilized for scheduling of short hold time tests and the production of any corresponding laboratory benchsheets. Most short hold parameters, i.e., BOD, hexavalent chromium, nitrite and nitrite nitrogen. turbidity, etc. are analyzed by the second and third shift staff members. An example of this worklist is presented in Figure 20.

Benchsheets for most routine tests are provided each evening or on demand through the TriMatrix LIMS system. Examples of selected benchsheets are presented in Figures 21 through 25.

The worklists and benchsheets produced by the TriMatrix LIMS system, are designed to provide the analyst with a gamut of important information. This information not only includes client/project specifications, but also provides an avenue for communication of test specifications, parameter expiration dates and times, formula's statistical control limits for all QC types and a uniquely designed form for recording calculating and reporting of analytical and QC data.

This up-front information enables the analyst to make vital decisions in their analytical scheme, and helps to minimize problems after samples are analyzed.

An example of a completed laboratory benchsheets are presented in Figures 26-27.

All laboratory benchsheets are dated and initialed at each review step. All approved benchsheet packages are scanned onto an optical disk, re-assembled and filed as part of the archiving process.

Test #: 413. 1- 288.02
Parameter: BOD, (5-DAY)
Method: BOD/5-DAY/WW ODL: 1.0
Ref. Cit.: USEPA-405.1 Unit: mg/l

Batch: _____

Comments:

Instrument #: _____
Benchsheet ID: I25869
Owner: _____
Date Run: _____
Supervisor: _____
Est anal hrs: .5
Act anal hrs: _____
Samples in batch: 1
Stock std #: _____

BOD QUALITY CONTROL

	Blank	BI Nut	BI Seed	BI Seed C	Seed	Seed	Seed	Seed C	Seed C	Seed C	LCS	LCS	LCS
SAMPLE #													
BOTTLE #													
INITIAL													
RESIDUAL													
SEED CORRECTION													
%/ML OF SAMPLE													
BOD MG/L													

LCS CONC: _____mg/l

E.I. DuPont de Nemours 29082- 197 COC:

	I07931	I07931	I07931	I07931	I07931	I07931	I07931	I07931	I07931	I07931	I07931	I07931
SAMPLE #												
BOTTLE #												
INITIAL												
RESIDUAL												
DEPLETION												
SEED CORRECTION												
% OF SAMPLE												
BOD MG/L												

BOD CONC: _____ mg/l

EARTH TECH ENVIRONMENTAL LABORATORY-GR

Fig 21

10-JAN-95 Confirm: REG RC1 RC2 RMS

FRACTION BENCHSHEET
VOLATILE ORGANIC LAB

Test #: 1151. 1- 409.51
Parameter: VOL'S IN DWTR BY 502.2
Method: VOLS/P&T/GC/WTR
Ref. cit.: USEPA-502.2 Unit: ug/l

Client: USEPA Performance Evaluation
Project: 29063 Water Supply Analysis
USEPA WS Study
Submittal: 8 WS Study-35
Sample: 105729 Volatiles #3
Proj Chem: DEK
Hold date: 23-DEC-1994 QC: LV2 COC:
Lab due date: 24-JAN-1995
Client due date: 25-JAN-1995 C=1 F=0 H=1 R=0
Received date: 12-DEC-1994

Benchsheet ID: 125868
Analyst: _____
Date Run: _____
Instrument #: _____
Stock Std: _____
Rack#: _____
Reviewed by: _____
QC Batch Number: _____

Initial wt./vol.: _____
Final volume: _____
% Solids: _____
Dilution factor: _____
Batch Number: _____
Batch Owner: _____
Batch Opened Date: _____
Batch Seq: _____

	Parameter	P	ODL	Result	LCL	UCL
42	1,2-DICHLOROBENZENE			< 1.0		
43	1,2-DIBROMO3CHLOROPROPANE			< 1.0		
44	1,2,4-TRICHLOROBENZENE			< 1.0		
45	HEXACHLOROBUTADIENE			< 1.0		
46	1,2,3-TRICHLOROBENZENE			< 1.0		
48	BENZENE			< 1.0		
49	TOLUENE			< 1.0		
50	ETHYLBENZENE			< 1.0		
51	XYLENE, META			< 1.0		
52	XYLENE, PARA			< 1.0		
53	XYLENE, ORTHO			< 1.0		
55	STYRENE			< 1.0		
56	ISOPROPYLBENZENE			< 1.0		
57	N-PROPYLBENZENE			< 1.0		
58	BROMOBENZENE			< 1.0		
59	1,3,5-TRIMETHYLBENZENE			< 1.0		
60	TERT-BUTYLBENZENE			< 1.0		
61	1,2,4-TRIMETHYLBENZENE			< 1.0		
62	SEC-BUTYLBENZENE			< 1.0		
63	PARA-ISOPROPYLTOLUENE			< 1.0		
64	N-BUTYLBENZENE			< 1.0		
65	NAPHTHALENE			< 1.0		
1	CL-2-FLB-(HALL)-SUR			_____%	47.55	145.71
2	CL-2-FLB-(PID)-SUR			_____%	81.06	171.18
3	4-CLT (HALL)-SUR			_____%	65.83	130.99
4	3-BCB (HALL)-SUR			_____%	69.91	131.11
5	FLUOROBENZENE (PID)-SUR			_____%	43	145
6	AAA-TFT (PID)-SUR			_____%	71.04	123.6
7	PCE (PID)-SUR			_____%	69.31	133.81
8	4-CLT (PID)-SUR			_____%	90.2	135.5
9	3-BCB (PID)-SUR			_____%	91	143.8

* - Result < corresponding ODL

EARTH TECH ENVIRONMENTAL LABORATORY-GR

Figure 22

10-JAN-95 Confirm: REG RC1 RC2 RMS

FRACTION BENCHSHEET
VOLATILE ORGANIC LAB

Test #: 1151. 1- 409.51
Parameter: VOL'S IN DWTR BY 502.2
Method: VOLS/P&T/GC/WTR
Ref. cit.: USEPA-502.2 Unit: ug/l

Client: USEPA Performance Evaluation
Project: 29063 Water Supply Analysis
USEPA WS Study
Submittal: 8 WS Study-35
Sample: 105729 Volatiles #3
Proj Chem: DEK
Hold date: 23-DEC-1994 QC: LV2 COC:
Lab due date: 24-JAN-1995
Client due date: 25-JAN-1995 C=1 F=0 H=1 R=0
Received date: 12-DEC-1994

Benchsheet ID: 125868
Analyst: _____
Date Run: _____
Instrument #: _____
Stock Std: _____
Rack#: _____
Reviewed by: _____
QC Batch Number: _____

Initial wt./vol.: _____
Final volume: _____
% Solids: _____
Dilution factor: _____
Batch Number: _____
Batch Owner: _____
Batch Opened Date: _____
Batch Seq: _____

	Parameter	P	ODL	Result	LCL	UCL
1	DICHLORODIFLUOROMETHANE			< 1.0		
2	CHLOROMETHANE			< 1.0		
3	VINYL CHLORIDE			< 1.0		
4	BROMOMETHANE			< 1.0		
5	CHLOROETHANE			< 1.0		
8	TRICHLOROFLUOROMETHANE			< 1.0		
9	1,1-DICHLOROETHYLENE			< 1.0		
10	METHYLENE CHLORIDE			< 1.0		
11	TRANS-1,2-DICHLOROETHYLEN			< 1.0		
12	1,1-DICHLOROETHANE			< 1.0		
13	2,2-DICHLOROPROPANE			< 1.0		
14	CIS-1,2-DICHLOROETHYLENE			< 1.0		
15	BROMOCHLOROMETHANE			< 1.0		
16	CHLOROFORM			< 1.0		
17	1,1,1-TRICHLOROETHANE			< 1.0		
18	1,1-DICHLOROPROPYLENE			< 1.0		
19	CARBON TETRACHLORIDE			< 1.0		
20	1,2-DICHLOROETHANE			< 1.0		
21	TRICHLOROETHYLENE			< 1.0		
22	1,2-DICHLOROPROPANE			< 1.0		
23	BROMODICHLOROMETHANE			< 1.0		
24	DIBROMOMETHANE			< 1.0		
26	CIS-1,3-DICHLOROPROPYLENE			< 1.0		
27	TRANS-1,3-DICHLOROPROPENE			< 1.0		
28	1,1,2-TRICHLOROETHANE			< 1.0		
29	1,3-DICHLOROPROPANE			< 1.0		
30	TETRACHLOROETHYLENE			< 1.0		
31	DIBROMOCHLOROMETHANE			< 1.0		
32	1,2-DIBROMOETHANE			< 1.0		
33	CHLOROBENZENE			< 1.0		
34	1,1,1,2-TETRACHLOROETHANE			< 1.0		
35	BROMOFORM			< 1.0		
36	1,1,2,2-TETRACHLOROETHANE			< 1.0		
37	1,2,3-TRICHLOROPROPANE			< 1.0		
38	2-CHLOROTOLUENE			< 1.0		
39	4-CHLOROTOLUENE			< 1.0		
40	1,3-DICHLOROBENZENE			< 1.0		
41	1,4-DICHLOROBENZENE			< 1.0		

* - Result < corresponding ODL

EARTH TECH ENVIRONMENTAL LABORATORY-GR

Fig 23

10-JAN-95 INORGANIC BENCHSHEET -- SPECTROPHOTOMETRIC ** QC ** PAGE 1

Test#: 399. 1- 259.01
Parameter: FLUORIDE
Method: FL/ION-ELEC/WTR ODL: 0.10
Ref. Cit.: USEPA-340.2 Unit: mg/l

Instrument #:
Benchsheet ID: I25866
Owner:
Batch Opened Date:
Supervisor:
Est anal hrs: .25
Act anal hrs:
Samples in batch: 1

Comments:

	Anl.	Run Date	Regressed Value	Dilution factor	mg/l	% Sol	Wt/dil factor	Reported Conc.	ODL	Spike Qty	% rec/dif	QH
BLK:										XXXXXXXX XXXXXXXX		
LCS: Stk												
SPK1: Stk Smp												
SPK2: Stk Smp												
MSD: Smp		XXXXXXX XXXXXXX	XXXXXXXXXXX XXXXXXXXXXX	XXXXXXXX XXXXXXXX	XXXXXX XXXXXX	XXX XXX	XXXXXXXXXXX XXXXXXXXXXX	XXXXXXXXXXX XXXXXXXXXXX	XXXXXXXX XXXXXXXX	XXXXXXXX XXXXXXXX		
DUP: Smp										XXXXXXXX XXXXXXXX		
SPK1: Stk Smp												
SPK2: Stk Smp												
MSD: Smp		XXXXXXX XXXXXXX	XXXXXXXXXXX XXXXXXXXXXX	XXXXXXXX XXXXXXXX	XXXXXX XXXXXX	XXX XXX	XXXXXXXXXXX XXXXXXXXXXX	XXXXXXXXXXX XXXXXXXXXXX	XXXXXXXX XXXXXXXX	XXXXXXXX XXXXXXXX		
DUP: Smp										XXXXXXXX XXXXXXXX		
MPB: QCB#										XXXXXXXX XXXXXXXX		
LFB: Stk QCB#												
CRDL: Stk												

QC Type	Range	Active Lcl	Active Ucl
DUP	1		22.04
DUP	2		12.97
LCS	1	81.02	120.74
MPB	1		10
MSD	1		35
MSD	2		25
SPK	1	65.69	128.75

EARTH TECH ENVIRONMENTAL LABORATORY-GR

Figure 24

10-JAN-95 INORGANIC BENCHSHEET -- SPECTROPHOTOMETRIC PAGE 1

Test#: 399. 1- 259.01
Parameter: FLUORIDE
Method: FL/ION-ELEC/WTR ODL: 0.10
Ref. Cit.: USEPA-340.2 Unit: mg/l

Batch: _____

	STD VAL	OBS VAL	WKG STD NUMBER
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Instrument #: _____
Benchsheet ID: I25866
Owner: _____
Batch Opened Date: _____
Supervisor: _____
Est anal hrs: .25
Act anal hrs: _____
Samples in batch: 1
Stock std #: _____
Wavelength (nm): _____
Cell path (mm): _____

Comments:

Client..... Submittal Location	Sample	COC	QC	Anl.*	Run Date	Regressed Value	Dilution factor	mg/l	% Sol	Wt/dil factor	Reported Conc.	ODL	QW	Spike Qty	% rec/dif
ICV: Stk															
ICB:														XXXXXXXX XXXXXXXX	
USEPA Performance Evaluation 29063- 8 105720 LV2															
Nitrate Ni															
CCV: Stk		Rep													
CCB:		Rep												XXXXXXXX XXXXXXXX	

EARTH TECH ENVIRONMENTAL LABORATORY-GR

Fig 25

8-16-94 KLV 8:00am

71637 DM 8/16

due 8-29

12-AUG-94 INORGANIC BENCHSHEET -- SPECTROPHOTOMETRIC PAGE 1

Test#: 408. I- 280.01
Parameter: PHOSPHORUS, ORTHO
Method: OPHOS/COLOR/WTR ODL: 0.01
Ref. Cit.: USEPA-365.2 Unit: mg/l

	STD VAL	OBS VAL	WKG STD NUMBER
1.	0.01	0.010	167K.1.1.1.3.1
2.	0.025	0.027	167K.1.1.1.2.1
3.	0.25	0.300	167K.1.1.1.2
4.	0.5	0.609	167K.1.1.1.1
5.	1.0	1.211	167K.1.1.1.3
6.			
7.			
8.			

Instrument #:
Benchsheet ID: II2688
Owner: GEH
Date run: 8-12-94
Supervisor: BJD
Est anal hrs: .75
Act anal hrs:
Samples in batch: 3

Comments:

Stock std #: 167K.1.1
Wavelength (nm): 880
Cell path (mm): 20

Client Submittal Location	Sample	COC	QC	Regressed Value	Wt/dil Factor	Reported Conc.	ODL	Spike Qty.	% rec/dif
ICB:						<0.01		XXXXXXXX XXXXXXXX	0
ICV: Stk 167K.1.1.1.2.1						0.025		0.025	100
Paulstra-CRC 32466- MW-4	1	94789 *	LV1			<0.01			
Paulstra-CRC 32466- MW-6	1	94790 *	LV1			<0.01			
Paulstra-CRC 32466- MW-10	1	94791 *	LV1			<0.01			

ANALYSIS NARRATIVE
SAMPLE NO: 94789, 94790, 94791
Sample was filtered prior to ortho phosphorus analysis.

CCB:						<0.01		XXXXXXXX XXXXXXXX	0
CCV: Stk 167K.1.1.1.1						0.49		0.5	98

EARTH TECH ENVIRONMENTAL LABORATORY-GR

Figure 26

Test#: 40S. 1- 290.01
Parameter: PHOSPHORUS, ORTHO
Method: OPHOS/COLOR/WTR
Ref. Cit : USEPA-365.2

MDL: 0.01
Unit: mg/l

Instrument #:
Benchsheet ID: II2668
Owner: GEH
Date run: 8-12-94
Supervisor:
Est anal hrs: .75
Act anal hrs:
Samples in batch: 3

Comments

Stock std #:
Wavelength (nm):
Cell path (mm):

			Regressed Value	Wt/dil factor	Reported Conc.	MDL	Spike Qty	% rec/dif
MPR:					<0.01		XXXXXXXX XXXXXXXX	0
LCS:	Stk WW# 220 A				0.40		0.38	105
SPK:	Stk 167K.L.1	Smp 94791			0.53		0.5	106
MSD:	Stk	Smp						
DUP:		Smp 94791			<0.01		XXXXXXXX XXXXXXXX	0
SPK:	Stk	Smp						
MSD:	Stk	Smp						
DUP:		Smp					XXXXXXXX XXXXXXXX	
MPR							XXXXXXXX XXXXXXXX	
LFS:	Stk							

QC Typ.	Range	Active Lcl	Active Ucl
DUP	1		20.88
DUP	1		7.93
LCS	1	89.16	112.14
MPR	1		10
MPR	1		35
MSD	1		25
SPK	1	88.02	117.42

EARTH TECH ENVIRONMENTAL LABORATORY-GR

Figure 26

12-21-94 KLV 2:21 pm

due Jan 3

INORGANIC BENCHSHEET - [illegible]VIMETRIC]

16- Dec -94 - File Name : '121694rd.ww1'

Table 3 CD1222

Test Number : 9. 1 - 10. 02
Paramater : Residue, Disolved
Matrix : WW
Ref. Cit. : USEPA-160.1

Cycle 1 Temp : Start 180 °C End 180 °C
Cycle 2 Temp : Start 180 °C End 180 °C
Unit : mg/l
ODL : 1

Owner : GEH
Date Run : 12-16-94
Supervisor : BJD

Client	Sample	RepConc	Dish	WtDishRes1	WtDishRes2	WtDish	SampAmt	ODL
KENT CO.	106283	753	10	131.4461	131.4456	131.3708	100.0000	1
KENT CO.	106284	377	11	123.4886	123.4882	123.4509	100.0000	1
KENT CO.	106285	377	12	130.3341	130.3336	130.2964	100.0000	1
KENT CO.	106286	780	13	120.4236	120.4232	120.3456	100.0000	1
KENT CO.	106287	594	14	120.5840	120.5835	120.5543	50.0000	1

QC	Stk	Sample	RepConc	SpkQty	Dish	WtDishRes1	WtDishRes2	WtDish	SampAmt	ODL	%RecDif
BLK		0	< 1	0.0	999	117.9183	117.9183	117.9183	100.0000	1	0.00
LCS	WW#291	0	198	200.1	700	122.8662	122.8662	122.8464	100.0000	1	98.95
SPK		0		0.0	800	0.0000	0.0000	0.0000	0.0000	1	0.00
DUP		106287	582	0.0	15	119.7324	119.7323	119.7033	50.0000	1	2.04
SPK	264G.2	106287	1240	659.2	16	123.2377	123.2378	123.1759	50.0000	1	98.00
DUP		0		0.0	901	0.0000	0.0000	0.0000	0.0000	1	0.00
DUP		0		0.0	902	0.0000	0.0000	0.0000	0.0000	1	0.00
DUP		0		0.0	903	0.0000	0.0000	0.0000	0.0000	1	0.00
DUP		0		0.0	904	0.0000	0.0000	0.0000	0.0000	1	0.00

EARTH TECH ENVIRONMENTAL LABORATORY DIVISION - GRAND RAPIDS

Figure 27

4.1.2.5 Management Reports

Several reports are provided within the TriMatrix laboratory system to help monitor operational conditions of the laboratory. These reports are provided or compiled both electronically and for various activities including but not limited to: jobs due report, workload-loading reports, sales summaries, client/project/submittal informational reports, etc.

The flow of information from these various reports is geared to a variety of personnel within the management structure of the laboratory and to some persons outside the laboratory. Information is generally provided to employees outside the laboratory for corporate management decisions or in providing information to a particular client about their project.

Examples of a few management type reports are presented in Figures 28 to 32.

EARTH TECH ENVIR[illegible]NTAL LABORATORY-GR
OFFICE JOB[illegible] REPORT

Project Type: CCS

CLIENT DUE DATE	PROJ. CHEM.	SUBMITTAL		CLIENT	PROJECT	FIRST SAMPLE	NUM.
02-MAR-1995	GJH	30854-38	6	EARTH TECH Laboratories -Livon	Analysis Of Wastewater	111303	4
02-MAR-1995	GJH	32420-83	6	EARTH TECH Laboratories -Livon	Wastewater Analysis	111088	6
06-MAR-1995	GJH	30822-17	3	EARTH TECH Laboratories -Livon	TCLP Analysis	111560	1
06-MAR-1995	GJH	32630-4	3	EARTH TECH Laboratories -Livon	MONSANTO	111040	2
07-MAR-1995	GJH	30854-37	3	EARTH TECH Laboratories -Livon	Analysis Of Wastewater	111307	2
07-MAR-1995	GJH	30854-39	3	EARTH TECH Laboratories -Livon	Analysis Of Wastewater	111296	7
07-MAR-1995	GJH	31573-234	3	EARTH TECH Laboratories -Livon	Mercury Analysis	111561	3
08-MAR-1995	GJH	32403-38	3	EARTH TECH Laboratories -Livon	Water Analysis	111591	2
08-MAR-1995	GJH	32266-37	3	White Construction, Inc.	Eli Lilly and Company	111422	27
09-MAR-1995	GJH	32420-84	3	EARTH TECH Laboratories -Livon	Wastewater Analysis	111564	6

Figure 28

2 - Partially Received; 3 - Completely Received; 4 - Compiled; 5 - Approved 6 - Released

WORKLOAD REPORT FOR DISTINCT SAMPLES
FOR VO LAB

Class ID	Prev Weeks	Sunday 01-JAN-95	Monday 02-JAN-95	Tuesday 03-JAN-95	Wednesday 04-JAN-95	Thursday 05-JAN-95	Friday 06-JAN-95	Saturday 07-JAN-95	Weekly Total	Max Per Week	Percent
ASVO	31	0	3	4	12	4	2	0	25	100	25%
WCV 8240	1	0	0	0	0	0	0	0	0	100	0%
WCV 624	2	0	0	0	0	0	0	0	0	100	0%
WCV TCCP	7	0	0	0	0	0	0	0	0	40	0%
GC-AIRWORK	0	0	0	0	0	0	0	0	0	20	0%
GCVO	17	0	0	0	0	0	0	0	0	240	0%

Figure 29

LAB: L

UNCOMPL[illegible] ANALYSIS WITH A LAB DUE DATE > OR = 01-Mar-1994 AND [illegible] = 01-Mar-1995

[illegible]283	ADRIAN MDNR 3.	USEPA-8121	WTR	2	!				
109284	ADRIAN MDNR 3.	USEPA-8121	WTR	2	!				

[redacted] TURNAROUND DAYS: 21 PROJECT CHEMIST: NBK QC TYPE: LV1 COC: E
32640-3 FORECAST AMT: $427.50 LAB DUE DATE: 20-FEB-1995 (MON)
General Electric-Holland February 9,1995 Submittal

110528	VOLS BY 8021/SCAN 1+2 LST	USEPA-8021	TCLP	2	!				
110529	VOLS BY 8021/SCAN 1+2 LST	USEPA-8021	TCLP	2	!				

[redacted] TURNAROUND DAYS: 21 PROJECT CHEMIST: GKR QC TYPE: LV1 COC: E
29011-230 FORECAST AMT: $65.00 LAB DUE DATE: 27-FEB-1995 (MON)
Outfall Monitoring Northkent Landfill February 1995 Week #2

110440	OXYGEN, % SATURATION	USEPA-360.2	WW	0	!	OXYGEN, DISSOLVED (FIELD)	USEPA-360.2	WW	0
	PH (FIELD)	USEPA-150.1	WW	0	!	TEMPERATURE, CELSIUS	USEPA-170.1	WW	0
110441	OXYGEN, % SATURATION	USEPA-360.2	WW	0	!	OXYGEN, DISSOLVED (FIELD)	USEPA-360.2	WW	0
	PH (FIELD)	USEPA-150.1	WW	0	!	TEMPERATURE, CELSIUS	USEPA-170.1	WW	0

[redacted] Paul, Minnesota TURNAROUND DAYS: 21 PROJECT CHEMIST: RWH QC TYPE: LV2 COC: E
31665-22 FORECAST AMT: $2,120.00 LAB DUE DATE: 28-FEB-1995 (TUE)
Cordova Priority Pollutan 3M Request # N1262

110391	3M CORDOVA PEST/PP	USEPA-608	WW	2	!				

[redacted] TURNAROUND DAYS: 14 PROJECT CHEMIST: GKR QC TYPE: LV1 COC: E
31667-4 FORECAST AMT: $668.00 LAB DUE DATE: 28-FEB-1995 (TUE)
Sludge Analysis 15-February-1995 Sampling

110863	PCB'S USEPA-8080 SCAN	USEPA-8080	SLG	2	!				

[redacted] TURNAROUND DAYS: 14 PROJECT CHEMIST: GLW QC TYPE: LV3 COC: E
32349-3 FORECAST AMT: $425.00 LAB DUE DATE: 28-FEB-1995 (TUE)
Raw Materials Analysis Perrigo 04366

110874	METHANOL	USEPA-8015	WASTE	0	!				
110876	ETHANOL	USEPA-8015	WASTE	0	!	ISOPROPANOL	USEPA-8015	WASTE	0

[redacted] TURNAROUND DAYS: 14 PROJECT CHEMIST: CJS QC TYPE: LV1 COC: E
32663-1 FORECAST AMT: $888.00 LAB DUE DATE: 28-FEB-1995 (TUE)
Wastewater for Volatiles and Lead February 16,1995 sampling

110997	TROY ALCOHOLS	USEPA-8015	WW	0	!				

Figure 30

EARTH TECH
LABORATORY PERFORMANCE REPORT
19-FEB-95 - 25-FEB-95

SUBMITTAL NOT MEETING CLIENT DUE DATE

CLIENT	SUBMITTAL	COMPILED DATE	APPROVED DATE	RELEASED DATE	MAILED DATE	CLIENT DUE DATE	LAB DUE DATE	TURN AROUND	PROJ CHEM
[redacted]	29015-242	02/14/95	02/20/95	02/20/95		02/24/95	02/21/95	21	RWH
Last Approved Date	Lab Id								
[redacted]	29491-168	02/13/95	02/20/95	02/20/95		02/24/95	02/21/95	21	RWH
Last Approved Date	Lab Id								
[redacted]	32641-1	02/23/95				02/24/95	02/21/95	21	GLW
Last Approved Date	Lab Id								
[redacted] - TN	30436-488	02/23/95	02/24/95	02/24/95		02/24/95	02/22/95	9	GLW
Last Approved Date	Lab Id								
[redacted]	32275-10	02/22/95				02/24/95	02/22/95	21	GLW
Last Approved Date	Lab Id								
[redacted]	29928-164	02/23/95				02/24/95	02/23/95	21	RVB
Last Approved Date	Lab Id								

Figure 31

FOR SAMPLES WITH A SAMPLE LOG DATE FROM 26-Feb-1994 TO 26-Feb-1996

CLIENT

SUBMITTAL	P CHEM	SALES AMT	SALES + ADD	PROJECT NUM	DUE DATE	SAMPLE #	SAM	S	TYPE
16-December-1994 soils	GKR	10,860.00	10,860.00	32454- 3	09-JAN-95	106695	15	5	CCS
Jan 12 Arrival MR	RVB	128.00	128.00	32583- 37	18-JAN-95	108488	4	6	CCS
Jan 16 Arrival GM	RVB	32.00	32.00	32583- 38	20-JAN-95	108593	1	6	CCS
Jan 16 Arrival NN	RVB	12.00	12.00	32583- 39	20-JAN-95	108594	1	6	CCS
Jan 18 Arrival PL	RVB	480.00	480.00	32583- 42	24-JAN-95	108892	40	6	CCS
Jan 19 Arrival MR	RVB	444.00	444.00	32583- 43	25-JAN-95	108971	17	6	CCS
Jan 24 Arrival MR	RVB	152.00	152.00	32583- 44	30-JAN-95	109233	6	6	CCS
Jan 24 Arrival NN	RVB	80.00	80.00	32583- 45	30-JAN-95	109240	5	6	CCS
Jan 30 Arrival MR	RVB	340.00	340.00	32583- 46	03-FEB-95	109617	25	6	CCS
January 20,1995 Submittal	GLW	17,800.00	17,800.00	31447- 4	07-FEB-95	109061	40	6	CCS
Feb 2 Arrival MR	RVB	36.00	36.00	32583- 47	08-FEB-95	109835	3	6	CCS
Feb 2 Arrival NN	RVB	96.00	96.00	32583- 48	08-FEB-95	109838	8	6	CCS
Jan 1995 Samples	RVB	29,775.00	29,775.00	29699- 23	10-FEB-95	109351	50	3	CCS
Feb 7 Arrival MR	RVB	648.00	648.00	32583- 49	13-FEB-95	110194	29	6	CCS
Feb 7 Arrival NN	RVB	288.00	288.00	32583- 50	13-FEB-95	110221	19	6	CCS
January 27, 1995 Submitta	GKR	12,396.00	12,396.00	32454- 9	15-FEB-95	109552	18	6	CCS
Jan. 27, 1995 - Soils	GKR	6,094.00	6,094.00	32454- 10	15-FEB-95	109545	7	6	CCS
TN 15216	GLW	300.00	300.00	31834- 24	19-FEB-95	110769	6	4	CCS
February 9,1995 Submittal	NBK	710.12	710.12	32640- 3	20-FEB-95	110528	2	3	CCS
Feb 14 Arrival NN	RVB	60.00	60.00	32583- 51	20-FEB-95	110571	5	6	CCS
Feb 14 Arrival MR	RVB	560.00	560.00	32583- 52	20-FEB-95	110576	35	6	CCS
February, 1995 Samples	GLW	4,211.00	4,211.00	32641- 1	21-FEB-95	110036	28	4	CCS
TN 15198,199,203	GLW	372.00	372.00	30436- 488	22-FEB-95	110827	11	6	CCS
February 6,1995 Submittal	NBK	5,814.00	5,814.00	32509- 13	22-FEB-95	110129	32	4	CCS
February 4, 1995 Samples	RVB	898.00	898.00	29928- 164	23-FEB-95	110191	2	4	CCS
TN 15268	GLW	52.50	52.50	30436- 492	24-FEB-95	111119	1	3	CCS
February 8,1995 Submittal	NBK	1,800.00	1,800.00	32509- 14	24-FEB-95	110298	10	4	CCS
03-February-1995 Sampling	GKR	1,408.00	1,408.00	32454- 11	24-FEB-95	110320	3	3	CCS
Specila Coliform Test	GJH	75.00	160.00	32666- 1	26-FEB-95	111100	5	3	CCS
02-February-1995 Sampling	GLW	216.00	216.00	30272- 128	27-FEB-95	110123	2	3	CCS
TN 15218, 15217	GLW	654.00	654.00	30436- 487	27-FEB-95	110815	19	6	CCS
TN 15221,234,241,242,243	GLW	405.50	405.50	30436- 490	27-FEB-95	110993	7	3	CCS
TN 15223,244,222,240	GLW	346.50	346.50	30436- 491	27-FEB-95	111072	9	3	CCS
19-January-1995 Sampling	GKR	60.00	60.00	29642- 17	27-FEB-95	111097	3	3	CCS
February 1995 Purge Wells	RVB	845.00	845.00	29158- 138	27-FEB-95	110431	9	3	CCS
February 9, 1995 Samples	GLW	736.00	736.00	31249- 140	27-FEB-95	110687	46	3	CCS
Feb 14 Samples	RVB	4,550.00	4,550.00	29140- 11	27-FEB-95	110654	7	3	CCS
TN 15255,260,257,256	GLW	598.50	598.50	30436- 493	28-FEB-95	111120	19	3	CCS
February 10,1995 Submittal	NBK	360.00	360.00	32509- 15	28-FEB-95	110520	2	4	CCS
15-February-1995 Sampling	GKR	668.00	668.00	31667- 4	28-FEB-95	110863	1	3	CCS
15-February-1995 sampling	GKR	172.00	172.00	31777- 71	28-FEB-95	110860	2	4	CCS
13-February-1995 Sampling	GKR	28.80	28.80	29280- 28	28-FEB-95	110858	1	3	CCS
15-February-1995 Sampling	GKR	694.00	694.00	32471- 2	28-FEB-95	110856	2	3	CCS
February 22, 1995 Sample	RVB	85.00	85.00	29841- 194	28-FEB-95	111353	1	3	CCS
Feb 9 Samples	RVB	898.00	898.00	29928- 165	28-FEB-95	110471	2	3	CCS
February 9, 1995 Samples	GLW	270.00	270.00	30505- 10	28-FEB-95	110869	2	6	CCS
TN 15269	GLW	190.50	190.50	30436- 494	01-MAR-95	111140	3	3	CCS
EARTH TECH Livonia:114907	GJH	465.00	465.00	30704- 145	01-MAR-95	111094	3	4	CCS

Figure 32

4.1.2.6 Quality Assurance Reports

Quality assurance reports play a vital role in the management of the quality system. Quality systems must be closely scrutinized in order to monitor, maintain, adjust and add procedures or systems to meet existing and new QA objectives of the laboratory.

