Site: Rose Martha
ID#: MOD980633069
Break: 10.9
Other: workplans
1-17-93
0780

Remedial Design Work Plan

Rose Chemicals Site

Holden, Missouri

prepared for:

Rose Chemicals
Steering Committee

prepared by:

Clean Sites, Incorporated
Alexandria, Virginia

submitted to:

U.S. EPA Region VII
Kansas City, Kansas

40024252
SUPERFUND RECORDS

January 17, 1993

CLEAN SITES

ROSE CHEMICALS STEERING COMMITTEE

Steering Committee Member Organizations

Central Illinois Public Service Company

Central Louisiana Electric Company

Colorado Springs Dept. of Utilities

Commonwealth Edison Company

Gainesville Regional Utilities

General Motors Corp.

Illinois Power Company

Iowa Public Service Company

Interstate Power Company

Kansas Power & Light Company

Louisiana Power & Light Company/New Orleans Public Service Inc.

Missouri Public Service

National Rural Electric Cooperative Assn.

New England Power Service Company

Oklahoma Gas and Electric Company

Omaha Public Power District

Southwestern Electric Power Company

West Texas Utilities Company

Western Area Power Administration

January 15, 1993

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REML SECTION

Mr. Steve Kinser
Environmental Engineer
Superfund Branch
U.S. EPA - Region VII
726 Minnesota Avenue
Kansas City, Kansas 66101

Subject: Rose Chemicals Site
Remedial Design Work Plan

Dear Steve:

Enclosed are 5 copies of the Remedial Design Work Plan, which is submitted in accordance with Section III of the Modified Administrative Order, Docket No. VII-92-F-0026, dated November 30, 1992. This document is submitted on behalf of the Rose Chemicals Site Steering Committee.

The Remedial Design Health and Safety is being submitted concurrently with this document, under separate cover.

Please contact me at (508) 366-9011 or Harry Walton at (217) 424-6832 with any questions.

Sincerely,

Joseph Kwasnik / by gsf

Joseph Kwasnik
Project Coordinator
CSI Project Manager

Enclosure

ROSE CHEMICALS SITE STEERING COMMITTEE
500 SOUTH 27TH STREET
DECATUR, ILLINOIS 62525
(217)424-6837

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LIST OF ATTACHMENTS

ATTACHMENT	TITLE
No. 1	Sampling and Analysis Plan
No. 2	Remedial Design Quality Assurance Project Plan

SECTION 1

INTRODUCTION

1.1 Administrative Order

On September 4, 1992, Region VII of the U.S. Environmental Protection Agency (USEPA) issued an Administrative Order for Remedial Design and Remedial Action, Docket No. VII-92-F-0026, for the Martha C. Rose Chemicals, Inc., Site in Holden, Missouri. The Order was issued pursuant to Section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. Section 9606(a). The Order directs the Respondents, the Rose Chemicals Steering Committee (RCSC) and others, to perform the Remedial Design (RD) for the remedy described in the Record of Decision issued on March 6, 1992 and to implement the remedial design by performing a Remedial Action (RA).

On November 30, 1992, USEPA issued a Modification to the Order. The Modification, effective December 17, 1992, amends the language of the earlier Order concerning RD/RA document deliveries and implementation requirements. The modified order will be referred to hereafter as AO3.

1.2 Site Description/History

The Martha C. Rose Chemicals, Inc., (Rose Chemicals) Site is located in the City of Holden, Johnson County, Missouri. The Site is limited to the property owned by the City of Holden (upon which Rose Chemicals operated) and the contiguous areas to which polychlorinated biphenyls (PCBs) have been released as a result of Rose Chemicals' operations; including East Pin Oak Creek and an intermittent unnamed tributary to East Pin Oak Creek, which flows through the southwest corner of the site . The Site is located at 500 West McKissock Street, north of Missouri Highway 58. The 13-acre Site contains two major buildings, the Main Building and the South Warehouse, which have a combined floor area greater than 100,000 sq. ft.

In 1982, Rose Chemicals began operations as a PCB-processing facility. Rose Chemicals was authorized by USEPA to decontaminate mineral oil dielectric fluids containing PCBs at concentrations equal to or less than 10,000 milligrams per liter (mg/l), and to

dismantle and decontaminate PCB transformers and capacitors for the purpose of recycle of metals and disposal of non-recycleable materials. During its period of operation, Rose Chemicals received approximately 23 million pounds of PCB materials. Rose Chemicals ceased operations at the Site in February 1986, abandoning approximately 14 million pounds of PCB materials. As a result of Rose Chemicals' operations, PCBs were released to the environment.

On October 29, 1987 USEPA issued an Administrative Order on Consent, Docket No. 87-F-0007 to the RCSC (AO1). Pursuant to AO1, PCB solids and liquids were removed from the Site and disposed in a chemical waste landfill or treated at a TSCA incineration facility, respectively.

Following the removal activities,USEPA issued another Administrative Order in 1988 (AO2) to conduct a Remedial Investigation/Feasibility Study (RI/FS) at the Site.

1.3 Previous Site Studies

Under the terms of AO2, the RCSC conducted a remedial investigation (RI) and a feasibility study (FS).

The RCSC submitted the Report on the Remedial Investigation of the Rose Chemicals Site, Holden, Missouri by Burns and McDonnell Engineering Company to USEPA in February 1990. The RI identified PCBs in surface and subsurface soils, pond sediments, the sediments of East Pin Oak Creek and the unnamed tributary to East Pin Oak Creek, and in on-site buildings. The RI concluded the following about site conditions:

- Limited surface soils contain PCBs at concentrations greater than 500 mg/kg
- Subsurface soils contain PCBs at concentrations up to 700 mg/kg,
- Sediments in East Pin Oak Creek and the unnamed tributary contain PCBs at concentrations up to 293 mg/kg,
- On-site buildings, including the concrete floor slabs contain PCBs at concentrations up to 670,000 mg/kg.

The Feasibility Study for the Rose Chemicals Site, Holden, Missouri, by Burns and McDonnell Engineering Company was submitted by the RCSC to USEPA in September 1990. The FS evaluated six remedial alternatives and screened out all but the following two alternatives:

Alternative 4 - removal and disposal of the PCB-containing sediments, removal and disposal of the Site buildings, and capping of the Site, and

Alternative 6 - removal and disposal of the PCB-containing sediments, removal and disposal of PCB-containing soils greater than 10 mg/kg PCBs, removal and disposal of the Site buildings and concrete floor slabs, and backfilling excavated areas of the Site with clean soil.

1.4 Record of Decision

The USEPA decision on the Remedial Action (RA) to be implemented at the Site is embodied in the final Record of Decision (ROD) for the Martha C. Rose Chemicals, Inc., Site issued on March 6, 1992.

The major components of the remedy chosen by USEPA and detailed in the ROD are:

1) removal and off-site disposal of an estimated 826 cubic yards of sediments containing PCBs above 0.18 mg/kg from the East Pin Oak Creek and the unnamed tributary;
2) removal and off-site disposal or treatment and disposal of an estimated 4,788 cubic yards of surface and subsurface soil containing PCBs above 10 mg/kg;
3) dismantling of the Main Building and South Warehouse, including floor slabs and insulation, and off-site disposal or treatment and off-site disposal of the debris;
4) backfilling all excavated areas with clean soil and regrading;
5) monitoring of ground water for a minimum 10-year period; and
6) prohibiting by deed restriction the use of ground water for purposes other than ground water