Several quality assurance reports are created in this monitoring maintenance effort. These reports serve different functions and are designed to inform the ultimate user. In the case of a client/invoice report, the quality assurance data is presented to facilitate the objectives of the project requirements from data assessment through full 3rd party data validation.

Internal quality assurance reports are created through both the TriMatrix LIMS system and external means. Some of the QA reports available through our LIMS includes:

Result Lists/Shewart Charts
Biased Statistics
Control Limit Comparison Report
Statistic Summary Report
Analytical Batch Detail Report
QC Batch Detail Report
Deviant Statistics
Locked Statistics
Analyst Certification
LIMS Qualifiers

Discussions and examples of these and other quality assurance reports are presented in section 4.1.2.9-F and section 4.9.

4.1.2.7 Client Invoice/Quality Control Reporting

Client/Invoice Reports are produced both automatically upon the completion of a submittal or sample delivery group. The initial report produced or "preliminary report" is an exact line printer replicate of the final report.

Preliminary reports are sorted, placed into the original submittal or project folder that was created at log-in and forwarded to the appropriate project chemist.

The project chemist reviews the preliminary report to validate that the data generated has fulfilled specifications originally created or requested for this project. The project chemist also validates the existence of the correct qualifications for when specifications have not been fulfilled.

Upon review, the project chemist approves the preliminary report, thus making it available for the final report generation process. The printing of the final report is performed by the laboratory data coordinator. All final reports are forwarded to the project chemist for final signature and release. Each signed report is forwarded to the laboratory secretary for mailing to the client and the laboratory project files. Dates are recorded as each submittal or report is mailed. Quality assurance data for a submittal or delivery package is presented as part of the both the preliminary and final reports. The extent of the quality assurance data presented as well as a description of part of each reporting level of the final report is present in subsections A-E.

A) Level 1 - General Reporting Format

The ***Level 1*** reporting format is the general reporting format and is typically utilized for most laboratory projects. The ***Level 1*** package will consist of the following :

Report Description	***No. of Copies Mailed***
Cover Letter w/Project Chemist sign-off	1
Results of Analysis	2
Statement of Data Qualifications	2
Invoice	1

Report/Invoice Options:

Results of Analysis	***Invoice***
a) General Format (Landscape or Portrait)	a) Internal Client
b) CAS Report	b) External Client
c) Detection Limit (fractions only)	c) Itemized[1]
	d) Lump Sum Invoice[2]

Notes:

1. The itemized invoice will list all samples and analyses on an individual basis.
2. The Lump Sum Invoice will print only single line items on the invoice with the corresponding amount. (example: "Program A Testing" $150.00).

B) Level 2 - Batch QC Reporting Format

The ***Level 2*** reporting format will consist of items from the ***Level 1*** reporting package, with the exception of batch method QC. This format will include the following:

Report Description	*No. of Copies Mailed*
Cover Letter w/Project Chemist sign-off	1
Results of Analysis	2
Methods Page	2
Batch QA/QC Results MPBs, LFBs, BLKs, LCSs & SURs	2
Statement of Data Qualifications	2
Field Chain-of Custody Form (COC)	1
Invoice	1

Report/Invoice Options:

Results of Analysis	*Invoice*
a) General Format (Landscape or Portrait)	a) Internal Client
b) CAS Report	b) External Client
c) Detection Limit (fractions only)	c) Itemized
	d) Lump Sum Invoice

C) Level 3 - Data Assessment Reporting Format

The ***Level 3*** reporting format will consist of all items from the ***Level 2*** package with the addition client specific matrix QC and the Analysis/Pretreatment Date Summary report. This format will include the following:

Report Description	***No. of Copies Mailed***
Cover Letter w/Project Chemist sign-off	1
Results of Analysis	2
Methods Page	2
Batch QA/QC Results (MPBs, LFBs, BLKs, LCSs & SURs	2
Client Specific Matrix QC (SPKs, MSDs and/or DUPs)	2
Pretreatment/Date Summary Page*	2
Statement of Data Qualifications	2
Field Chain-of Custody Form (COC)	1
Invoice	1

*The "Analysis/Pretreatment Date Summary Page" will present each sample and all tests with the dates of digestion, extraction and analysis and their corresponding expiration dates. This report will allow the data reviewer to quickly check for analysis hold time failures.

Report/Invoice Options:

Results of Analysis	***Invoice***
a) General Format (Landscape or Portrait)	a) Internal Client
b) CAS Report	b) External Client
c) Detection Limit (fractions only)	c) Itemized
	d) Lump Sum Invoice

D) Level 4 - Data Validation Reporting Format

The ***Level 4*** reporting format will consist of all items presented in the ***Level 3*** reporting package with the addition of providing raw data for all analyses. This format has been broken down into lab areas and will include the following:

General Reporting:

Report Description	***No. of Copies Mailed***
Cover Letter w/Project Chemist sign-off	1
Results of Analysis	2
Methods Page	2
Batch QA/QC Results (MPBs, LFBs, BLKs, LCSs, SURs)	2
Client Specific Matrix QC (SPKs, MSDs and/or DUPs)	2
Pretreatment/Date Summary Page	2
Statement of Data Qualifications	2
Internal Chain-of-Custody Forms (if requested)	1
Field Chain-of Custody Form (COC)	1
pH integrity Log forms from Log-in	1
Invoice	1
Batch Detail Reports for all batches	1

Report/Invoice Options:

Results of Analysis	***Invoice***
a) General Format (Landscape or Portrait)	a) Internal Client
b) CAS Report	b) External Client
c) Detection Limit (fractions only)	c) Itemized
	d) Lump Sum Invoice

Level 4 - Data Validation Reporting Format

Area Specific Reporting (raw data packages)

Client will be allowed to pick and choose from any of the items below.

GC/MS Reportables

*Tuning data for BFB and/or DFTPP

*Sample chromatograms and quantitation reports including all QC samples

*Sample chromatograms and quantitation reports for Initial and Continuing Calibrations

*Mass spectra, including reference spectra for all positive results

*Initial calibration response factor summaries with %RSD

*Continuing calibration response factor summaries with %RSD

*Library Search/Semi-Quantitation of TICs (if requested)

*Internal Standard Area and Retention Time Summary Report

GC Reportables

*Sample chromatograms and quantitation reports including all QC samples

*Record of standard curves

*Initial calibration response factor summaries with %RSD

*Continuing calibration response factor summaries with %RD

Retention Time Window Summary Table

*Second column confirmation and quantitation (if applicable)

*GC/MS confirmation (if applicable)

Metals Reportables

*Instrument printouts for all samples, standards and QC samples.

*preparation logs/forms for samples, QC samples and blanks

*Initial and continuing calibration verifications

*ICP inter element correction factors

*ICP linear range table

*ICP Serial Dilution's

Level 4 - Data Validation Reporting Format

Area Specific Reporting (raw data packages)

Inorganic/Nonmetals Reportables

*Instrument printouts for all samples, standards and QC samples.(if applicable)

*preparation logs/forms for samples, QC samples and blanks

*Initial and continuing calibration verifications

*Copies of all bench sheets used for reporting

Extraction Laboratory Reportables

*Extraction Summary forms for samples, QC samples and blanks

E) ***Level 5 - Contract Laboratory Program (CLP) Reporting Format***

The ***Level 5*** reporting package will consist of a CLP type report, presented as specified in the following USEPA Contract Laboratory Program statement of work outlines (SOW's):

Volatile Organics	(Aqueous/Solids) - CLP SOW 2/88
Semi-Volatile Organics	(Aqueous/Solids) - CLP SOW 2/88
Pesticides/PCB's	(Aqueous/Solids) - CLP SOW 2/88
Metals(except Mercury)	(Aqueous/Solids) - CLP SOW 10/91
Mercury	(Aqueous/Solids) - CLP SOW 2/88

General Reporting:

Report Description	***No. of Copies Mailed***
Cover Letter w/Project Chemist sign-off	1
Case Narrative	2
Methods Page	2
Pretreatment/Date Summary Page	2
Statement of Data Qualifications	2
Internal Chain-of-Custody Forms	1
Field Chain-of Custody Form (COC)	1
pH integrity Log forms from Log-in	1
Cooler temperature forms from Log-in	1
Invoice	1

Report/Invoice Options:

Results of Analysis	***Invoice***
a) CLP Format (Portrait)	a) Internal Client
	b) External Client
	c) Itemized
	d) Lump Sum Invoice

Level 5 - CLP Reporting Format

Area Specific Reporting (data packages)

GC/MS Reportables

*Form 1 - Sample Results

*Form 2 - Surrogate Results Report (SUR)

*Form 3 - Quality Control Data Report (SPK, MSD and LCS/LFB)

*Form 4 - Blank Summary Report (MPB and/or BLK)

*Form 5 - Tuning data for BFB and/or DFTPP

*Form 6 - Initial Calibration Report

*Form 7 - Continuing Calibration Report

*Form 8 - Internal Standard Area and Retention Time Summary Report (INS)

*Sample chromatograms and quantitation reports for all data

*Mass spectra, including reference spectra for all positive results

*Library Search/Semi-Quantitation of TICs (as requested)

GC Reportables

*Form 1 - Sample Results

*Form 2 - Surrogate Results Report (SUR)

*Form 3 - Quality Control Data Report (SPK, MSD and LCS/LFB)

*Form 4 - Blank Summary Report (MPB and/or BLK)

*Form 6 - Initial Calibration Report

*Form 7 - Calibration Verification Report

*Form 8 - Pesticide Analytical Sequence Report

*Form 9 - Pesticide Florisil Check

*Form 10 - Pesticide Identification Summary Report

*Sample chromatograms and quantitation reports including all QC samples

*Retention Time Window Summary Table

*Second column confirmation and quantitation (if applicable)

*GC/MS confirmation (if applicable)

Level 5 - CLP Reporting Format

Area Specific Reporting (data packages)

Metals Reportables

*Form 1 - Sample Data

*Form 2A - Initial and Continuing Calibration Data Report (ICV and CCV)

*Form 2B - CRDL Standards Report (CRL)

*Form 3 - Blanks Report (ICB, CCB, BLK and/or MPB)

*Form 4 - ICP Interference Check Sample Report (IEC)

*Form 5A - Matrix Spike Recovery Report (SPK)

*Form 5B - Post Digestion Spike Report (PDS)

*Form 6 - Matrix Spike Duplicate Report (MSD)

*Form 7 - Laboratory Control Sample Report (LCS and/or LFB)

*Form 8 - Standard Additions Report (If required)

*Form 9 - ICP Serial Dilution's Report (If required)

*Form 10 - Instrument Detection Limits Report

*Form 11 - ICP Inter-Element Correction Factors Report

*Form 12 - ICP Linear Range Table

*Form 13 - preparation logs/forms for samples, QC samples and blanks

*Form 14 - Analysis Run Log (If Required)

*Instrument Raw Data printouts for all samples, standards and QC samples.

Inorganic/Nonmetals Reportables

*Instrument printouts for all samples, standards and QC samples.(if applicable)

*preparation logs/forms for samples, QC samples and blanks

*Initial and continuing calibration verifications

*Copies of all bench sheets used for reporting

Extraction Laboratory Reportables

*Extraction Summary forms for samples, QC samples and blanks

TABLE 2
Quality Assurance/Quality Control Type Designations
LIMS Abbreviations:

Method QC:

MPB Method Preparation Blank
BLK Daily Blank, Analytical/Instrument
LFB Laboratory Fortified Blank
LCS Laboratory Control Sample
IEC ICP Interference Check Sample
CRL Contract Required Detection Limit Standard
ICB Initial Calibration Blank
ICV Initial Calibration Verification
CCB Continuing Calibration Blank
CCV Continuing Calibration Verification

Matrix QC:
SPK Sample Matrix Spike
MSD Sample Matrix Spike Duplicate
DUP Sample Matrix Duplicate
PDS Post Digestion Spike

Miscellaneous
SUR Surrogate Spike
TIC Tentatively Identified Compound
BFB 4-Bromofluorobenzene
DFTPP Decafluorotriphenylphosphine
INS Internal Standard

If a laboratory project is designated as a level 4 or higher, additional materials such as instrument raw data is also assembled as part of the final report. A flow chart illustrating the report generation process is presented in Figure 33.

TriMatrix Laboratories, Inc.

Report Generation Process

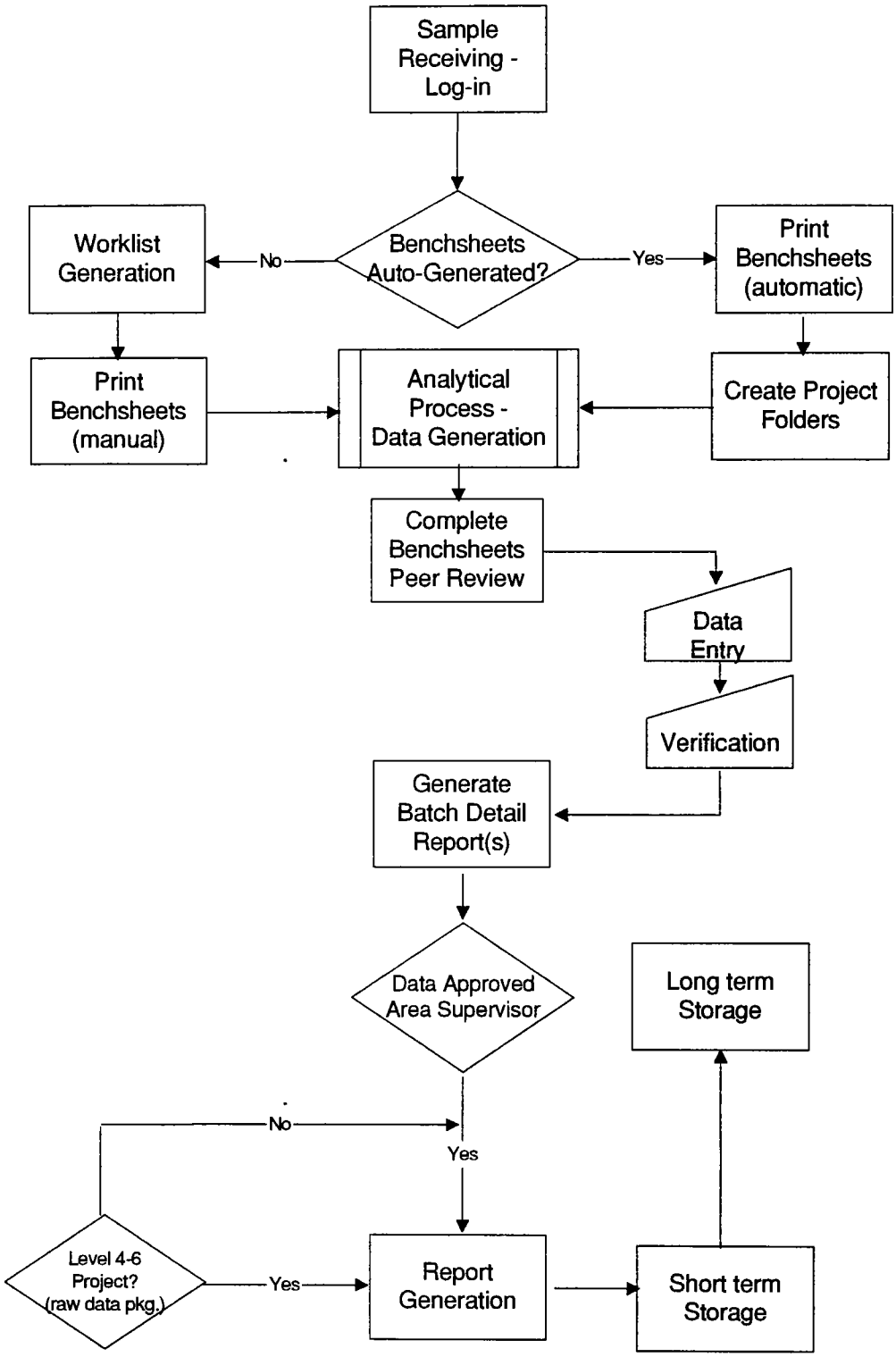


Figure 33

4.1.2.8 Project Files

The project file is the comprehensive record of every project completed at the TriMatrix laboratories. Each project file consists of a file folder set-up by the laboratory secretary, at the time of log-in. All project files are stored in a secure/strict limited-access area of the laboratory. The laboratory secretary is responsible for including the following in the project file:

- Initial project report/analysis plan/proposal
- All correspondence or documents mailed or received with the samples.
- All sample receiving/log-in forms.
- Chain-of-custody forms.
- Laboratory worksheets.
- Preliminary reports.
- Copy of the invoice.
- Final laboratory report including all reported quality control data.

All project files are stored on-site for 1 year and then off-site at a secured limited access storage facility for an additional 6 years.

4.1.2.9 Quality Control Documents

A) Analyst Notebooks

The lab notebooks are the daily records of all activities of an analyst, or group of analysts, working in the lab. The notebooks are bound and paginated. The notebook is cleanly labeled on the inside cover with the date issued, the analyst's name, and the date completed. There are several specific rules which are followed:

- All entries are in ink
- There are no erasures, obliteration's, or white outs allowed
- Corrections are single lined and initialed
- A new page is started each day or with every batch of samples
- Empty space is covered with a Z and signed and dated across the obtuse line
- Any and all work, observations, and errors are noted
- Problem areas identified
- Each page is signed and dated by the analyst performing the work.

When the instrument has just been repaired, a lamp changed, new column installed, detector repaired, or changed in any other manner, the log will also contain:

- A comment relative to the change or repair
- Reference page number to the Instrument Maintenance Log

The organic log books also contains the following information relative to GC and GCMS oven and column conditions UNLESS they are exactly as specified in the referenced method (which then will be commented on as such):

- column used (packing, diameter, length, type) o capillary as split or splitless
- current type and flow
- make-up flow if appropriate
- oven temperature and program if appropriate
- injector temperature
- detector temperature
- ion chamber voltage

B) Instrument Logbooks

Two different instrument logbooks are maintained on each laboratory instrument-an instrument run-log and an instrument maintenance log. Each log plays an important role in the documentation of daily instrument activities.

The instrument run-log is a bound and paginated log which is used to document all analytical determinations of a designated instrument. These determinations include not only sample analyses, but recordings of all calibration and calibration runs, quality control analyses and where applicable any instrument tuning activities.

The instrument run log also provides a chronology of each days analyses. This chronology plays an important role in the data validation process. All run logs are identified by instrument manufacturer name and model number, instrument serial number, and the starting and ending dates encompassed. All completed run logs are issued document control numbers, inventoried and properly archived.

The instrument maintenance log is a bound and paginated log which is used to track potential maintenance problems. The maintenance log is used to document whenever an instrument maintenance procedure, repair or modification activity is performed. All activities are documented by recording what was done, by whom and why. Other activities that are recorded in this log include routine daily functions such as septum changes on a GC injector or the cleaning of optical windows on an atomic absorption unit.

All completed maintenance logs are identified by instrument manufacturer name and model number, instrument serial number and the starting and ending dates encompassed. All maintenance logs are issued document control numbers, inventoried and properly archived.

C) Control Temperature Units

Each oven, incubator and all cold storage devices have their temperatures monitored and recorded on a daily basis. Within each controlled temperature unit is a thermometer which has been checked on a periodic basis against a NIST traceable thermometer. The schedule for these certifications is annually for mercury-in-glass and quarterly for all dial type thermometers.

All temperature readings and thermometer calibrations are recorded in a controlled temperature logbook. This log contains a page for each unit with detailed information on unit identification, serial number, laboratory location and designated operating temperature. Accompanying each unique log unit record page is a step by step corrective action procedure to be referenced when a temperature unit has fallen outside its predetermined operating range. An example of a controlled temperature log form and its corresponding corrective action procedure is presented in figures 34 and 35.

TriMatrix Laboratories, Inc.

Controlled Temperature Unit #5 (CTU5)
Daily Log Sheet

Unit Serial #	25AT-7	**Unit Description:**	BOD Refrigerator/Incubator
Thermometer #	Not Available	**Model Number**	Model 182
Correction Factor	< 0.1 C	**Location**	Organic Glassware Preparation Room
Control Windows	Low: 19 C High: 21 C	**Purpose**	BOD Incubation

Date	Initials	Time of First Reading	First Reading (C)	Time of Second Reading	Second Reading (C)	Adjustments/Observations/Comments

Figure 34

STANDARD OPERATING PROCEDURE
CORRECTIVE ACTION
"CONTROLLED TEMPERATURE UNITS"

Device: Randell Model 1020 Refrigerator

Operating Range: 1-5°C

*If temperature reading is outside the operating range, perform the following trouble shooting items.

1. If there is no obvious mechanical breakdown, take another temperature reading and record.

2. If the temperature is too low, adjust the controls up slightly and monitor frequently to prevent the contents from freezing.

3. Check the physical integrity and for continuous electrical power.

4. If the anomaly is a result of mechanical problems, move all samples to another refrigerator and notify affected lab areas.

5. If a minor adjustment will return the temperature to specification, adjust the temperature control and monitor the unit hourly to ensure the minor modification does not result in freezing the unit's contents.

6. Notate all actions in the logbook and unit problem report, notify area supervisor and the quality assurance area. If necessary the QA Supervisor will contact service representative the next business day:

Figure 35

D) Balance Monitoring

Each analytical and top loading balance used at the TriMatrix laboratory is monitored for accuracy. All daily checks are recorded in an TriMatrix balance log. Refer to section 4.3.3 below.

E) Standard Record Books

All standards and calibration solutions used at the TriMatrix laboratory are prepared when possible, from reagents or solutions traceable to national standards. Each standard solution, whether a stock, an intermediate or a working concentration is traceable to its origin source by means of standard logbooks.

Each standard logbook contains the following information:

- The analyte or analytes contained in the standard
- The concentration
- The solvent used to prepare the standard
- The preservative (i.e., nitric acid)
- The date of preparation
- Initials of the preparer
- The standard expiration date
- The standard reference number

The last item, the reference number, is a unique identifier which is an extension of the stock reagent identification number and any subsequent dilutions.

F) Pipet Logs

All autopipetors utilized within the TriMatrix laboratories for the delivery of standard solutions, dilutents, and reagents are periodically checked for delivery accuracy. Because these pipetors contain mechanical parts, they are subject to inaccuracies if not properly maintained and calibrated.

The TriMatrix laboratories perform monthly calibration checks on all autopipetors. All calibration activities are documented in an TriMatrix pipet logbook. Each log is identified by manufacturer name and model number, the pipetor serial number (if available), and the starting and ending dates encompassed. All complete pipet logbooks are assigned document control numbers, inventoried and properly archived.

G) QC Reports, Lists and Charts (Internal)

Quality control reports are used also within the TriMatrix laboratories to monitor the analytical process and to provide a means by which this analytical process can be viewed over time. These reports range from internal audit reports to management to standard control or SQC charts. It is the responsibility of the quality assurance staff to compile, monitor, and maintain the necessary quality control reports, which will allow both management and the laboratory staff the means to monitor the control of all analytical data.

Examples of efforts available for this monitoring process are presented in Figures 36 through 39.

TRIMATRIX LABORATORIES, INC. - GRR
Quality Assurance (Shewhart) Chart

Sample Duplicates (Percent Differences)
from 01-FEB-1995 to 25-JAN-1996

INORGANIC LABORATORY

Parameter: NITROGEN, NITRATE
Method: Colorimetric, Auto-Cadmium Reduction
Application: WATER
Reference: USEPA-353.2
ODL: 0.05
Unit: mg/l
Range: 1

Run Date	Oper	Sample	ZERO 0.0%	MEAN 1.3%	UWL 9.0%	UCL 13.0%
24-JAN-96	LEW	136506	**********			
24-JAN-96	LEW	136463	**********			
24-JAN-96	LEW	136441	**********			
16-JAN-96	LEW	135829	**********			
02-JAN-96	LEW	135062	**********			
27-DEC-95	LEW	135187	**********			
21-DEC-95	LEW	135013	**********			
21-DEC-95	LEW	135007	**********			
20-DEC-95	LEW	134835	**********			
15-DEC-95	LEW	134540	**********			
14-DEC-95	LEW	134298	**********			
13-DEC-95	LEW	133144	**			
07-DEC-95	LEW	133654	**********			
07-DEC-95	LEW	133645	**********			
10-NOV-95	LEW	131728	**********			
10-NOV-95	LEW	131785	**********			
09-NOV-95	LEW	131530	**********			
02-NOV-95	LEW	130803	**********			
02-NOV-95	LEW	130794	**********			
01-NOV-95	LEW	130646	**********			
20-OCT-95	LEW	130404	**********			
25-OCT-95	LEW	130277	**********			
20-OCT-95	LEW	130130	**********			
13-OCT-95	LEW	129537	**********			
11-OCT-95	LEW	129149	**********			
07-OCT-95	LEW	129009	**********			
04-OCT-95	LEW	128811	**********			
29-SEP-95	LEW	128516	**********			
27-SEP-95	LEW	128307	**********			
21-SEP-95	LEW	127866	**********			
21-SEP-95	LEW	127435	**********			
20-SEP-95	LEW	127767	**********			
14-SEP-95	LEW	127165	**********			
13-SEP-95	LEW	126919	**********			
13-SEP-95	LEW	126599	**********			
07-SEP-95	LEW	126562	**********			
30-AUG-95	LEW	126113	**********			
11-AUG-95	LEW	124831	**********			
08-AUG-95	LEW	124347	**********			
27-JUL-95	LEW	123600	**********			
25-JUL-95	LEW	123586	**********			
20-JUL-95	LEW	123148	**********			
19-JUL-95	LEW	123264	**********			
19-JUL-95	LEW	123192	**********			

Figure 36

TRIMATRIX LABORATORIES, INC. - GRR
Quality Assurance Report

Laboratory Control Samples (Percent Recoveries)
from 01-FEB-1995 to 25-JAN-1996

Parameter: NITROGEN, NITRATE
Method: Colorimetric, Auto-Cadmium Reduction
Application: WATER
Reference: USEPA-353.2
ODL: 0.05
Unit: mg/l

Run Date	Analyst	Blank Conc.	Spike Amt.	Final Conc.	% Rec.
24-JAN-96	Laurel E. White	0	6.47	6.36	98.00
24-JAN-96	Laurel E. White	0	0.32	0.32	100.00
23-JAN-96	Laurel E. White	0	6.47	6.32	98.00
23-JAN-96	Laurel E. White	0	0.32	0.32	100.00
17-JAN-96	Laurel E. White	0	6.47	6.20	96.00
17-JAN-96	Laurel E. White	0	0.32	0.31	97.00
16-JAN-96	Laurel E. White	0	6.47	6.18	96.00
16-JAN-96	Laurel E. White	0	0.32	0.31	97.00
02-JAN-96	Laurel E. White	0	6.47	6.30	97.00
02-JAN-96	Laurel E. White	0	0.32	0.32	100.00
27-DEC-95	Laurel E. White	0	6.47	6.28	97.00
27-DEC-95	Laurel E. White	0	0.32	0.32	100.00
21-DEC-95	Laurel E. White	0	6.47	6.12	95.00
21-DEC-95	Laurel E. White	0	0.32	0.31	97.00
20-DEC-95	Laurel E. White	0	6.47	6.43	99.00
20-DEC-95	Laurel E. White	0	0.32	0.32	100.00
15-DEC-95	Laurel E. White	0	6.47	6.18	96.00
15-DEC-95	Laurel E. White	0	0.32	0.32	100.00
14-DEC-95	Laurel E. White	0	6.47	6.22	96.00
14-DEC-95	Laurel E. White	0	0.32	0.32	100.00
13-DEC-95	Laurel E. White	0	6.47	6.32	98.00
13-DEC-95	Laurel E. White	0	0.32	0.32	100.00
07-DEC-95	Laurel E. White	0	6.47	6.35	98.00
07-DEC-95	Laurel E. White	0	0.32	0.32	100.00
07-DEC-95	Laurel E. White	0	6.47	6.29	97.00
07-DEC-95	Laurel E. White	0	0.32	0.32	100.00
02-DEC-95	Laurel E. White	0	6.47	6.31	98.00
02-DEC-95	Laurel E. White	0	0.32	0.32	100.00
30-NOV-95	Laurel E. White	0	6.47	6.31	98.00
30-NOV-95	Laurel E. White	0	0.32	0.32	100.00
29-NOV-95	Laurel E. White	0	6.47	6.27	97.00
29-NOV-95	Laurel E. White	0	0.32	0.32	100.00
15-NOV-95	Laurel E. White	0	6.47	6.21	96.00
15-NOV-95	Laurel E. White	0	0.32	0.32	100.00
10-NOV-95	Laurel E. White	0	6.47	6.24	96.00
10-NOV-95	Laurel E. White	0	0.32	0.32	100.00
09-NOV-95	Laurel E. White	0	6.47	6.33	98.00
09-NOV-95	Laurel E. White	0	0.32	0.32	100.00
03-NOV-95	Laurel E. White	0	0.32	0.33	103.00
03-NOV-95	Laurel E. White	0	6.47	6.51	101.00
03-NOV-95	Laurel E. White	0	0.32	0.33	103.00
02-NOV-95	Laurel E. White	0	6.47	6.13	95.00
02-NOV-95	Laurel E. White	0	0.32	0.31	97.00
01-NOV-95	Laurel E. White	0	6.47	6.08	94.00
01-NOV-95	Laurel E. White	0	0.32	0.31	97.00
28-OCT-95	Laurel E. White	0	6.47	6.20	96.00
28-OCT-95	Laurel E. White	0	0.32	[illegible]	97.00

Figure 37

TRIMATRIX LABORATORIES, INC. - GRR
Quality Assurance (Shewhart) Chart

Laboratory Control Samples (Percent Recoveries)
from 01-FEB-1995 to 25-JAN-1996

INORGANIC LABORATORY

Parameter: NITROGEN, NITRATE
Method: Colorimetric, Auto-Cadmium Reduction
Application: WATER
Reference: USEPA-353.2
ODL: 0.05
Unit: mg/l

Run Date	Oper	LCL 84.0%	LWL 89.0%	MEAN 98.7%	UWL 108.0%	UCL 113.0%
24-JAN-96	LEW			**		
24-JAN-96	LEW			*****		
23-JAN-96	LEW			**		
23-JAN-96	LEW			*****		
17-JAN-96	LEW			*********		
17-JAN-96	LEW			******		
16-JAN-96	LEW			*********		
16-JAN-96	LEW			******		
02-JAN-96	LEW			******		
02-JAN-96	LEW			*****		
27-DEC-95	LEW			******		
27-DEC-95	LEW			*****		
21-DEC-95	LEW			**********		
21-DEC-95	LEW			******		
20-DEC-95	LEW			*		
20-DEC-95	LEW			*****		
15-DEC-95	LEW			*********		
15-DEC-95	LEW			*****		
14-DEC-95	LEW			*********		
14-DEC-95	LEW			*****		
13-DEC-95	LEW			**		
13-DEC-95	LEW			*****		
07-DEC-95	LEW			**		
07-DEC-95	LEW			*****		
07-DEC-95	LEW			******		
07-DEC-95	LEW			*****		
02-DEC-95	LEW			**		
02-DEC-95	LEW			*****		
30-NOV-95	LEW			**		
30-NOV-95	LEW			*****		
29-NOV-95	LEW			******		
29-NOV-95	LEW			*****		
15-NOV-95	LEW			*********		
15-NOV-95	LEW			*****		
10-NOV-95	LEW			*********		
10-NOV-95	LEW			*****		
09-NOV-95	LEW			**		
09-NOV-95	LEW			*****		
03-NOV-95	LEW			**********		
03-NOV-95	LEW			********		
03-NOV-95	LEW			**********		
02-NOV-95	LEW			**********		
02-NOV-95	LEW			******		
01-NOV-95	LEW			**********		

Figure 38

TRIMATRIX LABOR[illegible]IES, INC. - GRR
Quality Assurance (Shewhart) Chart

Matrix Spike Duplicates (Percent Differences)
from 01-FEB-1995 to 25-JAN-1996

METALS LABORATORY

Parameter: SILVER, TOTAL
Method: Atomic Emission-ICP

Application: WW
Reference: EPA-200.7

ODL: 10
Unit: ug/l

Range: 2

Run Date	Oper	Sample	ZERO 0.0%	MEAN 3.6%	UWL 11.0%	UCL 20.0%
18-JAN-96	DWJ	136103		*******		
18-JAN-96	DWJ	135981		**********	**********	**********
16-JAN-96	DWJ	135896		**********		
11-JAN-96	DWJ	135485	**********			
11-JAN-96	DWJ	135640	**********			
09-NOV-95	DWJ	131303	**********			
07-NOV-95	DWJ	131205	***			
13-OCT-95	DWJ	129347	**********			
12-OCT-95	DWJ	129099	**********			
29-SEP-95	DWJ	128408	********			
27-SEP-95	DWJ	128028	**********			
15-SEP-95	DWJ	126774	***			
29-AUG-95	DWJ	125787	**********			
24-AUG-95	DWJ	125597	***			
24-AUG-95	DWJ	125355	********			
04-AUG-95	DWJ	124173	********			
04-AUG-95	DWJ	124100	********			
04-AUG-95	DWJ	124012		**********		
04-AUG-95	DWJ	123833	********			
05-JUL-95	DWJ	121909	**********			
05-JUL-95	DWJ	121911	***			
24-JUN-95	DWJ	120732	********			
16-JUN-95	DWJ	120258	**********			
16-JUN-95	DWJ	120257	***			
16-JUN-95	DWJ	120179	**********			
13-JUN-95	DWJ	119354	********			
13-JUN-95	DWJ	119841		**********		
22-MAY-95	DWJ	117741		**		
28-APR-95	DWJ	115465		**********		
28-APR-95	DWJ	115642	********			
24-APR-95	DWJ	115326	**********			
11-APR-95	DWJ	114171	********			
10-APR-95	DWJ	114301	********			
10-APR-95	DWJ	114320		**********		
06-MAR-95	DWJ	111627	********			
16-FEB-95	DWJ	110544		**********		
01-FEB-95	DWJ	109505		**********	**********	
01-FEB-95	DWJ	109460		**********		

Figure 39

Quality control reports are used extensively in the TriMatrix laboratory to access the analytical process. All QC reports are created through the TriMatrix LIMS system. Many of these reports such as the analytical and QC batch detail reports are utilized daily to monitor all aspects of quality control, i.e., method accuracy, precision, completeness and provide the means for overall data assessment at the batch level.

Many options are available through the TriMatrix LIMS in creating each type of report.

Presented in Table 3 is a list of quality control reports provided through our LIMS and a brief summary or description of their use.

TABLE 3

Report Name	Description of Use
Analytical Batch Detail Report	This report displays all analyses for a given analytical batch, including all sample data and quality control checks as tested in the analytical batch.
QC Batch Detail Report	This report displays all results for a given QC or matrix batch. The samples may have been analyzed in several analytical batches, but are presented as a review of the extraction or pretreatment batch.
Results List	This report generally is utilized in conjunction with a Shewart Chart to display QC data in a tabular form.
Shewart Chart	The Shewart report is created to graphically display the distribution of QC data. This report is available to display the distribution of both accuracy and precision data.
Compliance Summary	The compliance summary report was created to display batch and method compliance or completeness as defined for each analytical protocol. Also displayed in this report is a number of warning and control failures with specific data presented for all out-of-control data points.
Biased Statistics	The biased statistics report is utilized in listing tests which have become biased by having 7 continuous results on one side of the mean.
Control Limit Comparison Report	The control limit comparison report was designed to present current in-house statistical windows in comparison to those published in a specific method.

Statistics Summary	This report lists current statistical values by test for a given lab area. The information presented includes: no. of observations, mean, standard deviation, upper and lower control and warning limits and method specific or _____ limits.
Statistics Report by Class	This report is designed to present operational statistical windows for designated QC types and test lists.
Deviant Statistics	The deviant statistics report is used to list tests that have statistical values which have deviated significantly from the previous statistical data.
Locked Statistics	This report displays all locked statistics for a given laboratory area. An example of a locked statistic is an ICV or initial calibration verification standard for ICP analysis.
Analyst Certifications	The analyst certification report is produced to review laboratory control sample data for a given analyst, test, and defined time period. This report is utilized to review an analyst's performance.
Pre-Defined Qualifier Report	This report list defined all analysis, sample and batch qualifiers that are available for data qualifications. The report is used for reference purposes only.

Examples of these reports are presented in Appendix C.

4.1.2.10 Confidentiality and Proprietary Rights

Since a significant amount of information may be received in the laboratory by telephone, written submittals, and personal contact regarding details of a client's operations, it is essential that strict confidentiality be maintained in the handling of all client details. Client data is to be protected in locked filing cabinets and in limited access computer files. Under no circumstances is the name of a client or any information regarding that client to be revealed to another client or to a regulatory agency without the client's written permission.

Any details of a client's operations which have necessarily been revealed to the laboratory for testing purposes are to be considered as proprietary and protected by patents, copyrights, infringement laws, or other legal constraints against disclosure.

4.1.2.11 Document Storage and Traceability

Archiving of information at the TriMatrix laboratories has been designed to meet both short-term and long-term storage needs. Archives are maintained for a wide variety of data and documentation. These archives can be categorized into two main groups, a) document archives (physical documents) and b)electronic archives (data files). The following Table 4 illustrates the current TriMatrix archival systems, their location and duration.

TABLE 4
DATA ARCHIVING SYSTEMS

DOCUMENT ARCHIVES

Document Description	Storage Location	Storage Duration	Optically Scanned
Laboratory benchsheets	on-site	1 year	yes
Laboratory benchsheets	off-site	6 years	yes
Instrument Print-Outs (raw data)	on-site	1 year	yes[1]
Instrument Print-Outs (raw data)	off-site	6 years	yes[1]
Laboratory Logs (run, maint., etc,)	on-site	3 years	yes
Laboratory Logs (run, maint., etc,)	off-site	6 years	yes
Client Files (reports, correspondence, invoices)	on-site	1 year	yes[2]
Client Files (reports, correspondence, invoices)	off-site	6 years	yes[2]
Proposal Files	on-site	5 years	no
Purchase Agreements	on-site	5 years	no

1. Instrument printouts are only scanned if they contain handwritten notations. All other data is stored in both the hard copy version and as an electronic file (see below)
2. All LIMS generated client/invoice reports are automatically archived to the optical disk system.

ELECTRONIC ARCHIVES

File Description	Storage Location	Storage Duration	Storage Media
Instrument Data Files-GC/MS(Extrels)	on-site	3-5 years[3]	Tape
Instrument Data Files-GC/MS(ION Traps)	on-site	10 years	Optical Disk
Instrument Data files-GC (TurboChrome)	on-site	10 years	Optical Disk
Instrument Data files-AA/ICP	on-site	10 years	Optical Disk
Instrument Data files-Auto Analyzer	on-site	10 years	Optical Disk

3. All tapes are retained indefinitely, the anticipated life is expected to be 3-5 years.

Documentation records or logs are maintained for all archival systems to aid in the quick retrieval of information. Extended archival periods or special procedures are also in place for some projects and clients.

4.1.3 Standard Operating Procedures (SOPs)

A standard operating procedure (SOP) is a guide that addresses the need for each laboratory to maintain a manual that clearly defines the exact steps to be followed in performing an analytical procedure.

This delineation of these exact steps will improve the confidence and the ability to reproduce the analytical conditions, which in turn will help the overall reproduction of analytical data.

A significant part of the variability in the analytical data generated by a given method is in part largely due to minor variations in the operation and/or inability to routinely reproduce the steps in the analytical process. A standard operating procedure should clearly define these steps and help minimize these minor variations.

Many of the methods published today by various agencies provide only general guidance in performing an analytical determination. This is another important reason why specific laboratory procedures are needed.

4.1.3.1 SOP Categories-Types

The TriMatrix laboratories standard operating procedures are written for almost all laboratory activities. The categories utilized in the organization of SOPs are presented in Table 5:

TABLE 5

Trace Metals	Instrumental-General
Gas Chromatograph	Gas Chromatography/Mass Spectroscopy
Spectrophotometric Procedures	Titrimetric Procedures
Gravimetric Procedures	Electrochemical/Potentiometric Procedures
Extractions-Organic	Quality Assurance
Sales and Customer Service	Business and Accounting
Laboratory Computer Operations	Laboratory Safety and Security
Sample Receiving, Storage, & Disposal	Miscellaneous
Bottle Prep	Inorganic-General
Microbiology	
Waste Characterization	

4.1.3.2 SOP Development, Formatting and Review

All standard operating procedures are developed and written to the specifications outlined in the TriMatrix guidelines for the preparation of an SOP. These guidelines are presented as a standard operating procedure and are available in different formats that have been designed to accommodate analytical tests, non-tests such as extractions or digestions, and a documentation or non-analytical activity. The guidelines were developed from both USEPA and ASTM protocols for the creation of a standard operating procedure.

All SOP's developed by the TriMatrix laboratories are subject to a review process where signatures or approvals are required from the appropriate area supervisor, the quality assurance supervisor and the laboratory manager. In addition to this overall approval process, each page of an SOP is individually approved by the laboratory area and the quality assurance supervisors (see enclosed Figures 40 and 41).

4.1.3.3 SOP Documentation and Control

All SOPs are assigned procedure numbers that are unique to each laboratory, the effective date, revision number, information on the author, total number of pages and identification of any individual page revisions.

All TriMatrix SOPs are controlled through a controlled document management system. The system is used to document the release of any SOP to in-house staff, external clients or government agencies. This documentation procedure is maintained on an TriMatrix standard operating procedure inventory log form (see enclosed Figure 42). This form is generated for each SOP and revision number. All forms are maintained in a locked SOP file. Entries are made for each copy produced, including date issued, by whom, name of chemist, lab area, client, etc. to whom the SOP was issued and a unique document control number.

When an SOP is revised, all previously issued versions must be collected before replacement with the latest revision.

All copied SOPs are printed on special paper that is clearly labeled as a controlled TriMatrix document (see attached Figure 43).

TriMatrix Laboratories, Inc.

STANDARD OPERATING PROCEDURE

CYANIDE, TOTAL

PRELIMINARY MACRODISTILLATION

USEPA METHOD #SDM 4500-CN B, 4500 CN C

APPROVALS:

Inorganic Supervisor:_____ Date:_____

QA/QC Supervisor:_____ Date:_____

Laboratory Manager:_____ Date:_____

Procedure Number:

Revision Number: 0.0 By: Betty Doyle Effective Date: 2/8/95

Total Number of Pages: 10 Pages Revised: None

Figure 40

k:\project\in\sop\cn-dist

1.0 PRINCIPAL METHOD REFERENCE

Standard Methods for the Examination of Water and Wastewater, 18th Edition (1992), 4500-CN B, 4500-CN C.

2.0 PARAMETER LIST

Cyanide, Total.

3.0 SCOPE AND APPLICATION

3.1 This method is applicable to the determination of cyanide in soil, sludge, and waste. This method may be used for water and wastewater, if needed, using 250 mls of sample and 250 mls of DI H_2O for distilling.

3.2 The method detects inorganic cyanides that are present as either simple soluble salts or complex radicals.

3.3 The applicable range for this method is 0.05 to 10 mg/kg.

3.4 The reportable detection limit for this method is 0.05 mg/kg but varies as to % solids for soils and sludges. Wastes are reported on an "as received" basis.

4.0 SUMMARY OF TEST METHOD

The cyanide present in the sample is released as a gas (HCN) upon the addition of sulfuric acid. The HCN is collected in a NaOH scrubbing solution. The NaOH scrubbing solution is then analyzed for cyanide using EPA Method 335.3/9012. This method has been modified: Bismuth nitrate is used to remove sulfide interference rather than lead carbonate.

Figure 41

TriMatrix Laboratories, Inc.

STANDARD OPERATING PROCEDURES NUMBER LOG MASTER SECTION REFERENCE

Section Number	Section Titles
0 1	Trace Metals
0 2	Instrumental - General
0 3	Gas Chromatography
0 4	Gas Chromatography/Mass Spectroscopy (GC/MS)
0 5	Spectrophotometric Procedures
0 6	Titrimetric - Procedures
0 7	Gravimetric - Procedures
0 8	Electrochemical/Potentiometric - Procedures
0 9	Extractions - Organic
1 0	Quality Assurance
1 1	Sales and Customer Service
1 2	Business and Accounting
1 3	Laboratory Computer Systems
1 4	Laboratory Safety and Security
1 5	Sample Receiving, Storage, Disposal and Bottle Prep.
1 6	Miscellaneous
1 7	Microbiology
1 8	Inorganic - General
1 9	Waste Characterization
	Prefixes: GR- Grand Rapids, LI - Livonia
	Example: Procedure Number GR-15-104, "Hazard Waste Disposal" for Grand Rapids Lab.

Figure 42

Figure 43

4.1.4 LIMS Validation Procedures

The TriMatrix laboratory has developed and maintained a custom laboratory information system (LIMS). This TriMatrix system was exclusively designed to encompass all aspects of our laboratory operations. The main functions of the TriMatrix LIMS are:

- Project Management
- Sample Management
- Work Scheduling and Management
- Data Entry, Verification and Approval
- Report Generation
- Invoicing

4.1.4.1 Good Automated Laboratory Practices (GALP) Compliance

In designing the TriMatrix LIMS system, certain fundamental approaches were taken in an effort to maintain proper authority, documentation and control during the design, programming and implementation stages of the system.

Recently, the TriMatrix system has been reviewed against the USEPA's publication "Good Automated Laboratory Practices". Our review against the guidelines presented in the manual has validated our initial approach to the processes involved with the TriMatrix LIMS.

The GALP guidelines emphasize the need for proper organization and personnel, the correct facility to maintain system integrity, obtain the proper equipment to maximize on-going operations, identification and maintenance of system security, data security, consistent system use, software documentation/maintenance, operational logs and backup/recovery schemes.

The TriMatrix laboratory has numerous in depth protocols to deal with these guidelines as well as many others. Many of the procedures utilized to describe our efforts to meet these guidelines are presented in a series of standard operating procedures which includes the following categories and descriptions:

Security — Describe how the automated data collection system is kept secure. Discuss physical security of the computer(s), access to use of the installed software, ability to modify the installed software, ability to install additional software, and access to the data (*i.e.* retrieval, insertion, modification, and deletion).

Raw Data — Define what constitutes raw data (vs. processed data).

Data Entry — Describe how data, both raw and processed, is entered into the data storage files, and how the operator entering the data is identified in the files.

Verification — Describe how the accuracy of the data, whether entered manually or automatically, is verified.

Errors — Identify all anticipated error codes & messages, who is responsible for taking corrective action, and what corrective action should be taken.

Processing — Describe how the raw data is processed (manipulated) and analyzed (interpreted).

Change Control — Describe the ways in which data may be changed, how the original data is preserved for the historical record, and how the changed data is documented (*i.e.* who made the change, when, and why).

Reporting — Describe how the integrity of the data is protected on all reports, whether visual hardcopy or magnetic media.

Backup and Recovery — Describe the schedule and method of backing up the data files, how the backups are logged (manually or automatically), and how to recover/restore data from a backup.

Archiving & Purging — Describe how data is migrated to intermediate- and long-term storage, and how data is retrieved from that storage.

Maintenance — Describe the procedures for maintaining the hardware used in the collection, processing, reporting, backup, and archival of the data.

The TriMatrix laboratory will continue to monitor and implement procedures and protocols in an effort to meet or exceed the GALP requirements.

4.2 Sample Control, Flow and Storage

Presented in the following section is a description of the policies and procedures that were developed to identify, monitor and document the flow of samples through the TriMatrix Laboratory flow chart depicting this process is presented in Figure 44.

4.2.1 Project Initiation

When samples are received at the TriMatrix laboratories, the necessary information that will direct the analytical scheme has all ready been developed and implemented within the TriMatrix project initiation/project management process. This process starts with the award of a contract or proposal, a client request or a pre-scheduled sampling event. The basic steps and supporting documentation involved in the project initiation process begins with the gathering of project information, communications with all affected laboratory areas and the input of required project related data into the LIMS system.

If a new project will require support from the analytical facilities, that project must be coordinated with the laboratory supervisors and the laboratory manager prior to project pricing and sample receipt. Routine samples are those samples and analyses which are continuously processed by TriMatrix.

Projects which are non-routine are those that may require special testing, or which request parameters not routinely run within the laboratory, special holding times, or rush turnaround. Non-routine projects will require approval from all affected laboratory areas. This approval process is communicated in several different ways, including everything from the signing of a quality assurance project plan (QAPP) to the transmission and receipt of an electronic mail message.

The development of a project within the laboratory also involves the preparation and shipment of sample collection materials and containers. The processes involved in the procurement, preparation and shipment of sample collection materials and bottles are presented below.

TriMatrix Laboratories, Inc.

Sample Flow Diagram

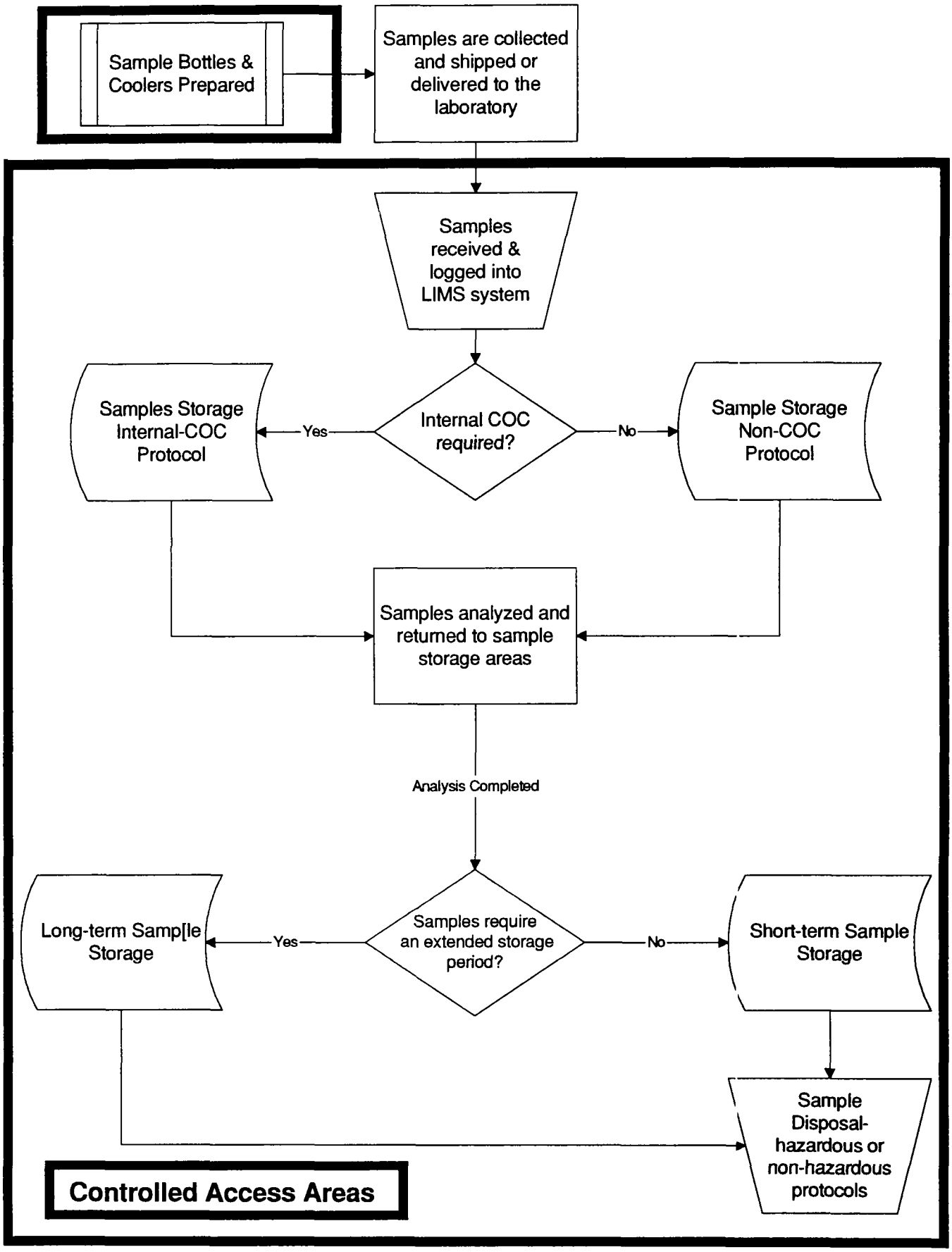


Figure 44

4.2.1.1 Sample Containers and Materials Procurement

The TriMatrix laboratories utilize only virgin bottle ware for all sample collection kits. Plastic ware is typically Nalge brand, NDPE, while glassware is I-CHEM Series 200 (or equivalent) pre-cleaned with the exception of oil and grease and TOX containers. These bottle types require special handling and cleaning prior to shipment.

I-CHEM Series 300 (or equivalent) bottle ware is available upon request and generally at an additional cost.

4.2.1.2 Preparation of Containers

All sample containers utilized for the collection and preservation of environmental samples are prepared by the TriMatrix bottle prep group. The staff members of this group focus the activities exclusively in the area of sample container procurement, preparation, and shipping. The procedures utilized performing these activities are outlined in the TriMatrix SOP for bottle preparation.

The TriMatrix laboratories have developed a unique color coded bottle tagging system for the purposes of defining and differentiating the various sample bottle types and the chemical additives that are required for proper sample preservation.

In conjunction with our color coded tagging system, a form was developed to display the coding system, identify chemical preservatives and provide a means of listing the exact quantity, bottle type and preservatives required for each sample location in a tabular format. An example of the TriMatrix "sample inventory and master bottle pricing list" form is provided in Figure 13 in section 4.1.2.1 of this document. An example of the TriMatrix sample bottle tagging system was presented in Figure 19 in Section 4.1.2.2. This illustration shows both

sides (front and back) of a bottle tag as it appears on a prepared sample container, upon completion of the log-in process.

Quality assurance measures utilized in monitoring sample coolers includes the use of trip blanks for volatile organics and temperature blank bottles which travel with all level 3 and higher projects. Trip blanks for all container types shipped are available upon request.

4.2.1.3 Sample Container Shipment

When all containers have been assembled as requested on the "master bottle packing list", the bottles are then packaged and placed into one or more shipping coolers. Each cooler is packed with bottles that have been carefully enclosed in poly bubble pack. 40 ml glass vials are packed in small bubble pack bags.

Coolers are generally organized in such a way to help minimize time spent in the field. This is usually accomplished by packing sets of bottles together that will be required at a particular sample location. A copy of the bottle pricing list is placed in each cooler with the sample locations highlighted to indicate which bottles are contained within the cooler. This practice is usually only necessary when sample collection sites require a different series of containers.

Also presented in each cooler in addition to the bottle packing list is a series of instructions or comments about the containers, material safety data sheets for all chemical preservatives present, a return address label, an external COC form, and if required TriMatrix sample bottle custody seals. All materials are packaged in a waterproof zip-lock type bag.

Examples of these additional materials are presented in Figures 45 to 48.

All sample coolers are sealed with a signed TriMatrix custody seal to validate the integrity of the containers at the sample site.

TriMatrix
Laboratories, Inc.

PROJECT NOTES

Enclosed are the sample containers that are required for your project. We have included several project notes that will allow the safe handling of containers and allow the completion of your project in a timely manner.

- The containers are pre-cleaned; therefore no additional cleaning is required.
- Some sample containers contain preservatives; please do not rise or overfill. These preservatives are there to adhere to EPA set standards.
- The chemicals in the containers are hazardous. Extreme caution should be used when handling. The sampler should not breathe or come in physical contact with these chemicals. For your safety, please read the complete Material Safety Data Sheets that are enclosed.
- When doing soil sampling, please clean off any residual soil from the outside of the coolers. This can prevent contamination of other samples in the cooler.
- Please fill out the sample identification tags as completely as possible.
- Please fill out the enclosed chain of custody form for adequate sample tracking.

If you have any questions concerning your sampling, please phone TriMatrix at (616) 975-4500 and ask for one of the Laboratory Client Services personnel.

TriMatrix Laboratories, Inc.
Laboratory Client Services

Figure 45

NAC

NITRIC ACID

[redacted]

Watery liquid Colorless to light brown Choking odor

Sinks and mixes with water. Harmful vapor is produced.

AVOID CONTACT WITH LIQUID AND VAPOR. Keep people away.
Wear chemical protective suit with self-contained breathing apparatus.
Stop emergency if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
May cause fire on contact with combustibles.
Flammable gas may be formed on contact with metals.
Poisonous gases are produced when heated.
Wear chemical protective suit with self-contained breathing apparatus.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Will burn eyes, nose and throat.
If inhaled, will cause difficult breathing or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with copious amounts of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

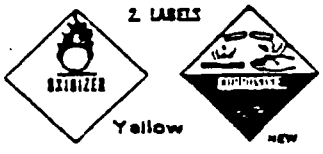
HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

[redacted]

Issue warning—corrosive
Restrict access
Evacuate area
Dilute and flush

2. LABELS



3. CHEMICAL DESIGNATIONS

3.1 Synonyms: No common synonyms
3.2 Coast Guard Compatibility Classifications: Nitric acid
3.3 Chemical Formula: HNO_3-H_2O
3.4 IMCO/United Nations Numerical Designations: 8.0/2031

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Acrid; sweet to acrid

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Air mask; rubber suit, hat, boots and gloves; chemical goggles, safety shower and eye bath.
5.2 Symptoms Following Exposure: Vapors irritate eyes and respiratory tract; lung injury may not become apparent for several hours following exposure. Liquid may cause severe burns to eyes and skin.
5.3 Treatment for Exposure: INHALATION: remove to fresh air, administer artificial respiration if required. INGESTION: drink large volumes of water; do NOT induce vomiting. SKIN OR EYES: flush with water for at least 15 min.
5.4 Toxicity by Inhalation (Threshold Limit Value): 2 ppm
5.5 Short-Term Inhalation Limits: 15 ppm for 5 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} 50 to 500 mg/kg
5.7 Lethal Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: 38-68%: Vapor is moderately irritating such that personnel will not usually tolerate moderate or high vapor concentrations. 95%: Vapors cause severe irritation of eye and throat and can cause eye and lung injury. They cannot be tolerated even at low concentrations.
5.9 Liquid or Solid Irritant Characteristics: Severe skin irritant. Causes second- and third-degree burns on short contact and is very injurious to the eyes.
5.10 Hypersensitivity: Data not available

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Use water on adjacent fires.
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: May give off poisonous oxides of nitrogen and acid fumes when heated in fires.
6.6 Behavior in Fire: Decomposes and gives off poisonous oxides of nitrogen.
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable

7. CHEMICAL REACTIVITY

7.1 Reactivity with Water: May heat up on mixing, but evaporation or formation of vapor unlikely.
7.2 Reactivity with Common Materials: Very corrosive to wood, paper, cloth and most metals. Toxic red oxides of nitrogen are formed.
7.3 Stability During Transport: When heated may give off toxic red oxides of nitrogen.
7.4 Neutralizing Agents for Acids and Caustics: Flush with water.
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent

8. WATER POLLUTION

8.1 Aquatic Toxicity:
72 ppm/96 hr/mosquito fish/TL_m/fresh water
330-1000 ppm/48 hr/oysters/LC_{50}/sea water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SELECTED MANUFACTURERS

1. Allied Chemical Corp.
   Agricultural Division
   Morristown, N. J. 07960
2. E. I. duPont de Nemours & Co., Inc.
   Explosives Dept.
   Wilmington, Del. 19898
3. Hercules, Inc.
   Explosives & Chemical Propulsion Dept.
   Bessemer, Ala. 35020

10. SHIPPING INFORMATION

10.1 Grades or Purity: Various grades: 52-98%
10.2 Storage Temperature: Ambient
10.3 Inert Atmosphere: No requirement
10.4 Venting: Open or pressure-vacuum

11. HAZARD ASSESSMENT CODE

[redacted]

A-P

12. HAZARD CLASSIFICATIONS

12.1 Coast of Federal Regulations: Oxidizer
12.2 NAS Hazard Rating for Bulk Water Transportation

Category	Rating
Fire	0
Health	
Vapor Irritant	3
Liquid or Solid Irritant	4
Poisons	3
Water Pollution	
Human Toxicity	3
Aquatic Toxicity	3
Aquatic Effect	2
Reactivity	
Other Chemicals	4
Water	0
Self-Reaction	0

12.3 NFPA Hazard Classifications

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	0
Reactivity (Yellow)	0
	ox

13. PHYSICAL AND CHEMICAL PROPERTIES

13.1 Physical State at 15°C and 1 atm: Liquid
13.2 Molecular Weight: Not pertinent
13.3 Boiling Point at 1 atm:
192.0°F = 88.9°C = 362.1°K
13.4 Freezing Point:
−50°F = −45.6°C = 227.6°K
13.5 Critical Temperature: Not pertinent
13.6 Critical Pressure: Not pertinent
13.7 Specific Gravity: 1.49 at 20°C (liquid)
13.8 Liquid Surface Tension: Not pertinent
13.9 Liquid-Water Interfacial Tension: Not pertinent
13.10 Vapor (Gas) Specific Gravity: Not pertinent
13.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1.244
13.12 Latent Heat of Vaporization:
214 Btu/lb = 119 cal/g = 4.98 × 10^5 J/kg
13.13 Heat of Combustion: Not pertinent
13.14 Heat of Decomposition: Not pertinent
13.15 Heat of Solution: −205 Btu/lb
= −114 cal/g = −4.76 × 10^5 J/kg
13.16 Heat of Polymerization: Not pertinent

NOTES

REVISED 1978

Figure 46

TriMatrix Laboratories, Inc.
5555 Glenwood Hills Parkway SE • PO Box 888692 • Grand Rapids, MI 49588-8692

Chain of Custody Record

COC No. [illegible]

Project Manager	Project Name	
Project No.	Sampler (Print)	
	Sampler Signature	

No's Correspond to Bottle Packing List

For Lab Use Only

Rack/Tray No:

Lab Project #

Date Sampled	Time Sampled	Matrix			Sample Identification	No. of Containers	Container Type	Analysis Required/Comments	Sample No.	Filtered Date/Time
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			

Relinquished By:	Date/Time	Received By:	Received to Lab By:	Date/Time	Logged in By:	Date/Time

Matrix: Water (W), Wastewater (WW), Soil (SOIL), Sludge (SLG), Air, Oil, Waste (WASTE)

Figure 47

Customer
Return Address
Label

FROM:

_____

_____

_____

Environmental Samples Enclosed

TO:

TriMatrix
Laboratories, Inc.

5555 Glenwood Hills Parkway SE
PO Box 888692
Grand Rapids MI 49588-8692

Figure 48

4.2.2 General Laboratory Security

Access to the TriMatrix laboratory is handled in a secured fashion, where access is restricted to authorized personnel only. All laboratory areas including, sample storage, sample container preparation, analytical laboratories, sample preparation, sample disposal, analytical documents and clients files are secured by a keyless entry system. Non-authorized personnel may enter these areas if escorted by a laboratory staff member.

It is the responsibility of all laboratory staff members to insure that the rules of restricted access are followed and maintained at all times.

4.2.3 Sample Log-In

All samples received by TriMatrix must be logged in before any analyses are conducted. The purpose of the log-in procedure, including sequential numbering of all samples received, is to insure that TriMatrix has a means by which samples can be tracked, data can be stored, and quality control can be tracked for any sequence of events during a particular analytical period. The primary steps involved in the sample log-in process are presented below.

4.2.3.1 Sample Receipt/Examination

Examination of Shipping Container

Immediately upon receipt of a sample shipment at the TriMatrix Laboratory, the SC will examine the shipping container to ascertain and document the condition of the samples and to process Chain-of-Custody papers, where appropriate. The SC will record the condition of the shipping container, the identification of the shipper, the presence or absence of any seals on the container and the labeling which may include special instructions prior to opening the container. If the shipping container is damaged, a report will be sent immediately to the shipper and the lab supervisor (see Figure 17 Problem Submittal Report).

Samples received at the TriMatrix laboratories are required to be accompanied by an TriMatrix laboratory Chain-of-Custody (COC) form. For these samples received without this form, the SC will initiate the COC process. Additional information and an example of the TriMatrix COC form is presented in section 4.2.4 of this manual.

Unless the shipping container contents are marked "hazardous" the SC will proceed to open the sample container. If the SC had not previously identified the LIMS submittal appropriate for these samples, the SC will attempt to ascertain immediately the origin of the samples found in this container and contact the appropriate project chemist. If a submittal and the project chemist are not available, the SC will lock up the samples and notify the lab manager. The SC will identify whether or not all the samples have arrived intact, whether or not the labels are intact and attached properly, and whether or not the samples have leaked in any fashion. The SC will also identify any shipping instructions, field instructions, or any other materials that may be present in the shipping container.

Should the SC identify a submittal or delivery group as an internal COC project, the SC will initiate the procedures outlined in the TriMatrix standard operation procedure for internal sample custody and those procedures outlined in Section 4.2.4 of this manual.

4.2.3.2 Computer Log-In

All samples received at the TriMatrix laboratory are logged into the TriMatrix LIMS System by the sample coordinator. The LIMS system assigns a sequential number to every sample entered into the system. In conjunction to the sample identification number, the submittal or delivery group can be identified by a unique number which consists of the LIMS project number and a sequenced number of the delivery group.

4.2.3.3 Project and Sample Verification

The SC having opened the shipping container(s) and having examined all the samples will then verify that the LIMS project report (see previous Figure 14) matches the samples, the number of samples received, and is consistent with the requirements of the project and submittal as created within the TriMatrix LIMS system. If the samples are not consistent with the information presented in the project report, the SC will complete an TriMatrix non-conformance report and turn it over to the appropriate Project Chemist.

4.2.3.4 Sample Distribution

The TriMatrix Sample Coordinator will inspect to insure that all samples received at the TriMatrix facility are received in the appropriate containers with the correct preservatives (Samples which must be split at log-in to added error).

Bottles and Preservative Requirements

The TriMatrix Laboratory has a series of bottle and preservative requirements that must be met before the log-in of samples into the laboratory. In the event that TriMatrix is unable to provide sample bottles, or circumstances prevent the splitting of samples in the field, the SC will provide sample splitting services. These services will include taking the sample as received and subsampling it into the appropriate bottle and preservative requirements as set forward in Appendix D - Bottle and Preservative Requirements.

A. Sample Splitting-Water Samples

The SC will insure that sufficient sample volume is available before initiating the splitting of a sample. If uncertain, the SC will involve the laboratory supervisors in order to insure that all

as a problem and will notify the Project Chemist immediately for resolution.

When a bulk sample arrives for organic/inorganic analysis and sufficient sample exists, the SC will transfer the sample to the organic preparation supervisor who will split the organic aliquot and return all aliquots to the SC. The remaining sample will then be returned to the SC who will split off the inorganic aliquots into the proper preserved containers.

B. Sample Splitting-Solid Samples

When solid samples, such as sediment or soil, are to be received at TriMatrix, every attempt will be made by the Project Chemist and field sampling personnel to insure that two samples are provided as replicates for the appropriate tests. One of these samples will be assigned to the organic facility; the other will be assigned to the inorganics facility. If only the sample is received and if organic analyses are required, the organics preparation chemist will be responsible for the initial splitting of the sample. Solid samples will be made homogeneous by either one or all of the following manners:

- Sitrring
- Grinding
- Particle separation (sieving)
- Quartering by ASTM Procedures

The lab area supervisor and the SC are responsible for the decisions on how a solid sample will be split. Problems or concerns which may arise on a solid sample will be addressed to the Project Chemist and the laboratory manager for resolution. After the organic portions have been removed or split, the remaining sample will be provided to the inorganic facilities for any further splitting they deem necessary.

C. Sample Identification/Labeling

All samples received at the TriMatrix laboratories are labeled by the SC at the time of log-in. These labels include the necessary information for proper identification of not only the sample ID number but also contain information on any potential for flammability, reactivity, contact or health based risks.

In addition to the sample identification tagging, all TriMatrix bottle and preservative types are clearly identified by means of a color coded tagging system. (As presented in section 4.2.1.1 "Sample Containers and Materials Procurement"). This section allows everyone involved in the analytical process from sample collection, sample analysis and sample disposal to clearly identify all containers for their intended use and chemical preservatives. This color coded process helps insure the right container type and preservative is utilized for the requested analytical procedure.

D. Sample Storage

- The SC, after completing all the log-in process of various samples connected with a particular project, will store the samples in the designated areas in the TriMatrix laboratory.

- Routine Water and Solid Samples: Samples which need to be refrigerated will be stored in the walk in facility designated for all routine water and soil samples.

- Routine Volatile Water and Solid Samples: All these samples are placed in the designated VOA refrigerator(s) located within the analytical facility. Volatile water and soil samples are segregated and stored separately. No other samples or standards may be stored in the VOA refrigerator(s).

- Routine Water and Solid Samples for Metal Parameters: The preserved water samples and solid samples, which are not preserved, may be stored on shelves designated for the metals analysis.

- Odoriferous and Hazardous Samples: These samples are stored in a special vented facility within the laboratory which is designated for odoriferous and hazardous samples. These samples will be identified to the laboratory by means of a sample or submittal narrative within the TriMatrix LIMS System.

All samples that are involved as physical evidence in a legal procedure or simply identified as Chain-of-Custody will be handled under certain procedural safeguards.

All samples of this nature will be stored within the locked confines of the analytical laboratory. Access is only available to authorized personnel.

4.2.4 Chain-of-Custody (COC)

All samples received at the TriMatrix laboratory will require some form of chain-of-custody (COC). The TriMatrix laboratories practices two levels of COC, the first being external COC and internal COC. The degree of custody tracking and documentation is driven by the final deposition of the laboratory data. Generally, if samples and their analytical results are subject to involvement as physical evidence or in a legal procedure; a full series of custody procedures must be implement. On the other hand, if samples or results are not subject to legal procedures, the COC process will end with the receipt of samples at the laboratory. A description of these two custody scenarios is presented as follows:

A. External COC

Samples only requiring external COC will have their custody tracked from sample collection to delivery at the laboratory. This process involves the completion of an TriMatrix external COC form, as presented in Figure 49. This form accompanies all sample containers prepared by TriMatrix to the sample collection site. Any sample or submittal received at the laboratory without an TriMatrix external COC form will initiate a process where the SC will complete the necessary external COC forms for carrier sign-off.

All external COC forms have a unique number for document control purposes.

B. Internal COC

Samples requiring strict COC will initiate the process by which all events or periods of sample handling will require a traceable document protocol.

The internal COC process involves the completion of an TriMatrix internal COC form for all phases of the analytical process. This includes

TriMatrix Laboratories, Inc.

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Chain of Custody Record

COC No. № 27056

Project Manager	Project Name		For Lab Use Only
Project No.	Sampler (Print)		Rack/Tray No:
	Sampler Signature		Lab Project #

Date Sampled	Time Sampled	Matrix*	Composite	Grab	Sample Identification	No. of Containers	No's Correspond to Bottle Packing List / Container Type	Analysis Required/Comments	Sample No.	Filtered Date/Time
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			
							1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20			

Relinquished By:	Date/Time	Received By:	Received to Lab By:	Date/Time	Logged in By:	Date/Time

* Matrix: Water (WTR), Wastewater (WW), Soil (SOIL), Sludge (SLG), Air, Oil, Waste (WASTE)

Figure 49

sample extractions distillations or digestion's, sample analyses and final sample disposal. An example of the TriMatrix internal COC form is presented in Figure 50.

All internal COC forms are maintained in a series of submittal or delivery group folders. These folders are held within the secure confines of the laboratory and or locked project file storage areas.

C. Sample Security

All samples whether under external or internal COC protocols are maintained in a limited access secured area. This level of security is applied to all phases of the analytical process from sample log-in to final sample disposal.

D. Sample Disposal

All samples received at the TriMatrix laboratories are subject to some type of disposal activities upon completion of the analytical process. The general categories or procedures for sample disposal are: 1) samples are returned to the client for disposal, 2) samples are classified as non-hazardous and disposed via the local WWTP and municipal landfill or 3) samples are deemed hazardous and require proper hazardous waste disposal protocols.

The procedures detailing these three disposal activities are detailed in the TriMatrix "Waste Disposal SOP for Analytical Samples".

CHAIN OF CUSTODY REPORT FOR AN ENTIRE SUBMITTAL

CLIENT: EARTH TECH-Grand Rapids Office PROJECT: Analytical Services

SUBMITTAL: January 16, 1996 Samples PROJECT: 33086-1

Parameter: IRON, TOTAL Method: ICP/EPA/WT Ref Cit: EPA-200.7/6010A Matrix: WATER

SAMPLE #	REMOVED BY: (SIGNATURE)	DATE & TIME REMOVED	RELINQUISHED BY: DATE & TIME	RECEIVED BY: DATE & TIME	DATE & TIME RETURNED
136055	David Johnson	1-17-96 8:02Am			1-17-96 12:02pm
136056	DWJ				
136057	DWJ				
136058	DWJ				

Figure 50

4.3 CALIBRATION AND CALIBRATION VERIFICATION

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

Calibration of laboratory instruments, conventional wet-chemistry methods, and equipment is performed to verify that the analysis portion of the total testing process is functioning properly, in range, at the required sensitivity. A separate written calibration procedure and calibration record is maintained for each laboratory instrument and applicable equipment. The procedure will specify calibration frequency, stability, and calibration steps based on analytical method requirements and instrument or equipment manufacturers recommended schedule of calibration.

Initial calibration is performed using standards of certified value to establish the linear range of the analysis for those concentrations of interest. Calibration verification is done immediately after initial calibration and on a continuing basis during an analysis batch. A standard from a different vendor or stock, than the initial calibration is used for calibration verification, in most cases.

Calibration activities are divided into four categories:

Field Equipment
Laboratory Instruments
Classical Inorganic (wet-chemistry) Methods
Secondary Calibration Group, including laboratory equipment requiring calibration (such as ovens, balances, thermometers).

4.3.1 Field Equipment

Perform daily calibration checks on field equipment as described in 4.3 before any field operations are performed with the equipment. Follow the written calibration procedure for each individual piece of field equipment. Tag any equipment that did not pass daily requirements as out-of-service in accordance with the standard operating procedure. The equipment is held out of service until repairs and successful recalibration occurs. A summary table of all calibration procedures and frequencies is included (Table 6).

TABLE 6
FIELD EQUIPMENT CALIBRATION

Equipment	Method Reference	# Standards Initial Calibration	Type of Curve	Frequency of Calibration	Acceptance/ Rejection Criteria Initial Calibration	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
Field Gas Chromatograph	USEPA SW846 Field Manual;	5	Linearity 0.995 corr. coef.	As Needed	20% D	Every 10 Samples	Same criteria as initial calibration
Conductivity Meter	*	2	---	Initial	± 5% of Value	Daily	---
Dissolved Oxygen Meter		---	---	Initial	± 5% of Value	Daily	---
Temperature Probes		---	---	Initial	± 5% of Value	Daily	---
pH Meter		3	Linearity	Initial	>0.995 correlation coefficient	Daily	---
Turbidity Meter		1 Std. each range Low 1.0 NTU Mid 10 NTU High 100 NTU	---	Initial	Instrument manually set at 100% reading for standard	(1 std in conc. range) every 10 samples each range	± 10% of Value
Salinity Meter		1	---	Initial	± 5% of Value	Daily	---

*USEPA Region Engineering Support Branch, Standard Operating Procedures and Quality Assurance Manual; USEPA Compendium of Superfund Field Operations Methods.

4.3.2 Laboratory Instrumentation

Calibration of laboratory instruments is based on approved written procedures. Records of calibration, repairs, or replacement are filed and maintained by the designated laboratory analyst. These records are filed at the location where the work is performed and are subject to QA audit. For all instruments, the laboratory maintains in-house spare parts or service contracts with vendors. A summary table of all calibration procedures and frequencies is included (Table 7). Tag any instrument that does not pass daily requirements as out of service per the written procedure. Hold the instrument out of service until repair or successful recalibration occurs.

4.3.2.1 Inorganic/Classical Chemistries

Inorganics analysis utilizes a wide variety of wet-chemical procedures and instruments. Calibration steps may vary depending on the specific analytical method being utilized. However, certain general principles of calibration apply to all inorganics testing. Every method must be calibrated before an analysis is performed. Using a group of certified standards, the linear range is defined. The calibration is checked on a continuing basis to be certain that the method is within the required test parameters. Any failure of a continuing calibration check will require that a recalibration be performed and any samples analyzed since the last acceptable calibration be reanalyzed.

All inorganics calibrations must meet the specific requirements described below unless the method or equipment necessitate some modifications.

The instrumentation used to conduct these analyses is calibrated by use of a minimum of five calibration standards prepared by dilution of stock solutions. One standard is prepared at the detection limit of the analyte of interest while the other standards bracket the concentration range of the samples.

A laboratory control standard, prepared from a different stock solution than that used for preparation of the calibration standards, is prepared and analyzed with each batch of 20 samples. An initial calibration blank and initial calibration verification are analyzed at the beginning of each run. A continuing calibration standard and continuing calibration blank will be analyzed after each batch of 10 samples. The value of the continuing calibration standard concentration must agree within ± 15 percent of the initial value or the appropriate corrective action is taken which may include recalibrating the instrument and reanalyzing the previous 10 samples.

4.3.2.2 Atomic Absorption/Emission Systems

The atomic absorption spectrophotometer (AAS) and inductively coupled plasma emission spectrophotometer (ICP) instruments are calibrated by use of a minimum of three calibration standards (1 calibration standard for ICP) prepared by dilution of certified stock solutions. One standard is prepared at the detection limit of the analyte of interest while the other standards bracket the concentration range of the samples. Calibration standards contain acids at the same concentration as the digestates. A laboratory control standard, prepared from a different stock solution than that used for preparation of the calibration standards, is prepared and analyzed after each ten samples or each two hours of continuous operation. A continuing calibration standard is analyzed after each batch of 10 samples. The value of the continuing calibration standard concentration must agree within method specifications (generally 5-10 percent) of the initial value or the appropriate corrective action is taken which may include recalibrating the instrument and reanalyzing the previous ten samples.

4.3.2.3 Gas/Liquid Chromatography

Analysis done by gas chromatography follows USEPA protocols. The instrument is calibrated using five point calibration curves for volatile compounds and semi-volatile compounds. Continuing calibrations are performed after every ten samples. The value of the continuing calibration standard must agree within ± 15 percent of the initial value or the appropriate corrective action is taken, which may include recalibrating the instrument and reanalyzing the previous ten samples.

4.3.2.4 Mass Spectroscopy

Prior to calibration, the instrument(s) used for gas chromatograph/mass spectrometer (GC/MS) analyses are tuned by analysis of p-bromofluorobenzene (BFB) for volatile analyses and decafluorotriphenyl phosphine (DFTPP) for semi-volatile analyses. Once the tuning criteria for these reference compounds are met, the instrument is initially calibrated by using a five point calibration curve. The instrument tune will be verified each 12 or 24 hours of operation (depending on method requirements). Continuing calibration is verified as specified in the method. The calibration standards are commercially available certified standards and are spiked with internal standards and surrogate compounds.

TABLE 7
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/Rejection Criteria Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification	Acceptance/ Rejection Criteria Initial Calibration Verification	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
Flame AA	SW-846	4	Correlation coefficient must be ≥0.995	At least daily, or as required (when CCV fails acceptance criteria).	Every calibration	90-110%R	Every 10 samples	90-110%R
Cold Vapor AA	SW-846	4	Correlation coefficient must be ≥0.995			80-120%R		80-120%R
ICP	SW-846	1	Not Applicable			95-110%R		90-110%R
Graphite Furnace AA	SW-846	4	Correlation coefficient must be ≥0.995			90-110%		90-110%
pH Meter	SW-846	2	± 0.1 STD units of true value	Every batch	Every calibration	± 0.1 STD units of true value	Every 10 samples	± 0.1 STD unit of true value

TABLE 7
INSTRUMENT CALIBRATION

Instrument	Method Reference	#Standards Initial Calibration	Acceptance/Rejection Criteria Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification	Acceptance/ Rejection Criteria Initial Calibration Verification	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
DL-12 Autotitrator	SW-846	2	± 0.1 STD units of true value	Every batch	Every calibration	85-115%	Every 10 samples	85-115%
Lachat: SO4 Cl Phenol (Total) Cyanide (Total) Cyanide (Amenable)	EPA 600/4-79-020 Method 375.4 Method 325.2 SW846-9066 SW846-9012	 6 7 4-6 6	 Nonlinear Nonlinear ≥0.995 ≥0.995 ≥0.955	Every batch	Every calibration	85-115%	Every 10 samples	85-115%
TOC Analyzer-TOC	EPA-415.1	1	90-110%	Every Batch	Every Batch	85-115%	Every 10 samples	85-115%
GC-PID/ ELCD	SW-846 8010 SW-846 8020 SW-846 8021	5	RF <20% RSD or cal. curve	As needed, when CCV >15%D	As needed, with prep of new std.	15%D	Daily 10%, and at end of each batch	15%D

TABLE 7
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/Rejection Criteria Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification	Acceptance/ Rejection Criteria Initial Calibration Verification	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
GC-ECD	SW-846 8080 SW-846 8150	5	Linearity <20% RSD	As needed when CCV >15%D	As needed with each new std. Quarterly at a minimum	15%D	Every 10 injections	Primary column %D <15. Conf column %D <20. Breakdown criteria: DDT <20% Endrin <20%
GC/MS-volatiles	SW-846 (8240, 8260)	5	%RSD <35% (CCC) 1,1-dichloroethene; chloroform 1,2-dichloropropane; toluene ethyl benzene; vinyl chloride RF> 0.30 (SPCC) chloromethane; 1,1-dichloroethane; bromoform (0.25); 1,1,2,2-tetrachloroethene; chlorobenzene	As needed	As needed	20%D	Every 12 hrs.-(SW-846) Ever 24 hrs.-(USEPA 600 Series)	CCC %D <25% same SPCC criteria as initial calibration

TABLE 7
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/Rejection Criteria Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification	Acceptance/ Rejection Criteria Initial Calibration Verification	Frequency of Continuing Calibration Verification	Acceptance/ Rejection Criteria Continuing Calibration Verification
GC/MS-semi-volatiles	SW846-8270	5	% RSD <30% (CCC) acenaphthene 1,4-dichlorobenzene hexachlorobutadiene N-nitroso-diphenylamine di-octylphthalate fluoranthene benzo(a)pyrene 4-chloro-3-methylphenol 2,4-dichlorophenol 2-nitrophenol phenol pentachlorophenol 2,4,6-trichlorophenol RF>0.05(SPCC) N-nitrosodipropylamine hexachlorocyclopentadiene 2,4-dinitrophenol 4-nitrophenol	As needed	As needed	20%D	Every 12 hours	CCC %D <30%. Same SPCC criteria as initial cal.

4.3.3 Laboratory Equipment

Perform calibration at the intervals described below on equipment such as thermometers, ovens, balances, furnaces which are stable and retain their calibration over a long period of time.

Balances

Perform a full calibration annually by using an outside contractor who is certified. Use class S or higher weights that are traceable to the National Institutes of Standards and Technology (NIST). Weights must be recertified every three years. Calibrate balances to approximately 95 percent of capacity. Use testing intervals of approximately 5, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, and 95 percent of capacity. Acceptable calibration readings for direct reading balances are plus and minus the combined tolerance of the calibration weights and the balance reproducibility, expressed as total tolerance in grams.

Perform a check of the balances each work day using certified calibration weights to cover each weighing range. The acceptable calibration readings are the same as those described above for annual calibration.

Maintain written records of annual calibrations and daily calibration checks. Place a sticker on the balance showing the date of the current calibration, name of person performing the calibration, and the next due date.

Thermometers

Use a primary NIST reference thermometer to check at least two points in the temperature range of working thermometers. Perform annually for all mercury thermometers and quarterly for all dial type thermometers.

If equipment fails calibration, remove the item from service and tag it to prevent use. Personnel performing the calibration should be also alert for any condition which renders a piece of equipment inoperable or unfit for use; for example, inspect thermometers to ensure that mercury or alcohol columns are not separated and that no other damage is present. If an equipment malfunction is noted during

calibration, the equipment is to be tagged and removed from service. The equipment is held out of service until repairs and successful recalibration occur. Record all malfunctions, repairs, and recalibrations in the appropriate instrument maintenance and calibration logs.

Maintain records for each piece of equipment requiring calibration, showing equipment description and identification number, calibration frequency and acceptable tolerances, the specific calibration procedure used, personnel performance calibration, date, reference material used, calibration results including acceptance or failure, removal from service, repairs, and date and authorization for return to service.

4.4 DATA REDUCTION, VALIDATION, AND REPORTING

All analytical data generated by TriMatrix laboratories is thoroughly reviewed. Data verification begins with the analyst, because it is the basic responsibility of the analyst that the data is complete and correct and that all applicable methods and standard operating procedures have been followed. If results are not acceptable, it is the duty of the analyst to perform the appropriate corrective action and to thoroughly document that action.

Data reduction is the process by which raw analytical data is tabulated and calculated. Data validation is the review of the data generation and reduction process according to an established set of guidelines. This verification of data generation and reduction steps, performed by the analyst, constitutes the first level review of the analytical data.

The data is then passed to the laboratory area supervisor or designated validator who performs the second level review of the test results. This independent review is also conducted according to an established set of validation guidelines.

The data is then entered and verified (via double blind entry) into the laboratory LIMS system. Upon completion of the verification process, the data accompanied by a printed report is returned to the area supervisor r designated validator for final approval. This process constitutes the third level of review.

The data reporting format, which is generated by the client services group, will vary depending upon the client project requirements. A wide variety of reporting packages are available, including customized presentations. Also, a fourth level review is performed at the point of report generation by client services.

The project chemist subsequently performs a fifth level review to ensure that the data fulfills the total objectives of the customer and is presented in an understandable manner. Further, the Quality Assurance Supervisor performs a random audit of approximately 5% of all laboratory data before the information is reported to the client (Refer to Figure 51).

4.4.1 Field Data

All data reduction, validation, and reporting for field activities must meet the same requirements as those listed in section 4.4.2 below involving laboratory data. In addition, field testing places an added responsibility on the analyst because it is much more difficult to return to the site for a retest at a later time than for the laboratory analyst who usually has sufficient sample to perform a requested retest in the laboratory. Furthermore, many of the field instruments, such as those measuring pH, dissolved oxygen, turbidity, temperature, and specific conductance, require a manual data printout from a computer interface. The analyst is responsible for immediate tabulation and calculation of raw data in the field. The field section supervisor must perform a prompt, on-site validation of field data before the opportunity is lost to perform any necessary field retests. Where possible, data which has been validated should be entered into a field electronic database using a portable (laptop) computer; this can facilitate transmission via modem to the laboratory and also the prompt transfer of data by diskette.

4.4.2 Laboratory Data

Data Reduction

Analytical data from most of the instruments at the TriMatrix laboratory is generated through computer programs interfaced to the instruments. For example, GC/MS data is processed through a local PC utilizing the manufactuer's software. Gas chromatographs are interfaced to turbochrome software from PE Nelson.

Computer data reduction utilizes software that has been validated for its intended purpose. The computer program usually incorporates all calculations, dilutions, etc. eliminating the need for further manual data reduction. Where manual data reduction is required, it is performed according to the written standard operating procedure for that analysis.

Data Reduction, Validation and Reporting

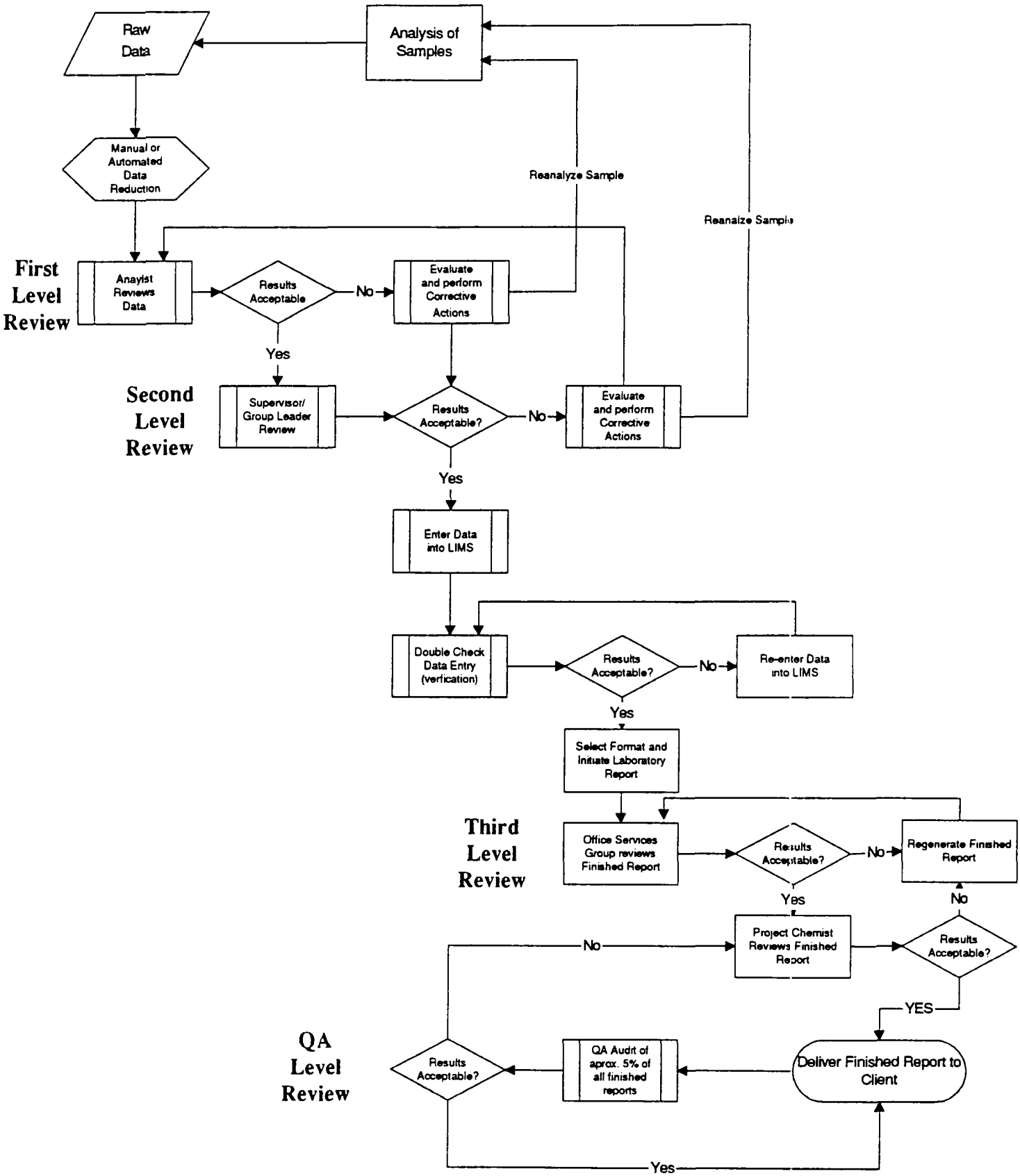

Figure 51

Data Validation

First Level Review: Raw Data

The laboratory analyst follows a written data validation check list to ensure:

Proper analytical sequence sample preparation information is correct.

Applicable standard operating procedures were followed.

Calibration has been performed properly.

Analytical results are complete.

Holding times have been met.

Analysis information is correct.

Calculations are performed properly.

Method criteria are met (sound analytically).

Quality control samples are within established limits.

Any special sample preparation or analytical requirements have been achieved.

Documentation is complete.

Raw data

Chromatograms, instrument printouts

Worksheets

Case narrative or qualifier pages

All analytical abnormalities have been noted.

Corrective actions are thoroughly described.

Good recordkeeping practices have been followed.

Any problems are communicated to supervisor.

Second Level Review; Raw Data

The laboratory area supervisor or designated validator ensures that:

quality control samples are within established limits

qualitative and quantitative results are correct

calibration data is correct per the analytical method

the analytical method has been followed

documentation is complete and data is legally defensible

the laboratory data package is ready for data entry and verification

any problems are communicated to analyst and, when appropriate for wider review, to the quality assurance supervisor.

Third Level Review; Raw Data and Finished Client Report

The client services staff ensures that data is accurately presented in final report.

Fourth Level Review; Finished Client Report

The project chemist ensures that:

Requirements of the client have been met.

The overall presentation of data to the client is in an attractive, understandable format.

Quality Assurance Review (Fifth Level of Review) Finished Client Report

The QA supervisor randomly audits approximately 5% of all data generated to ensure that:

Good record-keeping practices have been followed.

Quantitative results are correct.

Data is legally defensible.

Holding times have been met.

Calibration checks are sufficient.

QC results are acceptable.

Documentation is complete.

Corrective actions have been thoroughly described.

"Common Sense" Guidelines For All Levels of Review

In addition to the formal data validation guidelines listed above for the analyst, supervisor, project chemist, and QA supervisor , there are many practical questions that all of these persons need to keep in mind when reviewing data and finished client reports. Among these "common-sense" evaluations of laboratory data are the following important considerations:

Data makes good, sound, practical sense.

Multiple runs of the same samples relate, match, or are within acceptable range.

Data from complimentary analyses compares - COD>BOD>CBOD

- Total cyanide ≥ amenable and free cyanide
- Sum of anions and cations should not exceed specific conductance.
- Total solids ≥ suspended and dissolved solids.
- TKN ≥ organic N + ammonia N
- Inorganic N = ammonia N + nitrate N + nitrite N
- TOC < BOD or COD
- Total phosphorus ≥ orthophosphorus
- (Conductivity) x 0.6 - 0.9 = total dissolved solids
- TPH-GRO > BTEX

Analytical run looks good; proper decisions were made.

Peaks from chromatogram or instrument printout look normal.

Computer identifications are correct.

Are hits real, especially low level?

Know and be sensitive to common laboratory contaminants.

Know area/analytical method pitfalls-be extra cautious.

All practices are sound and are supported by documentation-no appearance of random decisions.

Data Reporting

When laboratory analyses and review of data are completed, laboratory reports for clients are generated by the office services group according to a written standard operating procedure. Each step of the procedure is critical to the prompt generation of an accurate and complete laboratory report by office services personnel.

Data entry requires a computer password and is restricted to certain individuals on the office services staff. An identification number for the entry person tracks each data item. Restricted entry to the computer database protects the client data. Data entry is verified for correctness by a second person after the initial entry.

To initiate a laboratory report, the office services staff must review the project for special instructions and completion of data entry before accepting the project as complete. The project is subsequently assigned a completion date and removed from the daily laboratory work schedule.

A format is selected from among many possibilities (regular, TCLP, state agency, BNA, VOA, Pest/PCB, etc.). If qualifiers or case narrative are involved, then the appropriate entries are made from a standardized list using uniform wording.

When the laboratory report content is complete, a printout is reviewed for accuracy and appearance before a final version is forwarded to the project chemist. A fourth level review by the project chemist is the last step before the finished laboratory report is delivered to the client.

4.5 VERIFICATION PRACTICES - EXTERNAL/INTERNAL QUALITY CONTROL

4.5.1 Standard Reference Materials

A crucial step in the generation of quality data is the purity and traceability of reference materials used in the analyses. Reference materials may be physical standards (such as certified thermometers and weights used to calibrate laboratory thermometers and balances) or chemical standards (used to establish and check operational calibration of analytical methods). Physical standards should be traceable to the National Institute of Standards and Technology (NIST). Physical standards must be recalibrated every two years by an external vendor who is certified to perform the calibration. Chemical reference materials of high quality can usually be obtained from reliable commercial vendors. In addition, Standard Reference Materials (SRM's) are available from NIST for a significant number of analytes and various matrices. For a given analysis, standard reference materials should be kept on hand from more than one vendor source. During the testing operation standard reference materials from different vendor sources should be cross-checked with each other. That is, a calibration curve would be performed using standards from a different vendor source.

4.5.2 Internal Quality Control Programs

4.5.2.1 TriMatrix Analytical Services routinely adds samples to the sample stream to demonstrate that the total testing process is operating within prescribed limits for accuracy and precision. With the exception of Blanks, the concentration of these quality control samples is known prior to the analysis. Types of Quality Control Samples are in Table 8.

TABLE 8

Blank Type	Abbreviation	Description	Frequency of Use
Method Preparation Blank	MPB	This blank has been carried through the entire analytical process including any pretreatment procedures. The MPB will monitor any contaminants that may affect the sample results. General acceptance limits for the MPB are ± the test reporting Limit. If contamination is detected in the MPB, all samples with analyte concentratins <5X the test reporting limit, must be flagged for re-extraction or digestion. If it is not possible to re-prep the samples, then all analyses for that batch must be qualified.	One per analytical batch
Daily Instrument Analytical Blank	BLK	Analyzed once per day and/or at the beginning of analytical operations, this blank is used to detect any contamination in the instrument system.	One per day or per analytical batch

TABLE 8

Blank Type	Abbreviation	Description	Frequency of Use
Initial Calibration Blank	ICB	This is reagent blank that is analyzed as a sample after a calibration curve has been generated for an analysis. The ICB will check how close the curve passes through zero. Acceptance limits for an ICB are ± the Test Reporting Limit. If the ICB is outside these limits, the instrument must be recalibrated and the ICB reanalyzed.	One per analytical batch or as specified in the analytical method.

TABLE 8

Blank Type	Abbreviation	Description	Frequency of Use
Continuing Calibration Blank	CCB	The continuing calibration blank is a reagent blank that is analyzed as a sample, generally after 10 samples have been tested. The CCB must be run prior to re-zeroing an instrument, unless this practice was performed for each previous sample. The CCB will verify whether significant instrument draft has occurred during the analytical run near the test method detection limit. General acceptance limits are ± the test reporting limit. If the CCB falls outside the acceptance limits, the instrument must be recalibrated and the previous 10 samples reanalyzed. For automated tests where run data is generated after all analyses are completed, 10 samples before and after the unacceptable CCB must be reanalyzed, i.e., all sample results must be encased in acceptable CCB. The reanalysis must also include the ICB and ICV QC samples.	Every ten samples/or as specified in the analytical method.

TABLE 8

Blank Type	Abbreviation	Description	Frequency of Use
Field Trip Blank	FTB	These are used with VOA vials where there is the possibility that organic contaminants may diffuse through the teflon-faced silicone rubber septum of the sample vial. A field trip blank vial filled with organic-free water accompanies the sample containers to and from a client location, at the discretion of the client, may be analyzed along with the samples.	One per sample shipping container
Storage Blank	STB	Reagent-grade water (40 ml aliquot) is stored with samples in a client set. Per the discretion of the client, it may be analyzed after all samples in that set are analyzed. The purpose is to determine the level of contamination acquired during storage.	One per sample storage refrigerator or client sample set (if required)

TABLE 8

Blank Type	Abbreviation	Description	Frequency of Use
Sulfur Blank	SVB	This is a modified method blank that is prepared only when some of the samples in a batch are subjected to sulfur cleanup. It is used to determine the level of contamination associated with the sulfur cleanup procedure. When all of the samples are subjected to sulfur cleanup, then the method preparation blank serves this purpose. When none of the samples are subjected to sulfur cleanup, no sulfur blank is required.	When some of the samples in a batch undergo sulfur cleanup.

TABLE 8

CONTROL SAMPLES

Control Type	Abbreviation	Description	Frequency of Use
Laboratory Fortified Blank	LFB	This is a fortified method preparation blank in which an aliquot of deionized water has been spiked with a known amount of a stock reference standard or spiking solution. A blank spike is required for each digestion or distillation batch. The purpose of the blank spike is to verify the analyst's spiking procedure and assure that any matrix interference shown by the spike and spike duplicate is really matrix induced.	One per analytical batch

TABLE 8

CONTROL SAMPLES

Control Type	Abbreviation	Description	Frequency of Use
Laboratory Control Sample	LCS	The laboratory control sample is a reference sample of know value traceable to a reliable commercial vendor such as APG, ERA; or NIST or EPA. This sample may also be prepared in the laboratory from an independently prepared stock standard. The purpose of the LCS is to validate the accuracy of the analytical procedure. A BLK is usually analyzed prior to the analysis of the LCS. Acceptance limits for this QC type are based on a 95% confidence limit generated from historical data for this test. Also, a particular test method may have published acceptance limits for the LCS. If the LCS falls outside the established limits, the analytical batch must be flagged for re-extraction, re-digestion, or reanalysis. It is impossible to repeat the analysis (e.g. BOD test) then all data for the batch must be qualified.	One per analytical batch or per new calibration curve (organic analyses)

TABLE 8

Control Type	Abbreviation	Description	Frequency of Use
Initial Calibration Verification	ICV	The initial calibration standard is a mid-range standard. Generally one of calibration from the same stock is used. This standard is analyzed as a sample and compared with the standard curve. The ICV checks the precision of the curve. Acceptance limits for this standard are ± 10%, or as stated in a particular method. An ICB must be analyzed prior to testing the ICV. If the ICV falls outside the acceptance limits, the instrument must be recalibration and the process repeated.	Once per analytical batch or as specified in the analytical method

TABLE 8

Control Type	Abbreviation	Description	Frequency of Use
Continuing Calibration Verification	CCV	The continuing calibration verification is generally the same midrange standard that was analyzed as the ICV. The standard is analyzed as a sample and compared with the standard curve. The ICV will reveal any significant draft of the curve. Acceptance limits for this QC type are ± 10%, or as stated in a particular method. If the CCV falls outside the acceptance window, the instrument must be recalibrated and the previous 10 samples reanalyzed. For automated tests where run data is generated after all analysis is complete, 10 samples before and after the unacceptable CCV must be reanalyzed, i.e. all samples must be encased in acceptable CCV. The reanalysis must include the ICB and ICV QC types.	Every 10 samples

TABLE 8

Control Type	Abbreviation	Description	Frequency of Use
Contract Required	CRDL	A standard which contains the minimum level of detection acceptable under a contract Statement of Work must be analyzed for particular contract sample sets to demonstrate that detection limit can be met.	One per analytical batch for certain contract sample sets and methods only.
MATRIX QC SAMPLES			
Sample Matrix Spike	SPK	The sample matrix spike is an aliquot of a sample that has been spiked with a known amount of a stock reference standard or spiking solution. A the purpose of the SPK is to monitor sample matrix effects on the test. Acceptance limits for this QC type are based on the 95% confidence limits established for a test and matrix.	Every 10 samples for each matrix type, or as specified in the analytical method

TABLE 8

Matrix QC Type	Abbreviation	Description	Frequency of Use
Matrix Spike Duplicate	MSD	A matrix spike duplicate is an aliquot of the same sample used for the matrix spike (SPK). A spike duplicate is required for each matrix type within a digestion or distillation batch. A spike duplicate analysis may be required on an non-distilled or non-digested sample if the spike has indicated a matrix interference. The purpose of this duplicate spike is to confirm any matrix effects on the test. Acceptance limits for this QC type are based on the 95% confidence limits established for a test and matrix.	Every 10 samples for each matrix type or as specified in the analytical method
Sample Duplicate	DUP	The sample duplicate is a replicate analysis of a particular sample that has been analyzed previously during the sample analytical batch. The purpose of the duplicate is to monitor precision within the analytical process.	Every 10 samples for each matrix type

TABLE 8

Matrix QC Type	Abbreviation	Description	Frequency of Use
Field Duplicate	FDUP	This may be required to evaluate the uniformity of samples and sampling techniques at a field location. Acceptance limits for this QC type are based on established confidence limits, with generally two levels or ranges. The first range extends from the test reporting limit test to 10x the test reporting limit. The second range encompasses any values higher than 10x the MDL.	As required on a project basis
Post Digestion Spike	PDS	The post-digestion spike may be required, on a project basis, when a matrix precludes the use of pre-digestion spike.	One per analytical batch when required by project

TABLE 8

MISCELLANEOUS QC SAMPLES

	Abbreviation	Description	Frequency of Use
Surrogate Spike	SUR	For semi-volatile, volatiles, pesticide, PCB analyses, these surrogate compounds are added to every blank, sample, matrix spike, matrix spike duplicate, and standard. Surrogate compounds, which are used to measure analytical efficiency by measuring recovery, are brominated, fluorinated, or isotopically labeled compounds not expected to be detected in environmental samples.	Every QC and per batch for semi-volatile, volatile, pesticide, PCB analysis
Internal Standard	INS	These are compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatiles), at a known concentration, prior to analysis. Internal standards are used as the basis of quantitation of the target compounds.	Every QC and client sample per batch for volatiles and semi-volatiles

4.5.2.2 Presented in Table 9, is an example of a sequence of analysis using Internal Quality Control Samples for trace metals.
(Note that sequences may vary depending on the analytical method and the instrument being used).

TABLE 9
Sequence of Analysis
Metals Analysis - ICP

ID/WT Sheet Setup for Instrument Calibration and Verification

Sequence Number	Autosampler Position	Sample ID	Solution Name
1	1	is_init	BLANK
2	2	Std OPT A	Std OPT A
3	3	Std OPT B	Std OPT B
4	4	Std OPT C	Std OPT C
5	1	blank	BLANK
6	2	ICS-A	Std OPT A
7	3	ICS-B	Std OPT B
8	4	ICS-C	Std OPT C
9	5	ICV-A	ICV/CCV OPT A
10	6	ICV-B	ICV/CCV OPT B
11	7	ICV-C	ICV/CCV OPT C
12	1	Blk	BLANK
13	9	IEC-1	IEC-1
14	10	IEC-2	IEC-2
15	11	ICAP-7	Independent check
16	12	IV-19	Independent check
17	13	era1027	Independent check
18	14	Sn 10.0	Independent check
19	15	era3.11	Independent check
20	16		Sample1
21	17		Sample 2
22	5		CCV OPTA
23	6		CCV OPTB
24	7		CCV OPTC
25	18		CCB
26	19		Sample 4
27	20		Sample 5
28	21		Sample 6
29	22		Sample 8
30	23		Sample 9
31	24		Sample 10

4.5.3 External Quality Control Samples-Proficiency Testing

TriMatrix laboratories receive performance evaluation (PE) samples on a scheduled basis from state and federal regulatory agencies as well as certain client organizations. A summary of these PE samples is given below:

Evaluation Sample Identification	*Sample Type*	*Source*	*Frequency of Receipt of Samples*
WS	Drinking Water Certification	USEPA	Twice Per Year
WP	Waste Water (NPDES)	USEPA	Twice Per Year
DMR-QA	Discharge Monitor Reporting	USEPA	Once Per Year
PE	Environmental	Certain State Certifying Agencies	Once Per Year
PE	Environmental	Specific Clients	Once Per Year
Double-Blind PE	Environmental	Analytical Standards Inc. (ASI)	Once Per Year

TriMatrix laboratories receive written reports from sponsoring agencies grading not only the laboratory performance but also showing the comparison to other laboratories participating in the same performance evaluation studies. This provides feedback to laboratory personnel regarding the satisfactory use of analytical methods and equipment.

4.6 DATA ASSESSMENT PROCEDURES

4.6.1 Precision

Precision of laboratory analyses will be assessed by comparing the analytical results between matrix spike/matrix spike duplicate (MS/MSD) for organic analyses, and laboratory duplicate or MSD analyses for inorganic analyses. The relative percent difference (% RPD) will be calculated for each pair of duplicate analyses using Equation 4.6.1.

Equation 4.6.1

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

Where:

S = first sample value (original of MS value)

D = second sample value (duplicate or MSD value)

4.6.2 Accuracy

Accuracy of laboratory results will be assessed for compliance with the established QC criteria using the analytical results of method blanks, reagent/preparation blank, matrix spike/matrix spike duplicate samples, equipment blank, and trip blanks. The percent recovery (%R) of matrix spikes will be calculated using Equation 4.6.2.

Equation 4.6.2

$$\% \text{ R} = \frac{A-B}{C} \times 100$$

Where:

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

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

C = the amount of the spike added.

4.6.3 Completeness

The data completeness of laboratory analyses results will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using Equation 4.6.3.

Equation 4.6.3

$$\text{Completeness} = \frac{\text{valid data obtained}}{\text{total data planned}} \times 100$$

4.7 PROCEDURES FOR CORRECTIVE ACTION

When an even occurs which is outside the normal operating parameters for the total testing process, a non-conforming event or process deviation has occurred which places the process out of control, and corrective action is required. A written standard operating procedure (plan for corrective action) provides the steps for dealing with an out-of-control testing situation. The assessment of whether the process is out of control is based on predetermined limits for laboratory operations. Nonconformances based on statistical analysis or quality control samples are readily apparent and easy to identify. A process deviation which does not have an directly observable impact on data quality is more difficult to discern. Examples of the latter, more subtle types of nonconformances include volatiles samples not properly stored; oily layers in certain types of samples which may interfere with the analysis; a water-soaked sample label whose information is barely readable; a cluttered and disorganized laboratory bench which increases the probability that a mix-up will occur; a person too preoccupied with interruptions or distractions to concentrate on a task; the expected quantity has not been removed from a sample container after the testing has commenced. Discovery of a nonconforming event or process deviation

can result from the observations of a staff member, a review of laboratory data at any level, or as the result of a quality audit.

The overall scheme of a correction action plan can be outlined as follows:

1. Define the problem.
2. Assign responsibility for evaluating the problem.
3. Determine thorough investigation of all the pertinent facts what the probable cause of the problem is.
4. Define a corrective action to eliminate the problem.
5. Assign responsibility for carrying out the corrective steps and implement the action.
6. Follow-up to ensure that the problem has been eliminated.

Specific responsibility for implementing corrective action is as follows.

It is the responsibility if the analyst or other employee who observes a non-conforming event to:

- Identify and define the problem.
- Write a non-conformance report (refer to Figure 52).
- Investigate and attempt to determine the cause of the problem.
- Report the problem promptly to the immediate supervisor along with a recommended course of action to eliminate the problem.
- Accept responsibility for implementing the corrective action approved by the supervisor.
- Implement the corrective action and evaluate its effectiveness.
- Verify that the corrective action has eliminated the problem.
- Document the corrective action in laboratory notebook or on worksheet.

It is the responsibility of the laboratory area supervisor to:

- Review the problem and the proposed corrective action.
- If the reporting person does not have a remedy, to work together with the person to determine a satisfactory solution.
- Assign the final corrective action steps to be performed.
- Sign and date corrective action entry in the laboratory notebook or on worksheet after completion.

It is the responsibility of the QA supervisor to:

- Review, sign, and categorize every nonconformance/report memo for later inclusion in the QA monthly report.
- Randomly review corrective action documentation in laboratory record through internal audits to ensure that adequate records are being kept.

In general, there are three major areas where corrective action is required, and these categories are described below.

4.7.1 Quality Control Failures

These are usually handled within the laboratory by the analyst.

Indications of Nonconformance

Blanks, laboratory controls, spikes, or surrogates contain contamination greater than acceptable levels.

Suspicious trends in spike recoveries or relative percent difference (RPD) between duplicates.

Initial instrument blank, initial calibration standards. QC check standards, continuing calibration standard spikes, or method blanks are outside acceptance criteria.

The method blank or instrument blank analysis exceeds the detection limit for that analyte.

Recommended Corrective Action

Prepare another instrument blank. If the response is still greater than the reporting limit, look for sources of contamination in reagents, laboratory working environment, instrument.

Reanalyze standard. If results are still unacceptable, prepare new standards. If necessary obtain new primary standards.

Reanalyze continuing calibration standard. If necessary, recalibrate and reanalyze samples since last successful continuing calibration.

Evaluate preparation of spikes, spiking techniques, spiking equipment and materials.

4.7.2 Procedural Failures

These are usually handled by the laboratory area supervisor and the quality assurance supervisor.

Indications of Nonconformance

There are unusual changes in detection limits.

Statistical quality control data (SQC) is demonstrating unacceptable trends or is outside the warning or acceptance limits.

Deficiencies are evidenced on performance evaluation samples or internal or external audits.

Clients express concern about the quality of their data.

Recommended Corrective Action (per USEPA guidelines)

Review the method with the analyst.

Reanalyze the samples and evaluate the results.

Recalibrate the instrument or analysis method with freshly prepared standards and reanalyze the samples.

Re-extract and reanalyze the samples per the method.

Evaluate the data and sample behavior and investigate any possible chemical interferences.

Re-run the samples using the method of standard additions.

Check the instrument for possible maintenance deficiencies.

Seek additional help from other analysts or provide additional training for personnel involved.

Perform a system audit to evaluate corrective action measures.

4.7.3 Test Specification Failures

These are usually handled by the analyst, laboratory area supervisor, and the quality assurance supervisor.

Indications of Nonconformance

Quality control check standard data is outside the acceptance limits defined for that analyte.

Recommended Corrective Action

Review the method with the analyst.

Reanalyze the check standard and evaluate the results.

Prepare fresh check standard or new primary standard.

Recalibrate the instrument or analysis method.

Switch to a different standard vendor.

Investigate possible chemical interferences.

Check the instrument for possible maintenance deficiencies.

Retrain the analyst.

4.7.4 Customer Complaints

The Quality Assurance Supervisor coordinates with the client services staff to receive quality feed back from clients. It is the responsibility of the QA Supervisor to communicate any customer complaints to the laboratory operating areas and to follow-up on corrective action taken to prevent a recurrence.

4.8 DEPARTURE FROM DOCUMENTED PROCEDURES

4.8.1 Management Policies

4.8.1.1 Any departure from a laboratory written standard operating procedure not directly involving sample analysis or processing must be approved by the immediate supervisor. The supervisor must file a Nonconformance Report.

4.8.1.2 Any departure from a USEPA or compendia analytical method involving sample processing or sample analysis must be justified in writing by they analyst and laboratory supervisor. The prior written approval of the laboratory director must be received before performing the analysis. Furthermore, the Laboratory Director must notify in writing the Vice-President, Laboratory Division, within 48 hours of this deviation. The laboratory director must also file a Nonconformance Report.

(Note: the exception to this requirement in 4.8.1.2 is those items in the analytical methods where a written justification for technical and scientific reasons has been determined by the analyst and approved by the Laboratory Director as a deviation from the analytical method).

4.8.2 Method Modification and Variances

Modification of and variances in analytical methods, except for the deviations justified in writing and approved per section 4.8.1.2 above, are strictly prohibited.

4.9 PERFORMANCE AND SYSTEM AUDITS

4.9.1 Internal Audits

4.9.1.1 System Audits

At least once each month, the Quality Assurance Supervisor or his designate performs an audit of at least one of the laboratory systems listed below, so that all laboratory systems receive a formal audit at three times per year.

A). Sample Handling and Control
B). Sample Analysis
C). Records Processing and Control
D). Support Systems (such as air handling, DI water, analytical balances, raw materials, etc.)

The system audits are to be used to determine that each component within a laboratory system is functioning properly and adheres to the appropriate standard operating procedures, analytical methods, and requirements of the Quality Assurance Manual. Develop formal checklists to use in System Audits to ensure that consistency of inquiring is maintained from month-to-month.

4.9.1.2 Documentation Audits

At least once each month, the Quality Assurance Supervisor or his designate performs an audit of the laboratory documentation (laboratory notebooks, benchsheets, instrument run logs, client file folders, etc) to assess the thoroughness and completeness of the documents. The guidelines for documentation (DO's and DO NOT's of GOOD RECORD KEEPING) are to be used as a benchmark in evaluation of documentation. Develop formal checklists for Documentation Audits to ensure that consistency of inquiry is maintained from month-to-month.

4.9.1.3 Surveillance Audits

At least once a month, the Quality Assurance or area Supervisor or their designate observes an analyst in detail as a test is being performed. Attention is given to general laboratory demeanor (orderliness, cleanliness, good laboratory practices in measuring, documentation, etc.) as well as to adherence to analytical methods and standard operating procedures., Develop formal checklists for surveillance audits to ensure that consistency of inquiry is maintained from month-to-month.

4.9.1.4 Quality Assurance Reports to Management

The Quality Assurance Supervisor issues a written report to the Laboratory Director within 1 week of an audit. The report should detail any deficiencies identified as well as recommended corrective action. The report should designate how follow-up on corrective actions by the Laboratory Area Supervisor and the Quality Assurance Supervisor will occur.

4.9.2 External Audits

4.9.2.1 On-Site Audits

A well-run laboratory should have nothing to fear from a visit by external auditors. Therefore, the audits of the laboratory conducted by regulating agencies and client organizations are to be perceived by the laboratory staff as positive occurrences-learning experiences and opportunities to hear suggestions from knowledgeable persons on how operations might be improved. Consequently, the laboratory staff is to be open and cooperative with external auditors. Formal follow-up using written summaries of external audits is to be carried out to ensure that any suggested improvements are thoroughly evaluated.

4.9.2.2 Double-Blind Evaluation Studies

TriMatrix Laboratories participate in at least one double-blind sample program each year. An example is the current arrangement with Analytical Services, Inc. (ASI) to provide such samples. In this program, only the Quality Assurance Supervisor is aware of the arrival of these proficiency check samples, since ASI uses one or more fictitious engineering companies to conduct the entire transaction with the laboratory. A follow-up report is issued by ASI to the Quality Assurance Supervisor, showing not only the laboratory performance but the ranking among the many other laboratories which participate in the double-blind evaluation study.

TriMatrix Laboratories, Inc.

ENVIRONMENTAL LABORATORY

NON-CONFORMANCE REPORT

Client Name: _____ **Document Control No:** _____

Project Description: _____ **Submittal Number:** _____

_____ **Sample Number(s):** _____

Lab Area/Activity:

Sample Receiving:	☐	Extraction Lab:	☐
Sample Log-In	☐	Inorganic Lab:	☐
Sample Storage:	☐	Metals Lab:	☐
Client Services:	☐	Volatiles Lab:	☐
Customer Compliant:	☐	Semi-Volatiles Lab:	☐

Non-Conformance : _____

Initials/Date: _____

Corrective Action: _____

Initials/Date: _____

Preventative Action: _____

Due Date: _____ **By Whom:** _____

Client Notification: FAX / TEL / SDQ / WRT **By Whom:** _____ **Date/Time:** _____

QA Review:

QA Officer: _____ **Area Supervisor:** _____

FIGURE52.XLS

Figure 52

5.0 REFERENCES

- Methods for Chemical Analysis of Water and Wastes; EPA-600/4-79-020 revised March, 1983.
- Standard Methods for the Evaluation of Water and Wastewater; Current Edition, APHA, AWWA, WPCF.
- Handbook for Analytical Quality Assurance in Water and Wastewater Laboratories; EPA 600/4-79-019, March 1979.
- Physical and Chemical Methods for the Evaluation of Solid Waste; EPA-SW846 Third Edition.
- Guidelines Establishing Text Procedures for the Analysis of Pollutants; 40 CFR; Parts 100 to 149, Current Edition.
- Water and Environmental Technology", Annual Book of ASTM Standards , Volume 11.01; Section 11; Current Edition.
- Good Automated Laboratory Practices; USEPA Office of Adiminstation and Resource Management, December 28, 1990.

6.0 TABLES

All Tables are currently incorporated into the text of the manual.

7.0 APPENDICES

Appendix A - Employee Training Record

Appendix B - Equipment List

Appendix C - Example Quality Control Reports

Appendix D - Bottle and Preservative Requirements

APPENDIX A

Employee Training Record

TriMatrix Laboratories, Inc.

LABORATORY ANALYST CERTIFICATION FORM

NAME OF ANALYST: _____

PROCEDURE NUMBER_____

PROCEDURE NAME_____

I. Certification Steps:

- Complete Items 1) through 5) on Laboratory Analyst Training Checklist.
- Analyze at least four performance evaluation samples by the same procedures used to analyze actual test samples.
- Calculate the average recovery (x) and the standard deviation (s) for each analyte of interest expressed as percent recovery of the performance evaluation sample.
- For each analyte, compare s and x with the corresponding acceptance criteria for precision and accuracy, respectively, given in the QC Acceptance Criteria at the end of the analytical method. If s and x for all analytes of interest meet the acceptance criteria, the system performance is acceptable and analysis of actual test samples can begin.
- If any individual s exceeds the precision limit or any individual x falls outside the range for accuracy, then the system performance is unacceptable for that analyte and the following corrective action is required:
- Locate and correct the source of the problem and repeat the analysis for all analytes of interest which failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system; if this occurs, locate and correct the source of the problem. Repeat the test until the s and x for all analytes of interest meet the acceptance criteria.
- Attach a copy of all supporting analytical data to the Laboratory Analyst Certification Form.

Results of Performance Evaluation Sample Analysis:

Sample ID	Test Result (% Recovery)
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Statistical Analysis of Data

Σ _____

n _____

x _____

s _____

x + s _____

Analytical Method Acceptance:
Criteria:
Accuracy (x) _____
Precision (x + s) _____

II. Analysis of Blanks

- Analyze two MPB, results must be < current established MDL.

The certification sample results are acceptable and the analyst is authorized to perform this procedure for one year from the date below.
Signed(Area Manager) :_____ Date: _____

k:/project/sop/qam/CERTFORM

TriMatrix Laboratories, Inc.

LABORATORY ANALYST TRAINING CHECKLIST

NAME OF ANLAYST_____

METHOD NUMBER_____

METHOD TITLE _____

_____

PROCEDURE NUMBER _____

PROCEDURE TITLE _____

_____

_____ 1) The analyst has read the method and the standard operating procedure.

_____ 2) The instructor has reviewed the method and the procedure with the analyst.

_____ 3) The instructor has performed a manual demonstration of the procedure.

_____ 4) The analyst has successfully performed the procedure under direct supervision.

_____ 5) The analyst has successfully performed the procedure without direct supervision.

_____ 6) The analyst has successfully analyzed at least four performance evaluation samples, following the steps listed on the Laboratory Analyst Certification Form.

_____ 7) The Laboratory Analyst Certification Form has been compiled and all supporting analytical data attached.

INSTRUCTOR _____ DATE _____

Form Labancert; Revision New; Effective Date 11-30-94.

TriMatrix Laboratories, Inc.

LABORATORY ANALYST TRAINING CHECKLIST

NAME OF ANLAYST_____

METHOD NUMBER_____

METHOD TITLE _____

_____

PROCEDURE NUMBER _____

PROCEDURE TITLE _____

_____

_____ The analyst has read the method and the standard operating procedure as required for annual recertification.

ANALYST _____ DATE _____

INSTRUCTOR _____ DATE _____

Form Labancert; Revision New; Effective Date 2-1-95.

TriMatrix Laboratories, Inc.

Analytical Services

Employee Training Record

Name: _____ **Employee No:** _____

Date of Hire: __/__/__

Position: _____ **Lab Area:** _____

Primary Responsibilities: _____

_____

_____

_____

_____

Position Change (1): _____ **Lab Area:** _____ **Start Date:** __/__/__ **End Date:** __/__/__

Primary Responsibilities: _____

_____

_____

_____

Position Change (2): _____ **Lab Area:** _____ **Start Date:** __/__/__ **End Date:** __/__/__

Primary Responsibilities: _____

_____

_____

_____

Document Control No: _____

Training General

Signatures/Dates

Name:_____

	Trainee:	Trainer:
Laboratory Introduction/Walk-Through	_____ __/__/__	_____ __/__/__
Company Benefits Review-Personnel Dept.	_____ __/__/__	_____ __/__/__
Safety-Chemical Hygiene Plan Review	_____ __/__/__	_____ __/__/__
Safety Exam	_____ __/__/__	_____ __/__/__
Safety Walk/Safety Equipment Review	_____ __/__/__	_____ __/__/__
Computer Network/Email Training	_____ __/__/__	_____ __/__/__
Laboratory Information Management System	_____ __/__/__	_____ __/__/__

Document Control No: _____

Training-Quality Assurance

Name: _____

	Signatures/Dates	
	Trainee:	Trainer:
QA Officer Interview/QA Manual Review	_____ __/__/__	_____ __/__/__
General QA Objectives-QC Types	_____ __/__/__	_____ __/__/__
Bench sheets/Control Windows/Qualifications	_____ __/__/__	_____ __/__/__
Chemical Inventory Program	_____ __/__/__	_____ __/__/__
Stock Standard Record Procedures	_____ __/__/__	_____ __/__/__
Instrument Maintenance Logs	_____ __/__/__	_____ __/__/__
Instrument Run Logs	_____ __/__/__	_____ __/__/__
Analyst Notebook Procedures	_____ __/__/__	_____ __/__/__
Data Recording and Changes	_____ __/__/__	_____ __/__/__
Data Review and Documentation	_____ __/__/__	_____ __/__/__

Document Control No: _____

Training-Laboratory Specific

Signatures/Dates

Name: _____

	Trainee:	**Trainer:**
Introduction to Apparatus/Equipment	_____ __/__/__	_____ __/__/__
Paperwork Flow-Lims Training	_____ __/__/__	_____ __/__/__
SOP Review-General Format	_____ __/__/__	_____ __/__/__
SOP Review-Method Specific	_____ __/__/__	_____ __/__/__
Methods: _____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__

Document Control No: _____

Training-Analyst Certifications

Signatures/Dates

Name: _____

Methods:	**Trainee:**	**Trainer:**
_____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__
_____	_____ __/__/__	_____ __/__/__

TriMatrix Laboratories, Inc.

Analytical Services

APPENDIX B
Equipment List - Inorganic

Instrument Description	Manufacturer	Model No.	Year Purchased	Detector or Type	Primary Use	TriMatrix I.D. No.
Auto-Analyzer (dual channel)	Bran & Lubbe	TRAACS 800	1987	VIS	353.2/350.1	160
Auto-Analyzer (four channel)	Lachat	Quick Chem	1990	VIS	300 series EPA	161
Conductivity Meter	YSI	32	1986	-----	120.1/9050	162
FTIR Spectrophotometer	Perkin-Elmer	1600	1990	IR	418.1	163
pH/mv Meter	Orion	710A	1993	-----	150.1	164
pH/mw/ISE Meter	Orion	EA920	1991	-----	150.1	165
Spectrophotometer (UV-VIS)	Shimadzu	1604	1990	UV/VIS	300 series EPA	166
Spectrophotomer (UV-VIS)	Shiamdzu	1201	1992	UV/VIS	300 series EPA	167
Total Organic Carbon Analyzer (TOC)	O.I.C.	700	1990	ND-IR	415.1	168
Total Organic Halogen Analyzer (TOX)	Xertex/Dohrman	---	1986	coulometric	9020	169
Turbidimeter	HACH	43900	1992	nephlometric	180.1	170
Polarograph	EG&G Princeton AR	384B	1991	dropping Hg	7198/8411	171

TriMatrix Laboratories, Inc.

Analytical Services

APPENDIX B
Equipment List - Inorganic

Auto-Titrator	Metler	DL12	1992	-----	310.x	-----

TriMatrix Laboratories, Inc.
Analytical Services

Equipment List - Atomic Absorption/ICP

Instrument Description	Manufacturer	Model No.	Year Purchased	Detector or Type	Primary Use	EARTH TECH I.D. No.
AA Spectrophotometer (flame/furnace)	Perkin Elmer	5100 PC	1989	190-800nm	200/7000 EPA	104
AA Spectrophotometer (furnace)	Perkin Elmer	5100 PC	1990	190-800nm	200/7000 EPA	105
AA Spectrophotometer (furnace)	Perkin Elmer	4100 PC	1992	190-800nm	200/7000 EPA	106
ICP Spectrophotometer	Perkin Elmer	Plasma 400	1989	160-800nm	200.7/6010	102
ICP Spectrophotometer	Perkin Elmer	Optima 3000	1993	167-792nm	200.7/6010	101
Autosampler	Perkin Elmer	AS-50	1989	-----	-----	-----
Autosampler	Perkin Elmer	AS-51	1990	-----	-----	-----
Autosampler	Perkin Elmer	AS-60	1992	-----	-----	-----
Autosampler	Perkin Elmer	FIAS-200	1989	-----	-----	-----
Mercury Amalgam System	Perkin Elmer	---	1990	-----	245.1	-----
Automated Mercury Analyzer	Leeman Labs	PS200	1992	-----	200/7000 EPA	103
Automated Mercury Preparation System	Leeman Labs	AP200	1992	-----	200/7000 EPA	-----
Microwave Digestion System	CEM	MDS 810	1989	-----	3051	-----

TriMatrix Laboratories, Inc.

Analytical Services

Equipment List - Gas Chromatography

Instrument Description	Manufacturer	Model No.	Year Purchased	Detector or Type	Primary Use	TriMatrix I.D. No.
Gas Chromatographs w/ECD	Varian	3700	1986	ECD	8080/8121	143
Gas Chromatograph w/FID	Varian	3400	1991	ECD/FID	8080	156
Gas Chromatographs w/ECD	Varian	3700	1988	FID/FID	8015/18-Air	130
Gas Chromatographs w/FID/ECD	Varian	3700	1988	FID/PID	8015/18-Air	131
Gas Chromatograph w/FID/CED	Varian	3400	1989	ECD/FID	8080	148
Gas Chromatograph w/Hall-PID	Tracor	540	1990	HALL/PID	601/602/8021	123
Gas Chromatograph w/Hall-PID	Varian	3400	1991	HALL/PID	601/602/8021	146/147
Gas Chromatograph w/Hall-PID	Tracor	9000	1992	HALL/PID	601/602/8021	125/126
Gas Chromatograph w/Hall-PID	Tracor	9000	1992	HALL/PID	601/602/8021	121/122
Autosampler	Varian	2016/LCS 2000	1988	-----	5030	-----
Autosampler	Varian	8000	1991	-----	5030	-----
Autosampler/Concentrator	Tekmar	2016/LCS 2000	1989	-----	5030	-----
Autosampler/Concentrator	Tekmar	2016/LCS 2000	1989	-----	5030	-----
Autosampler/Concentrator	Tekmar	2016/LCS 2000	1990	-----	5030	-----

TriMatrix Laboratories, Inc.
Analytical Services

Equipment List - Gas Chromatography

Autosampler	Tekmar	ALS 2050	1989	-----	5030	-----
Autosampler Concentrator	Tekmar	2016/LCS 2000	1989	-----	5030	-----
Autosampler/Concentrator	Tekmar	2016/LCS 2000	1989	-----	5030	-----
Autosampler/Concentrator	Tekmar	2016/LCS 2000	1991	-----	5030	-----
					5030	
Thermal Tube Desorber	Envirochem, Inc.	850	1990	-----	-----	-----

TriMatrix Laboratories, Inc.

Analytical Services

Equipment List - Gas Chromatography

Instrument Description	Manufacturer	Model No.	Year Purchased	Detector or Type	Primary Use	TriMatrix I.D. No.
Field GC's:						
Gas Chromatograph (FID/ECD)	Trimetrics	9000	1992	FID/ECD	Field Screen	128
Gas Chromatograph w/PID	HNU	301	1986	PID	Field Screen	-----
Gas Chromatograph (Hall/PID)	SRI	8610	1993	HALL/PID	Field Screen	-----
Gas Chromatograph (PID)	Photovac	10555	1991	PID	Field Screen	-----

TriMatrix Laboratories, Inc.

Analytical Services

Equipment List - HPLC

Instrument Description	Manufacturer	Model No.	Year Purchased	Detector or Type	Primary Use	TriMatrix I.D. No.
HPLC	Isco	2300	1988	UV	misc.	152
HPLC	Perkin Elmer	Series 410	1992	Diode Array	8310	151
LC Oven	Perkin Elmer	101	1992	-----	-----	-----
Diode Array Detector	Perkin Elmer	235	1992	-----	-----	-----
Fluorescence Detector	Perkin Elmer	LC240	1992	-----	-----	-----
Chromatography Data Systems:						
Turbochrom	Perkin Elmer		Continually Updated	-----	-----	-----

TriMatrix Laboratories, Inc.

Analytical Services

Equipment List - GC/MS

Instrument Description	Manufacturer	Model No.	Year Purchased	Detector or Type	Primary Use	TriMatrix I.D. No.
Ion Trap	Varian	Saturn II	1991	ION Trap	624/8260	132
Ion Trap	Varian	Saturn II	1991	ION Trap	624/8260	133
Ion Trap	Varian	Saturn II	1993	ION Trap	625/8270	138
Mass Spectrometer	Extrel	ELQ-400	1988	Quadrapole	625/8270	134
Mass Spectrometer	Extrel	ELQ-400	1989	Quadrapole	625/8270	135
Autosampler	Leap	CTC A2005	1993	-----	-----	-----
Autosampler	Leap	CTC A2005	1993	-----	-----	-----
Autosampler	Leap	CTC A2005	1993	-----	-----	-----
Gas Chromatographs w/FID(screening)	Varian	3700	1987	ECD/FID	8080	156
Autosampler/Concentrator	Tekmar	2016/LCS 2000	1991	-----	5030	-----
Autosampler	Dynatech	Dynasoils	1992	-----	5030	-----
Autosampler	Dynatech	Dynasoils	1992	-----	5030	-----
Autosampler	Dynatech	Dynasoils	1992	-----	5030	-----

Chromatography Data Systems:

TriMatrix Laboratories, Inc.

Analytical Services

Equipment List - GC/MS

Turbochrome	Perkin Elmer	4.0	1993	-----	-----	-----

APPENDIX C
Example
Quality Control Reports

15m7 J66t15m7 J66t

16-AUG-1994

8/16/94 1PM

ANALYTICAL BATCH DETAIL REPORT
INORGANIC LABORATORY

OPTICALLY SCANNED BY: DATE: 08-17-94

Batch Number: 71637 Date opened: 12-AUG-1994 Last Used: 16-AUG-1994 Owner: GEH Sequence: 1 Complete: N Control: Y

Method	Subset Application	Subset Ref. Citation	Samples	ICB	ICV	LCS	CCB	CCV
OPHOS/COLOR/WTR	WTR	USEPA-365.2						

	Sequen	QC Batch	Samp	SUR-Seq	Date	Anal	Parameter	Appli	Ref Cit	Det. Lim.	Init Conc	Final Conc	Spike	Typ	%	LCL	UCL	QC	E	D
v	1.000	000000.000.00			12-AUG	GEH	PHOSPHORUS, ORTHO	WTR	USEPA-365.2	0.01		< 0.01		ICB	0.00		10			
v	2.000	000000.000.00		-	12-AUG	GEH	PHOSPHORUS, ORTHO	WTR	USEPA-365.2	0.01		0.025	0.025	ICV	100.00	85	115			
v	3.000	071637.000.00	94789	-	12-AUG	GEH	PHOSPHORUS, ORTHO	WTR	USEPA-365.2	0.01		< 0.01								
v	4.000	071637.000.00	94790	-	12-AUG	GEH	PHOSPHORUS, ORTHO	WTR	USEPA-365.2	0.01		< 0.01								
v	5.000	071637.000.00	94791	-	12-AUG	GEH	PHOSPHORUS, ORTHO	WTR	USEPA-365.2	0.01		< 0.01								
v	6.000	000000.000.00		-	12-AUG	GEH	PHOSPHORUS, ORTHO	WTR	USEPA-365.2	0.01		< 0.01		CCB1	0.00		25			
v	7.000	000000.000.00		-	12-AUG	GEH	PHOSPHORUS, ORTHO	WTR	USEPA-365.2	0.01		0.49	0.5	CCV1	98.00	85	115			
v	8.000	000000.000.00		-	12-AUG	GEH	PHOSPHORUS, ORTHO	WTR	USEPA-365.2	0.01		< 0.01		BLK1	0.00					
v	9.000	000000.000.00		-	8 12-AUG	GEH	PHOSPHORUS, ORTHO	WTR	USEPA-365.2	0.01	< 0.01	0.40	0.38	LCS1	105.26	89.16	112.14			
v	10.000	071637.000.00	94791	-	5 12-AUG	GEH	PHOSPHORUS, ORTHO	WTR	USEPA-365.2	0.01	< 0.01	0.53	0.5	SPK1	106.00	88.02	117.42			
v	11.000	071637.000.00	94791	-	5 12-AUG	GEH	PHOSPHORUS, ORTHO	WTR	USEPA-365.2	0.01	< 0.01	< 0.01		DUP	0.00		20.88			

Batch Narrative

Analysis Narrative

94789	PHOSPHORUS, ORTHO	USEPA-365.2	WTR	16-AUG-94	DMM Sample was filtered prior to ortho phosphorus analysis.
94790	PHOSPHORUS, ORTHO	USEPA-365.2	WTR	16-AUG-94	DMM Sample was filtered prior to ortho phosphorus analysis.
94791	PHOSPHORUS, ORTHO	USEPA-365.2	WTR	16-AUG-94	DMM Sample was filtered prior to ortho phosphorus analysis.

QC BATCH QUALIFIERS

PARAM. NUM.	METHOD NUM.	METHOD VAR.	PARAMETER	METHOD	TYPE	RANGE			
1268	39	12	DECACHLOROBIPHENYL-SUR	GC/ECD/P&P/WW	SUR	1	45	88.470	34.940
1108	39	21	HEXABROMOBENZENE-PCB-SUR	GC/ECD/P&P/WTR	SUR	1	228	105.100	21.540
1267	39	21	TETRACHLORO-M-XYLENE-SUR	GC/ECD/P&P/WTR	SUR	1	139	97.750	18.760
1268	39	21	DECACHLOROBIPHENYL-SUR	GC/ECD/P&P/WTR	SUR	1	137	91.880	31.780
1108	39	23	HEXABROMOBENZENE-PCB-SUR	GC/ECD/P&P/SOIL	SUR	1	237	87.730	25.220
1268	39	23	DECACHLOROBIPHENYL-SUR	GC/ECD/P&P/SOIL	SUR	1	126	121.830	40.410
1268	39	24	DECACHLOROBIPHENYL-SUR	GC/ECD/P&P/SLG	SUR	1	3	160.330	24.090
1108	39	25	HEXABROMOBENZENE-PCB-SUR	GC/ECD/P&P/WST	SUR	1	45	99.330	13.590
1268	39	25	DECACHLOROBIPHENYL-SUR	GC/ECD/P&P/WST	SUR	1	9	163.220	37.980
1268	39	26	DECACHLOROBIPHENYL-SUR	GC/ECD/P&P/TCLP	SUR	1	19	139.890	23.560
1102	48	3	D5-NITROBENZENE-SUR	SEMI-VOL/MS/WW	SUR	1	135	71.750	12.790
1105	48	3	O-TERPHENYL-SUR	SEMI-VOL/MS/WW	SUR	1	135	81.030	14.690
1099	50	1	2-FLUOROPHENOL-SUR	SEMI-VOL/MS/WTR	SUR	1	781	43.940	9.280
1100	50	1	D6-PHENOL-SUR	SEMI-VOL/MS/WTR	SUR	1	777	29.240	6.860
1101	50	1	2,4,6-TRIBROMOPHENOL-SUR	SEMI-VOL/MS/WTR	SUR	1	772	74.720	14.210
1102	50	1	D5-NITROBENZENE-SUR	SEMI-VOL/MS/WTR	SUR	1	1212	70.740	11.090
1103	50	1	2-FLUOROBIPHENYL-SUR	SEMI-VOL/MS/WTR	SUR	1	1214	73.880	11.190
1105	50	1	O-TERPHENYL-SUR	SEMI-VOL/MS/WTR	SUR	1	1200	81.530	15.030
1099	50	2	2-FLUOROPHENOL-SUR	SEMI-VOL/MS/SOL	SUR	1	445	57.050	10.920
1100	50	2	D6-PHENOL-SUR	SEMI-VOL/MS/SOL	SUR	1	445	59.980	11.980
1101	50	2	2,4,6-TRIBROMOPHENOL-SUR	SEMI-VOL/MS/SOL	SUR	1	440	63.540	14.690
1102	50	2	D5-NITROBENZENE-SUR	SEMI-VOL/MS/SOL	SUR	1	1182	62.090	12.000
1103	50	2	2-FLUOROBIPHENYL-SUR	SEMI-VOL/MS/SOL	SUR	1	1227	66.510	11.880
1105	50	2	O-TERPHENYL-SUR	SEMI-VOL/MS/SOL	SUR	1	1206	72.820	14.080
1099	50	4	2-FLUOROPHENOL-SUR	SEMI'S/MS/TCLP	SUR	1	189	46.250	12.870
1100	50	4	D6-PHENOL-SUR	SEMI'S/MS/TCLP	SUR	1	185	31.200	9.800
1117	50	4	2,4,5-T-SUR	SEMI'S/MS/TCLP	SUR	1	48	64.420	16.090
1101	50	7	2,4,6-TRIBROMOPHENOL-SUR	SEMI'S/MS/SPLP	SUR	1	120	86.830	18.060
1102	50	7	D5-NITROBENZENE-SUR	SEMI'S/MS/SPLP	SUR	1	130	84.780	15.010
1103	50	7	2-FLUOROBIPHENYL-SUR	SEMI'S/MS/SPLP	SUR	1	130	85.160	15.160
1105	50	7	O-TERPHENYL-SUR	SEMI'S/MS/SPLP	SUR	1	130	84.630	15.760
1147	327	1	2,4-DB-SUR	GC/ECD/HRB/WTR	SUR	1	2	155.500	0.710

*** END OF REPORT ***

PARM NUM	METH NUM	METH VAR	PARAMETER	METHOD	REF CIT	TYPE	RANGE
1107	39	11	HEXABROMOBENZENE-PEST-SUR	GC/ECD/P&P/WTR	USEPA-608	SUR	1

BATCH	SEQ	F SEQ	SAMPLE	PENDING QTY	PENDING MEAN	PENDING STD DEV	PERCENT	CALCULATED T VALUE	STORED T VALUE
65053	2	003	82239	6	77.00	17.93	106.00	1.617	1.82
STATS AFTER EXCLUSION:				6	77.00	17.93			

PARM NUM	METH NUM	METH VAR	PARAMETER	METHOD	REF CIT	TYPE	RANGE
1107	39	12	HEXABROMOBENZENE-PEST-SUR	GC/ECD/P&P/WW	USEPA-608	SUR	1

BATCH	SEQ	F SEQ	SAMPLE	PENDING QTY	PENDING MEAN	PENDING STD DEV	PERCENT	CALCULATED T VALUE	STORED T VALUE
71878	2	002	93854	41	87.02	18.33	40.00	2.565	2.87
STATS AFTER EXCLUSION:				41	87.02	18.33			

PARM NUM	METH NUM	METH VAR	PARAMETER	METHOD	REF CIT	TYPE	RANGE
1108	39	12	HEXABROMOBENZENE-PCB-SUR	GC/ECD/P&P/WW	USEPA-608	SUR	1

BATCH	SEQ	F SEQ	SAMPLE	PENDING QTY	PENDING MEAN	PENDING STD DEV	PERCENT	CALCULATED T VALUE	STORED T VALUE
70863	63	001	93376	79	93.92	22.97	30.00	2.782	3.12
STATS AFTER EXCLUSION:				79	93.92	22.97			

PARM NUM	METH NUM	METH VAR	PARAMETER	METHOD	REF CIT	TYPE	RANGE
1267	39	12	TETRACHLORO-M-XYLENE-SUR	GC/ECD/P&P/WW	USEPA-608	SUR	1

BATCH	SEQ	F SEQ	SAMPLE	PENDING QTY	PENDING MEAN	PENDING STD DEV	PERCENT	CALCULATED T VALUE	STORED T VALUE
76272	20	002	101498	39	83.77	20.15	32.00	2.569	2.85
STATS AFTER EXCLUSION:				39	83.77	20.15			

PARM NUM	METH NUM	METH VAR	PARAMETER	METHOD	REF CIT	TYPE	RANGE
1268	39	12	DECACHLOROBIPHENYL-SUR	GC/ECD/P&P/WW	USEPA-608	SUR	1

BATCH	SEQ	F SEQ	SAMPLE	PENDING QTY	PENDING MEAN	PENDING STD DEV	PERCENT	CALCULATED T VALUE	STORED T VALUE
78943	10	001	106893	45	88.47	34.94	170.00	2.333	2.91

QC COMPLIANCE SUMMARY
Analytical Batches opened between 06-JAN-1996 and 22-JAN-1996
(result types BLK, CCB, CCV, CRL, ICB, ICV, IEC, LCS)

METALS LABORATORY
ANALYST: J.T. Whitmore

	Batches #	Batches %	Results #	Results %
Last used:	24		150	
Incomplete:	24	100.0	150	100.0
Out of warning:	0	0.0	0	0.0
Out of control:	0	0.0	0	0.0

*** THE FOLLOWING RESULTS ARE OUT OF CONTROL ***

RESULTS OUT OF CONTROL
THAT WERE RUN BETWEEN 19-Jan-1996 AND 19-Jan-1996

Lab Id: IN

Parameter	Method	Ref Cit	Appl	Anly	Batch Num	Seq	F Seq	Type	Sample	Percent
SULFATE	SO4/AUTO/WTR	USEPA-375.4	WATER	HLB	97724	24	0	SPK 2	136055	16

Parameter	Method	Ref Cit	Appl	Qualifier	Batch Num	Seq	F Seq	Qc Batch Num
SULFATE	SO4/AUTO/WTR	USEPA-375.4	WATER	2	97724	15	0	15709
SULFATE	SO4/AUTO/WTR	USEPA-375.4	WATER	33	97724	15	0	15709

Usage: N Description: NARRATIVE

Type: Q Description: QC BATCH

#	Explain	Active	Res Type	Repl	CLP	Site	Description
54	N	Y					The laboratory fortified blank (LFB) recovery for this analysis, fell outside the laboratory established control limits but within the test specification for this method. No data qualifications are required.

PRE-DEFINED QUALIFIERS

Usage: N Description: NARRATIVE

Type: R Description: RESULT

#	Explain	Active	Res Type	Repl	CLP	Site	Description
26	N	Y					All positive results for this sample and analysis were confirmed by a replicate measurement.
32	N	Y					The reporting limit for this analysis was elevated due to chromatographic interferences.
33	N	Y					This sample was filtered to remove particulate interferences prior to analysis.
37	N	Y					The procedure for the analysis of Cyanide Reactivity was not performed on this sample because the corresponding Total Cyanide result is <250 mg/kg.
38	N	Y					The procedure for the analysis of Amenable Cyanide was not performed on this sample because the corresponding Total Cyanide result is <0.005 mg/l.
39	N	Y					The procedure for the analysis of Amenable Cyanide was not performed on this sample because the corresponding Total Cyanide result is <0.05 mg/l.
40	N	Y					The procedure for the analysis of Free Cyanide was not performed on this sample because the corresponding Total Cyanide result is <0.005 mg/l.
41	N	Y					The procedure for the analysis of Free Cyanide was not performed on this sample because the corresponding Total Cyanide result is <0.05 mg/l.
42	N	Y					The reported Biochemical Oxygen Demand result for this sample was calculated on an oxygen depletion of <2.0 mg/l

PRE-DEFINED QUALIFIERS

Usage: N Description: NARRATIVE

Type: R Description: RESULT

#	Explain	Active	Res Type	Repl	CLP	Site	Description
43	N	Y					Nitrite Nitrogen was analyzed on this sample within the mandated USEPA 48 hour holding time. The sample was also chemically preserved and later analyzed for Nitrate+Nitrite Nitrogen within the 28 day USEPA mandated hold time. Nitrate Nitrogen was calculated by subtraction (NO3+NO2-NO2=NO3).
44	N	Y					The secondary surrogate (tetrachloro-m-xylene) % recovery for this sample fell outside the laboratory established control limits. The primary surrogate (decachlorobiphenyl) % recovery for this sample fell within the laboratory established control limits. No qualifications are required.
45	N	Y					The primary surrogate (decachlorobiphenyl) % recovery for this sample fell outside the laboratory established control limits. The secondary surrogate (terachloro-m-xylene) % recovery for this sample fell within the laboratory established control limits. No qualifications are required.
48	N	Y					This sample was filtered after distillation or digestion and prior to analysis, to remove a particulate interference.
55	N	Y					This sample was prepared in accordance to the Methanol sample extraction procedure, as outlined in USEPA Method 5030.
56	Y	Y					This sample also contains Cis-1,2-Dichloroethylene at a concentration of:
59	N	Y					This analysis was performed beyond an established USEPA maximum allowable parameter hold time. However, because the sample is a laboratory trip blank, the established hold time is inappropriate to the purpose of this analysis.

Usage: Q Description: QUALIFIER

Type: A Description: ANALYTICAL BATCH

#	Explain	Active	Res Type	Repl	CLP	Site	Description
4	N	Y			J	GRR	The laboratory control sample (LCS) recovery for this analysis, fell outside the laboratory established control limits. All samples in this analytical batch must be considered estimated.
49	N	Y					Analytical Batch Qualifier without Explanation.

Usage: Q Description: QUALIFIER

Type: Q Description: QC BATCH

#	Explain	Active	Res Type	Repl	CLP	Site	Description
50	Y	Y					See explanation below:
51	N	Y					QC Without

PRE-DEFINED QUALIFIERS

Usage: Q Description: QUALIFIER

Type: R Description: RESULT

#	Explain	Active	Res Type	Repl	CLP	Site	Description
1	Y	Y				GRR	Analysis performed beyond established USEPA maximum allowable parameter hold time. Result must be considered estimated.
2	N	Y	SPK	3	J	GRR	The matrix spike recovery (SPK) for this sample, fell outside the laboratory established control limits for this method and matrix. The corresponding sample result must be considered estimated.
3	N	Y	MSD			GRR	The matrix spike duplicate (MSD) RPD for this sample, fell outside the laboratory established control limits for this method and matrix. The corresponding sample result must be considered estimated.
5	N	Y				GRR	The laboratory fortified blank (LFB) recovery for this analysis, fell outside the laboratory established control limits. All samples in the associated pre-treatment batch must be considered estimated.
6	N	Y	DUP			GRR	The matrix duplicate (DUP) RPD for this sample, fell outside the laboratory established control limits for this method and matrix. The corresponding sample result must be considered estimated.
7	Y	Y				GRR	The reporting limit for this sample and the corresponding analysis is elevated due to an analytical interference which was a direct result of the sample matrix.
8	N	Y			U	GRR	Compound was not detected.
9	N	Y			J	GRR	Concentration is below the compound reporting limit, result must be considered estimated.
10	N	Y			M	GRR	Duplicate injection precision not met for this analysis.

PRE-DEFINED QUALIFIERS

Usage: Q Description: QUALIFIER

Type: R Description: RESULT

#	Explain	Active	Res Type	Repl	CLP	Site	Description
11	Y	Y				GRR	Sample integrity suspect upon arrival.
12	N	Y				GRR	Sample was received outside USEPA maximum allowable hold time. Result(s) must be considered estimated.
13	N	Y				GRR	Sample was lost during the sample preparation process, re-preparation of the sample was not possible due to low sample volume. The corresponding result(s) are not available.
14	N	Y				GRR	Sample was consumed during analysis, re-analysis was not possible due to low sample volume.
15	N	Y			J	GRR	Surrogate spike result(s) for this sample and analysis had a percent recovery outside the upper control limit for this method and matrix. All positive results must be considered estimated.
16	N	Y			J	GRR	Surrogate spike result(s) for this sample and analysis had a recovery of > 10%, but are below the lower control limit for this method and matrix. All positive results must be considered estimated. All < or non-dectectable results must be considered approximate.
17	N	Y			J	GRR	Surrogate spike result(s) for this sample and analysis had a recovery of < 10%. All positive results must be considered estimated.
18	N	Y			UJ	GRR	Surrogate spike result(s) for this sample and analysis had a recovery of < 10%. All < or non-detectable results must be considered unusable.
19	N	Y			J	GRR	Surrogate result(s) are unavailable due to a sample matrix interference problem encountered during the analysis of this sample. All positive results must be considered estimated, all < or non=detectable results must be considered unusable.

PRE-DEFINED QUALIFIERS

Usage: Q Description: QUALIFIER

Type: R Description: RESULT

#	Explain	Active	Res Type	Repl	CLP	Site	Description
20	N	Y				GRR	Surrogate results are unavailable due to positive results in the sample extract resulting in a dilution of greater than 1:5 of the sample extract.
21	N	Y			U	GRR	The analysis of the Method Preparation Blank (MPB) for this parameter, method and associated digestion/extraction batch, had a positive value above the project reporting limit. This corresponding sample result is < 5 times the positive MPB value and therefore must be be considered estimated.
22	N	Y					The reporting limit for this sample and corresponding analysis is elevated due to the percent solids content of this sample.
23	N	Y					Matrix QC results (SPK and MSD) for this sample, QC batch, matrix and analysis were diluted out due to background matrix interferences.
24	N	Y					Matrix QC results (SPK and MSD) for this sample, QC batch, matrix and analysis are unavailable due to high analyte concentrations resulting in a dilution of this sample and/or it's extract.
25	N	Y					Matrix QC results (SPK and MSD) for this sample, QC batch, matrix and analysis are unavailable due to interfering peaks.
27	N	Y					The result(s) for this sample and analysis are reported on a "dry weight" basis.
28	N	Y					The result(s) for this sample and analysis are reported on an "as received" weight basis.
29	N	Y					As specified in 40CFR Part 136, Appendix A; Method 624, Acrolein and Acrylonitrile may only be screened by GC/MS. All positive results must therefore be considered estimated.

PRE-DEFINED QUALIFIERS

Usage: Q Description: QUALIFIER

Type: R Description: RESULT

#	Explain	Active	Res Type	Repl	CLP	Site	Description
30	N	Y					Sample was not preserved in accordance to 40 CFR Part 136.3; Table II; which states that a sample collected for Acrolein must be pH adjusted to a range of 4-5 or analyzed with 3 days of collection. All results for this compound must be considered estimated.
31	N	Y					The Analytical and/or Instrument Blank (BLK) for this parameter and method, had a positive value above the project reporting limit. This corresponding sample result is < 5 times the positive BLK value and therefore must be considered estimated.
34	N	Y					Total coliform bacterial colonies were detected in this sample. A confirmation procedure for the presence of E. coli was NEGATIVE.
35	N	Y					Total Coliform bacterial colonies were detected in this sample. A confirmation procedure for the presence of E. coli was POSITIVE.
36	N	Y					The reported detection limit for this sample and analysis is based on the current reagent water method detection limit (MDL).
46	N	Y			J		The percent difference (%D) between the original sample concentration and a serial dilution of this sample resulted in a value > 10%(D). Because the <10% difference criteria was not met, the corresponding sample and analysis must be considered estimated.
47	N	Y					The result for this analyte and method was reported at a value between the Method Detection Limit (MDL) and the laboratory established Reporting Limit. All postive results must be considered estimated, all non-detectable results must be considered aproximate.
52	N	Y					The result for this compound was quantitated from our continuing calibration standard but is estimated due to levels above the linear range of our calibration curve.
53	N	Y					Surrogate results are unavailable due to sample matrix interference(s) which resulted in a dilution of greater than 1:5 of the sample extract.

PRE-DEFINED QUALIFIERS

Usage: Q Description: QUALIFIER

Type: R Description: RESULT

#	Explain	Active	Res Type	Repl	CLP	Site	Description
57	N	Y					One or more surrogate compounds were not reported for this sample, matrix and method, due to unresolveable matrix intereferences. All remaining surrogate compound(s) had recoveries within the laboratory established control limits. No qualifications are required.
58	N	Y			N		The result for this sample and analysis was quantitated from the Photoionization Detector (PID) due to an interfering peak on the Electrolytic Conductivity Detector (HECD).
60	N	Y			J		The result for this compound was quantitated from our average response factor of the calibration curve but is estimated due to levels above the linear range of the curve.
61	N	Y			J		The reported result for this sample is the minimum estimated amount based on the upper limit of the calibration curve and all sample extraction and/or dilution factors.
62	N	Y	PDS	1	J		The post digestion spike result (PSD) for this sample had a percent recovery of outside the 85 - 115 % method window. All corresponding positive sample results where the PDS is <40% are estimated, all non-detectable results with a PDS <40 & 10% are considered approximate, all <10% are unusable.
63	N	Y	SPK				One of the matrix spike accuracies fell outside of the esatblished laboratory control limits, but the precision for MS/MSD is within the control limits for this matrix and method. The corresponding sample result is not considered estimated.
64	N	Y					The detection limit for this sample and corresponding analysis were elevated due to insufficient sample volume received.
65	N	Y					Matrix quality control analysis unavailable due to insufficient sample volume received.

APPENDIX D

SAMPLE RECEIVING AND STORAGE
BOTTLE AND PRESERVATION REQUIREMENTS

The collection of the sample is the starting point for the generation of quality data. It is the responsibility of TriMatrix to provide the client who collects the sample with sample collection instructions which ensure sample integrity. Also, where applicable TriMatrix also supplies the client with appropriate clean sample containers and preservative chemicals; these glass containers are purchased new and certified as clean and vendors such as I-Chem Research and Fischer Scientific.

Sampling and Preservation Requirements for certain common environmental analyses are listed in the following table: (NOTE: Holding times are based on EPA guidelines for CLP, NPDES, and RCRA).

APPENDIX D
SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

Analyte	Matrix	Holding Time (fron Date Sampled)	Preservation	Container	Sample Size	Method Reference	Container Label
Volatile Halocarbons-GC **	Water	14 days	4°C	2-40ml VOA vials	40 ml	601 or 8010 or 8240 or 8260	Yellow
	Soil/ Waste	14 days	4°C	Glass 4 oz. jar	40g		
Volatile Aromatics-GC **	Water	7 days 14 days	4°C 4°C w/Hcl	2-40 ml VOA vials	40 ml	602 or 8020 or 8240 or 8260	Yellow
	Soil/Waste	14 days	4°C	Glass 4 oz. jar or VOA vial	40 g		
Phenols **	Water	* 7 days	4°C	One liter glass bottle	1000 ml	604 or 8040 or 8270	Orange
	Soil/Waste	* 14 days	4°C	Glass 4 oz. jar	100 g		
Phthalate Esters	Water	* 7 days	4°C	One liter glass bottle	1000 ml	606 or 8060 or 8270	Orange
	Soil/Waste	* 14 days	4°C	Glass 4oz. jar	100 g		
Organo-chlorine Pesticides/ PCB's	Water	* 7 days	4°C	One liter glass bottle	1000 ml 8080	608 or	Orange
	Soil/Waste	* 14 days	4°C	Glass 4oz. jar	100 g		
	PCB oils	N/A	None	VOA Vial	20 ml		
Polyaromatic Hydrocarbons **	Water	* 7 days	4°C	One liter glass bottle	1000 ml	610 or 8100 or 8270 or 8310	Orange
	Soil/Waste	* 14 days	4°C	Glass 4 oz. jar	100 g		
Organo-phosphorous Pesticides	Water	* 7 days	4°C	One liter glass bottle	1000 ml	614 or 8140	Orange
	Soil/Waste	* 14 days	4°C	Glass 4 oz. jar	100 g		
Phenoxy Acid Herbicides	Water	* 7 days	4°C	One liter glass bottle	1000 ml	8150	Orange

APPENDIX D
SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

	Soil/Waste	* 14 days	4°C	Glass 4 oz. jar	100 g		
Volatiles-GC/MS **	Water	7 days 14 days	4°C 4°C w/Hcl	2-40 ml VOA vials	40 ml	8240 or 8260	Yellow
	Soil/Waste	14 days	4°C	Glass 4 oz. jar	100 g		

APPENDIX D
SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

1,2-Dibromoethane 1,2-Dibromo-3-chloropropane	Drinking Water	28 days	4°C	2-40ml VOA vials	40 ml	504	Orange
Semi- Volatiles **	Water Soil/Waste	* 7 days * 14 days	4°C 4°C	One liter glass bottle Glass 4oz. jar	1000 ml 100 g	8270	Orange
Carbamate & Urea Pesticides	Water Soil/Waste	* 7 days * 14 days	4°C 4°C	One liter glass bottle Glass 4 oz. jar	1000 ml 100 g	531.1	Orange
Dioxins/ Furans	Water Soil/Waste	*7 days None Required	4°C 4°C	One liter glass bottle Glass 4 oz. jar	1000 ml 100 g	Screen- 625	Orange
Petroleum Hydrocarbons	Water Soil/Waste	*7 days * 14 days	4°C H2SO4 4°C	One liter glass bottle Glass 4 oz. jar	1000 ml 100 g	418.1 or 9071 or 9073 04 Cal. Method-D.R.	Green
BETX/TPH- GRO	Water Soil/Waste	7 days 14 days 14 days	4°C 4°C w/Hcl 4°C	2-40ml VOA vials Glass 4 oz. jar	40 ml 100 g	8020 or Modified 8015	Green
TCLP-UST (Benzene, TPH, Lead)	Soil/Waste	14 days	4°C	Glass 4oz. jar	100 g	1311	Green
Metals (ICP)	Water Soil/Waste	6 months 6 months	HNO3 to pH <2.0 None	16 oz. plastic bottle 4 oz. glass jar	500 ml 50 g	260.7 or 6010	Red
Arsenic (GF-AA)	Water Soil/Waste	6 months 6 months	HNO3 to pH <2.0 None	16 oz. plastic bottle 4 oz. glass jar	500 ml 50 g	7060 or 206.2	Red
Mercury (CV-AA)	Water Soil/Waste	28 days 28 days	HNO3 to pH <2.0 None	16 oz. plastic bottle 4 oz. glass jar	500 ml 50 g	245.1 or 7470 or	Red

APPENDIX D
SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

Selenium (GF-AA)	Water	6 months	HNO3 to pH <2.0	16 oz. plastic bottle	500 ml	7470 or 270.2	Red
	Soil/Waste	6 months	None	4 oz. glass jar	50 g		
Thallium (GF-AA)	Water	6 months	HNO3 to pH <2.0	16 oz. plastic bottle	500 ml	7421 or 279.2	Red
	Soil/Waste	6 months	None	4 oz. glass jar	50 g		
Lead (GF-AA)	Water	6 months	HNO3 to pH <2.0	16 oz. plastic bottle	500 ml	S.M. 3500 239.2	Blue
	Soil/Waste	6 months	None	4 oz. glass jar	50 g		
Chromium (III/VI)	Water	24 hours	4°C	16 oz. plastic bottle	500 ml	S.M. 3500 Cr D.	Blue
	Soil/Waste	24 hours	4°C	4 oz. glass jar	50 g		
Chromium (Total)	Water	6 months	HNO3 to pH < 2.0	16 oz. plastic bottle	500 ml	6010	Red
	Soil/Waste	6 months	None	4 oz. glass jar	50 g		
Silica	Water	28 days	4°C	16 oz. plastic bottle	500 ml	6010	Red
	Soil/Waste	28 days	4°C	4 oz. glass jar	50 g		
Color	Water	48 hours	4°C	8 oz. plastic bottle	250 m	S.M. 2120 B	Blue
Oil & Grease	Water	28 days	4°C H2SO4 to	1 liter glass bottle	1000 ul	S.M. 5520 B or 413.1 or 9050 or 9071	Blue
	Soil/Waste	14 days	None	4 oz. glass jar			
Specific Conductance	Water	28 days	4°C	8 oz. plastic bottle	250 ml	S.M. 2510 or 120.1 or 9050	Blue
Acidity	Water	14 days	4°C	8 oz. plastic bottle	250 ml	S.M. 2310 or 350.1	Blue
pH	Water	24 hours	4°C	8 oz. plastic	50 ml	S.M. 2400 H+ or	Blue

APPENDIX D
SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

	Soil/Waste	24 hours	4°C	bottle 4 oz. glass jar	100 g	150.1 or 9045/9041	
Alkalinity	Water	14 days	4°C	8 oz. plastic bottle	250 ml	S.M. 2320 or 310.1	Blue
Hardness	Water	6 months	HNO3 to pH <2.0	8 oz. plastic bottle	250 ml	S.M. 2340 B	Blue
Biochemical Oxygen Demand (BOD)	Water	48 hours	4°C	16 oz. plastic bottle bottle	500 ml	S.M. 521 B or 405.1	Blue
Chemical Oxygen Demand (COD)	Water	28 days	4°C H2SO4 to pH <2.0	8 oz. plastic bottle	250 ml	S.M. 5220 or 410.4	Blue
Organic Carbon (TOC)	Water	28 days	4°C H2SO4 to pH <2.0	8 oz. plas/bottle or 4 oz. glass jar or 2-VOA vials	250 ml 125 ml 80 ml	S.M. 5310 B or 415.1 or 9060	White
Chlorophyll	Water	7 days	4°C keep dark; foil wrap	500 ml plastic bottle	500 ml	S.M. 102OOH	Blue
Ortho- Phosphate	Water	48 hours	4°C	8 oz. plastic bottle	100 ml	S.M. 4500-PC or 300.0	Blue
Total Phosphorus	Water	28 days	H2SO4 to pH <2.0	8 oz. plastic bottle	250 ml	S.M. 4500-PC	Blue
Total Kjeldahl Nitrogen (TKN)	Water Soil/Waste	28 days 28 days	4°C H2SO4 to pH <2.0 None	8 oz. plastic bottle 4 oz. glass jar	250 ml 100 g	S.M. 4500- N (org) B or 351.4	Blue
Ammonia	Water	28 days	4°C H2SO4 to pH <2.0	8 oz. plastic	250 ml	S.M. 4500-NH3. F or 350.3	Blue

APPENDIX D
SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

Nitrite	Water	48 hours	4°C	8 oz. plastic bottle	250 ml	S.M. 2400-NO2.C.	Blue
Nitrate	Water	48 hours	4°C	8 oz. plastic bottle	250 ml	S.M. 4500-NO3.C. or 300.0	Blue
Nitrite plus Nitrate (No distinction between NO2 and NO3)	Water	48 hours	4°C	8 oz. plastic bottle	250 ml	S.M. 4500-NO2, NO3.C or 300.0	Blue
Total Volatile Solids	Water	7 days	4°C	8 oz. plastic bottle	250 ml	S.M. 2540-E or 160.4	Blue
	Soil/Water	7 days	4°C	4 oz. glass jar	100 g		
Turbidity	Water	48 hours	4°C	8 oz. plastic bottle	250 ml	S.M. 2130	Blue
Sulfate	Water	28 days	4°C	8 oz. plastic bottle	250 ml	S.M. 4500-SO4 B.	Blue
Sulfite	Water	48 hours 3 ml 1% EDTA	4°C	8 oz. plastic	250 ml	S.M. 4500-SO3 B.	Blue
Sulfide	Water	7 days	4°C, NaOH, Zinc Acetate	8 oz. plastic bottle	250 ml	S.M. 4500-S2 E.	Blue
Acrolein **	Water	3 days	4°C	VOA vial	40 ml	624, 603, 8240 8260	Yellow
	Water	14 days	4°C, pH4-5	VOA vial	40 ml	624, 503, 8240, 9260	
Acrylonitrile **	Water	14 days	4°C	VOA vial	40 ml	524, 503, 8240, 8260	Yellow
	Water	14 days	4°C, pH4-5	VOA vial	40 ml	624, 603, 8240, 8260	
Cyanide **	Water	14 days	4°C, NaOH to pH >12	32 oz. plastic	1000 ml	S.M. 4500-CN E or 335.2 or	Blue

APPENDIX D
SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

	Soil/Waste	14 days	4°C	4 oz. glass jar	100 g	9010	
Coliform Fecal and Total **	Water	24 hours	4°C	Sterile plastic bottle or whirl pak	100 ml	S.M. 9222-B, D. or 9132	White
Bromide	Water	28 days	4°C	8 oz. plastic bottle	250 ml	S.M. 4500 Br-C. or 300.0	Blue
Chloride	Water	28 days	4°C	8 oz. plastic bottle	250 ml	S.M. 4500-Cl-B or S.M. 4500-Cl-F or 300.0	Blue
Chlorine Residual	Water	Analyze Immediately	4°C	8 oz. plastic bottle	250 ml	S.M. 4500 B.	Blue
Total Solids (% Moisture)	Water Soil/Waste	7 days 7 days	4°C 4°C	8 oz. plastic bottle 4 oz. glass jar	250 ml 160.3 100 g	S.M. 2540 B. or	Blue
Total Dissolved Solids (TDS)	Water	7 days	4°C	8 oz. plastic bottle	250 ml	S.M. 2540 C. or 160.2	Blue
Total Suspended Solids (TSS)	Water	7 days	4°C	8 oz. plastic bottle	250 ml	S.M. 2540 D. or 160.1	Blue
TDS plus TSS	Water	7 days	4°C	16 oz. plastic bottle	250 ml	Same as Above	Blue
Fluoride	Water	28 days	None	8 oz. plastic bottle	250 ml	S.M. 2500F-C. or 340.2	Blue
Iodide	Water	28 days	None	8 oz. plastic bottle	250 ml	Ion Chromatograph Not EPA Approved	Blue
Organic Halogen	Water	7 days	4°C H2SO4 to	500 ml glass Bottle	560 ml	S.M. 5320 B 9020	White

APPENDIX D
SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

(TOX)			pH <2.0				
Phenolics	Water	28 days	4°C H2SO4 pH <2.0	1 liter glass bottle	1060 ml	S.M. 5530 C. or 420.1 or 9065	Blue
Surfactants (MBAS)	Water	48 hours	4°C	8 oz. plastic bottle	250 ml	S.M. 5540 C. or 425.1	Blue
TCLP-	Soil/Waste					1311	White
Volatiles		14 days	4oC	4 oz. glass jar	100 g		
Semi-Volatiles		14 days	4oC	8 oz. glass jar	250 g		
Metals		180 days (Hg-28 days)	None	8 oz. glass jar	250 g		
Pest./Herb.		14 days	4oC	8 oz. glass jar	250 g		
Flash Point	Solid/Liq./	N/A	None	(Appropriate to Sample)	250 g or	1010	White
	Waste	N/A	None	8 oz. glass jar or 8 oz. plastic (min. 0 ml) bottle	250 ml		
Corrosivity (pH and Method 1110)	Waste	N/A	None	(Appropriate to Sample) 16 oz. glass jar or 16 oz. plastic bottle	500 ml	9040, 9041	White
Paint Filter (Free Liquids)	Waste	N/A	None	(Appropriate to Sample) 4 oz. glass jar or 8 oz. plastic bottle	250 ml or 50 g	9095	White
Chloride/ Halogens (on Waste)	Waste	N/A	None	(Appropriate (to Sample) 4 oz. glass jar or 8 oz. plastic bottle	50 ml 50 g	ASTM D808	White
Radionuclides (Alpha + Beta, Alpha, Beta, Ra226, Ra228	Water	6 month	HNO3 to pH <2.0	32 oz. plastic bottle or 32 oz. glass bottle	1000 ml		White

APPENDIX D
SAMPLE COLLECTION GUIDELINES
BOTTLE AND PRESERVATIVE REQUIREMENTS

Reactivity (Releasable CN and S)	Waste	N/A	$4^{o}C$	(Appropriate to Sample 8 oz. plastic bottle or 4oz. glass jar	10 g	SW 846 Chapt. 7	White

* 7 or 14 days until extraction, 40 days after extraction

** Use Sodium Thiosulfate or Ascorbic Acid if samples are chlorinated

NOTE: For Organics parameters, container lid should be teflon or metal foil lined.

NOTE: For Inorganic parameters, container lid should be plastic or teflon lined.

NOTE: When testing for several like parameters (ICP metals, Ion Chromotograph anions), one container per sample is sufficient. For example, a sample to be tested for the 13 priority pollutant metals needs one 500 ml container.

8.0 GLOSSARY OF TERMS

ABSORBANCE - a measure of the decrease in incidient light passing through a sample into the detector. It is defined mathematically as:

$$A = \frac{I\,(\text{solvent})}{I\,(\text{solution})} - \log \frac{Io}{I}$$

ALIQUOT - a measured portion of a field sample taken for analysis.

ANALYSIS DATE/TIME - the date and military time (24-hour clock) of the introduction of the sample, standard, or blank into the analysis system.

ANALYTE - the element or ion an analysis seeks to determine; the element of interest.

ANALYTICAL SAMPLE - any solution or media introduced into an instrument on which an analysis is performed excluding instrument calibration, initial calibration verification, initial calibration blank, continuing calibration verification and continuing calibration blank. Note the following are all defined as analytical samples: undiluted and diluted samples (EPA and non-EPA), predigestion spike samples, duplicate samples, serial dilution samples, analytical spike samples, post-digestion spike samples, interference check samples (ICS), CRDL standard for AA (CRA), CRDL standard for ICP (CRI), laboratory control sample (LCS), method preparation blank (MPB) and linear range analysis sample (LRS).

ANALYTICAL SPIKE - The furnace post-digestion spike. The addition of know amount of standard after digestion.

AUTOZERO - zeroing the instrument at the proper wavelength. It is equivalent to running a standard blank with the absorbance set at zero.

AVERAGE INTENSITY - the average of two different injections (exposures).

BACKGROUND CORRECTION - a technique to compensate for variable background contribution to the instrument signal in the determination of trace elements.

BLANK - an analytical sample designed to assess specific sources of laboratory contamination. See individual types of Blanks: Method Blank, Instrument Blank, Storage Blank, and Sulfur Blank.

BAR GRAPH SPECTRUM - a plot of the mass-to-charge ratio (m/e) versus relative intensity of the ion current.

BATCH - a group of samples prepared at the same time in the same location using the same method.

BREAKDOWN - a measure of the decomposition of certain analytes (DDT and Endrin) into by-products.

4-BROMOFLUOROBENZENE (BFB) - the compound chosen to establish mass spectral instrument performance for volatile (VOA) analyses. It is also in the VOA fraction as a system monitoring compound (SMC).

CALIBRATION - the establishment of an analytical curve based on the absorbance, emission intensity, or other measured characteristic of known standards. The calibration standards must be prepared using the same type of acid or concentration of acids as used in the sample preparation.

CALIBRATION BLANK - a volume of acidified deionized/distilled water.

CALIBRATION STANDARDS - a series of known standard solutions used by the analyst for calibration of the instrument (i.e., preparation of the analytical curve).

CALIBRATION FACTOR (CF) - a measure of the gas chromatographic response of a target analyte to the mass injected. The calibration factor is analogous to the Relative Response Factor (RRF) used in the Volatile and Semivolatile fractions.

CASE - a finite, usually predetermined number of samples collected over a given time period from a particular site. Case numbers are assigned by the Sample Management Office. A Case consists of one or more Sample Delivery Groups.

CHARACTERIZATION - a determination of the approximate concentration range of compounds of interest used to choose the appropriate analytical protocols.

COEFFICIENT OF VARIATION (CV) - the standard deviation as a percent of the arithmetic mean.

CONCENTRATION LEVEL (low or medium) - characterization of soil samples or sample fractions as low concentration or medium concentration is made on the basis of the laboratory's preliminary screen, not on the basis of information entered by the sampler.

CONTAMINATION - a component of a sample or an extract that is not representative of the environmental source of the sample. Contamination may stem from other samples, sampling equipment, while in transit, from laboratory reagents, laboratory environment, or analytical instruments.

CONTINUING CALIBRATION - analytical standard run ever 12 or 24 hours to verify the initial calibration of the system.

CONTINUOUS LIQUID-LIQUID EXTRACTION - used herein synonymously with the terms continuous extraction, continuous liquid extraction, and liquid extraction. This extraction technique involves boiling the extraction solvent in a flask and condensing the solvent above the aqueous sample. The condensed solvent drips through the sample, extracting the compounds of interest from the aqueous phase.

CONTRACT REQUIRED DETECTION LIMIT (CRDL) - minimum level of detection acceptable under the contract Statement of Work.

CONTROL LIMITS - a range within which specified measurement results must fall to be compliant. Control limits may be mandatory, requiring corrective action if exceeded, or advisory, requiring that noncompliant data be flagged.,

CORRELATION COEFFICIENT - a number (r) which indicates the degree of dependence between two variables (concentration - absorbance). The more dependent they are the closer the value to one. Determined on the basis of the least squares line.

DATE - MM/DD/YY - where MM = 01 for January, 02 for February, ... 12 for December; DD = 01 to 31; YY = 94, 95, 96, 97, etc.

DAY - unless otherwise specified, day shall mean calendar day.

DIGESTION LOG - an official record of the sample preparation (digestion).

DISSOLVED METALS - analyte elements which have not been digested prior to analysis and which will pass through a 0.45 um filter.

DRY WEIGHT - the weight of a sample based on percent solids. The weight after drying in an oven.

DUPLICATE - a second aliquot of a sample that is treated the same as the original sample in order to determine the precision of the method.

EXTRACTED ION CURRENT PROFILE (EICP) - a plot of ion abundance versus time (or scan number) for ion(s) of specified mass(es).

EXTRACTABLE - a compound that can be partitioned into an organic solvent from the sample matrix and is amenable to gas chromatography. Extractables include semivolatile (BNA) and pesticide/Aroclor compounds.

FIELD BLANK - any sample submitted from the field identified as a blank.

FIELD SAMPLE - a portion of material received to be analyzed that is contained in single or multiple containers and identified by a unique Sample Number.

FLAME ATOMIC ABSORPTION (AA) - atomic absorption which utilizes flame for excitation.

GRAPHITE FURNACE ATOMIC ABSORPTION (GFAA) - atomic absorption which utilizes a graphite cell for excitation.

GAS CHROMATOGRAPH (GC) - the instrument used to separate analytes on a stationary phase within a chromatographic column. The analytes are volatized directly from the sample (VOA water and low-soil), volatized from the sample extract (VOA medium soil), or injected as extracts (SVOA and PEST). In VOA and SVOA analysis, the compounds are detected by a Mass Spectrometer (MS). In PEST analysis, the compounds are detected by an Electron Capture (EC) detector. In the screening procedure (all fractions), the Flame Ionization Detector (FID) is used as the detector.

GEL PERMEATION CHROMATOGRAPHY (GPC) - a size-exclusion chromatographic technique that is used as a cleanup procedure for removing large organic molecules, particularly naturally occurring macro-molecules such as lipids, polymers, viruses, etc.

HOLDING TIME - the elapsed time expressed in days from the date sampled by the Contractor until the date of its analysis.

Holding time - (sample analysis date - sample collection date)

INDEPENDENT STANDARD - a Contractor-prepared standard solution that is composed of analytes from a different source than those used in the standards for the initial calibration.

INDUCTIVELY COUPLED PLASMA (ICP) - a technique for the simultaneous or sequential multi-element determination of elements in solution. The basis of the method is the measurement of atomic emission by an optical spectroscopic technique. Characteristic atomic line emission spectra are produced by excitation of the sample in a radio frequency inductively coupled plasma.

IN-HOUSE - at the Contractor's facility.

INITIAL CALIBRATION - analysis of analytical standards for a series of different specified concentrations; used to define the linearity and dynamic range of the response of the mass spectrometer or electron capture detector to the target compounds.

INJECTION - introduction of the analytical sample into the instrument excitation system for the purpose of measuring absorbance, emission or concentration of an analyte. May also be referred to as exposure.

INSTRUMENT CALIBRATION - analysis of analytical standards for a series of different specified concentrations; used to define the quantitative response, linearity, and dynamic range of the instrument to target analytes.

INSTRUMENT DETECTION LIMIT (IDL) - determined by multiplying by three the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of 3x-5x IDL on three nonconsecutive days with seven consecutive measurements per day.

INSTRUMENT CHECK SAMPLE - a solution containing both interfering and analyte elements of known concentration that can be used to verify background and interelement correction factors.

INSTRUMENT CHECK STANDARD - a multi-element standard of known concentrations prepared by the analyst to monitor and verify instrument performance on a daily basis.

INTEGRATION SCAN RANGE - this scan number of the scan at the beginning of the area of integration to the scan number at the end of the area of integration.

INTERFERENTS - substances which affect the analysis for the element of interest.

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatiles), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantitation of the target compounds.

INSTRUMENT/ANALYTICAL BLANK - a blank designed to determine the level of contamination associated with the analytical instruments.

INSUFFICIENT QUANTITY - when there is not enough volume (water sample) or weight (soil/sediment) to perform any of the required operations: sample analysis or extraction, percent moisture, MS/MSD, etc.

LABORATORY - synonymous with Contractor as used herein.

LABORATORY CONTROL SAMPLE (LCS) - a control sample of known composition. Aqueous and solid laboratory control samples are analyzed using the same sample preparation, reagents, and analytical methods employed for the samples received.

LABORATORY RECEIPT DATE - the date on which a sample is received at the Contractor's facility, as recorded on the shippers delivery receipt.

LINEAR RANGE, LINEAR DYNAMIC RANGE - the concentration range over which the ICP analytical curve remains linear.

MATRIX - the predominant material of which the sample to be analyzed is composed. For the purpose of this statement of work, a sample matrix is either water or soil/sediment. Matrix is not synonymous with phase (liquid or solid).

MATRIX EFFECT - in general, the effect of a particular matrix (water or soil/sediment) on the constituents with which is contacts. This is particularly pronounced for clay particles which may adsorb chemicals and catalyze reactions. Matrix effects may prevent extraction of target analytes, and may affect surrogate recoveries. In addition, nontarget analytes may be extracted from the matrix causing interferences.

MATRIX MODIFIER - salts used in AA to lessen the effects of chemical interferents, viscosity, and surface tension.

MATRIX SPIKE - aliquot of a matrix (water or soil) fortified (spiked) with know quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.

MATRIX SPIKE DUPLICATE - a second aliquot of the same matrix as the matrix spike (above) that is spiked in order to determine the precision of the method.

METHOD BLANK - an analytical control consisting of all reagents, internal standards and surrogate standards (or SMCs for VOA), that is carried throughout the entire analytical procedure. The method blank is used to define the level of laboratory, background and reagent contamination.

METHOD OF STANDARD ADDITIONS (MSA) - the addition of 3 increments of a standard solution (spikes) to sample aliquots of the same size. Measurements are made on the original and after each addition. The slope, x-intercept and y-intercept are determined by least-square analysis. The analyte concentration is determined by the absolute value of the x-intercept. Ideally, the spike volume is low relative to the sample volume (approximately 10% of the volume). Standard addition may counteract matrix effects; it will not counteract special effects. Also referred to as Standard Addition.

m/z - Mass to charge ration, synonymous with "m/e"

NARRATIVE - portion of the data package which includes laboratory, contract, case and sample number identification, and descriptive documentation of any problems encountered in processing the samples, along with corrective action taken and problem resolution.

PERCENT DIFFERENCE (%D) - to compare two values, the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero. (In contrast, see relative percent difference).

PERCENT MOISTURE - an approximation of the amount of water in a soil/sediment sample made by drying an aliquot of the sample at 105°C. The percent moisture determined in this manner also includes contributions from all compounds that may volatilize at or below 105°C, including water. Percent moisture may be determined from decanted samples and from samples that are not decanted.

PERCENT SOLIDS - the proportion of solid in a soil sample determined by drying an aliquot of the sample.

PERFORMANCE EVALUATION MIXTURE - a calibration solution of specific analytes used to evaluate both recovery and percent breakdown as measures of performance.

PERFORMANCE EVALUATION (PE) SAMPLE - a sample of known composition provided by EPA for Contractor analysis. Used by EPA or client to evaluate laboratory performance.

PREPARATION BLANK (reagent blank, method blank) - an analytical control that contains distilled, deionized water and reagents, which is carried through the entire analytical procedure (digested/distilled or extracted and analyzed). An aqueous method blank is treated with the same reagents as a sample with a water matrix; A solid method blank is treated with the same reagents as a soil sample.

PRIMARY QUANTITATION ION - a contract specified ion used to quantitate a target analyte.

PROTOCOL - a compilation of the procedures to be followed with respect to sample receipt and handling, analytical methods, data reporting and deliverables, and document control. Used synonymously with Statement of Work (SOW).

PURGE AND TRAP (DEVICE) - analytical technique (device) used to isolate volatile (purgeable) organics by stripping the compounds from water or soil by a stream of inert gas, trapping the compounds on an adsorbent such as a porous polymer trap, and thermally desorbing the trapped compounds onto the gas chromatographic column.

PURGEABLES - volatile compounds.

QUALITY CONTROL SAMPLE - a solution obtained from an outside source having known concentration values to be used to verify the calibration standards.

REAGENT BLANK - a volume of deionized, distilled water containing the same acid matrix as the calibration standards carried through the entire analytical scheme.

REAGENT WATER - water in which an interferent is not observed at or above the minimum quantitation limit of the parameters of interest.

RECONSTRUCTED ION CHROMATOGRAM (RIC) - a mass spectral graphical representation of the separation achieved by a gas chromatograph; a plot of total ion current versus retention time.

RELATIVE PERCENT DIFFERENCE (RPD) - As used in this SOW and elsewhere to compare two values, the relative percent difference is based on the mean of the two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero. (In contrast, see percent difference above).

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. Relative Response Factors are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples. RRF is determined by the following equation:

$$RRF = \frac{Ax}{Ais} \times \frac{Cis}{Cx}$$

where:

A = area of the characteristic ion measured

C = concentration

is = internal standard

x = analyte of interest

RELATIVE RETENTION TIME (RRT) - the ration of the retention time of a compound to that of a standard (such as an internal standard).

$$RRT = \frac{RTc}{RTis}$$

Where,

RTc = Retention time for the semivolatile target or surrogate compound in continuing calibration.

RTis = Retention time for the internal standard in calibration standard or in a sample.

RESOLUTION - also termed separation or percent resolution, the separation between peaks on a chromatogram, calculated by dividing the depth of the valley between the peaks by the peak height of the smaller peak being resolved, multiplied by 100.

RESOLUTION CHECK MIXTURE - a solution of specific analytes used to determine resolution of adjacent peaks; used to assess instrumental performance.

RESPONSE - or Instrumental Response: a measurement of the output of the GC detector (MS, EC, or FID) in which the intensity of the signal is proportionate to the amount (or concentration) detected. Measured by peak area or peak height.

RETENTION TIME (RT) - the time a target analyte is retained on a GC column before elution. The identification of a target analyte is dependent on a target compound's retention time falling within the specified retention time window established for that compound. Retention time is dependent on the nature of the column's stationary phase, column diameter, temperature, flow rate, and other parameters.

ROUNDING RULES - If the figure following those to be retained is less than 5, the figure is dropped, and the retained figures are kept unchanged. As an example, 11.443 is rounded off to 11.44.

If the figure following those to be retained is greater than 5, the figure is dropped, and the last retained figure is raised by 1. As an example, 11.446 is rounded off to 11.45.

If the figure following those to be retained is 5, and if there are no figures other than zeros beyond the five, the figure 5 is dropped, and the last-place figure retained is increased by one if it is an odd number or it is kept unchanged if an even number. As an example, 11.435 is rounded off to 11.44, while 11.425 is rounded off to 11.42.

If a series of multiple operations is to be performed (add, subtract, divide, multiply), all figures are carried through the calculations. Then the final answer is rounded to the proper number of significant figures.

See forms instructions (Exhibit B) for exceptions.

RUN - a continuous analytical sequence consisting of prepared samples and all associated quality assurance measurements as required by the contract Statement of Work.

SAMPLE - a portion of material to be analyzed that is contained in single or multiple containers and identified by a unique sample number.

* Case; or
* Each 20 samples within a Case; or
* Each 14-day calendar period during which samples in a Case are received, beginning with receipt of the first sample in the Case or SDG.

Samples may be assigned to Sample Delivery Groups by matrix (i.e., all soils in one SDG, all waters in another), at the discretion of the laboratory.

SAMPLE NUMBER - a unique identification number designated for each sample. The Sample Number appears on all laboratory documents which contain information on that sample.

SEMIVOLATILE COMPOUNDS - compounds amenable to analysis by extraction of the sample with an organic solvent. Used synonymously with Base/Neutral/Acid (BNA) compounds.

SENSITIVITY - the slope of the analytical curve, i.e., functional relationship between emission intensity and concentration.

SERIAL DILUTION - the dilution of a sample by a factor of five. When corrected by the dilution factor, the diluted sample must agree with the original undiluted sample within specified limits. Serial dilution may reflect the influence of interferents.

SOIL - synonymous with soil/sediment or sediment as used herein.

SONIC CELL DISRUPTOR (SONICATOR) - a device that uses the energy from controlled ultrasound applications to mix, disperse, and dissolve organic materials from a given matrix.

STANDARD ANALYSIS - an analytical determination made with known quantities of target compounds; used to determine response factors.

STORAGE BLANK - reagent water (40.0 ml aliquot) stored with samples. It is analyzed on a weekly basis, and is used to determine the level of contamination acquired during storage.

STOCK SOLUTION - a standard solution which can be diluted to derive other standards.

SULFUR BLANK - a modified method blank that is prepared only when some of the samples in a batch are subjected to sulfur cleanup. It is used to determine the level of contamination associated with the sulfur cleanup procedure. When any of the samples are subjected to sulfur cleanup, then the method blank serves this purpose. When none of the samples are subjected to sulfur cleanup, no sulfur blank is required.

SURROGATES (Surrogate Standard) - for semivolatiles, volatiles and pesticides/Aroclors, compounds added to every blank, sample, matrix spike, matrix spike duplicate, and standard; used to evaluate analytical efficiency by measuring recovery. Surrogates are brominated, fluorinated, or isotopically labeled compounds not expected to be detected in environmental media.

SUSPENDED - those elements which are retained by a 0.45 um membrane filter.

SYSTEM MONITORING COMPOUNDS - compounds added to every blank, sample, matrix spike, matrix spike duplicate, and standard for volatile analysis, and used to evaluate the performance of the entire purge and trap-gas chromatograph-mass spectrometer system. These compounds are brominated or deuterated compounds not expected to be detected in environmental media.

TARGET COMPOUND LIST (TCL) - a list of compounds designated by the Statement of Work (Exhibit C) for analysis.

TENTATIVELY IDENTIFIED COMPOUNDS (TIC) - compounds detected in samples that are not target compounds, internal standards, system monitoring compounds, or surrogates. Up to 30 peaks (those greater than 10% of peak areas or heights of nearest internal standards) are subjected to mass spectral library searches for tentative identification.

TIME - when required to record time on any deliverable item, time shall be expressed as Military Time, i.e., a 24-hour clock.

TOTAL METALS - analyte elements which have been digested prior to analysis.

TWELVE-HOUR TIME PERIOD - The twelve (12) hour time period for GC/MS system instrument performance check, standards calibration (initial or continuing calibration), and method blank analysis begins at the moment of injection of the DFTPP or BFB analysis that the laboratory submits as documentation of instrument performance. The time period ends after 12 hours have elapsed according to the system clock. For pesticide/Aroclor analyses performed by GC/EC, the twelve hour time period in the analytical sequence begins at the moment of injection of the instrument blank that precedes sample analyses, and ends after twelve hours have elapsed according to the system clock.

VOLATILE COMPOUNDS - compounds amenable to analysis by the purge and trap technique. Used synonymously with purgeable compounds.

WET WEIGHT - the weight of a sample aliquot including moisture (undried).

WIDE BORE CAPILLARY COLUMN - a gas chromatographic column with an internal diameter (ID) that is greater than 0.32 mm. Columns with lesser diameters are classified as narrow bore capillaries.

10% FREQUENCY - a frequency specification during an analytical sequence allowing for no more than 10 analytical samples between required calibration verification measurements, as specified by the contract Statement of Work.

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For Bruck Clarke of EARTH TECH

ANALYSIS	PRICE--$$
Bod	30
Cod	30
TSS	20
O&G	45
Arsenic	
Beryllium	
Cadmium	
Chromium	
Copper	
Lead	
Mercury	35
Nickel	
Silver	
Zinc	
Cyanide	30
PH	15 (Should be done in field)
Chlorine Demand	45
Temperature	Field
8260 Vol	190
8270-SemiVol	225--not including Pesticides and Herbicides
8270-SemiVol	350- includinbg Pesticides and Herbicides (annual event)
8080-PCBs	110
Acrolein/Acrylonitrile	50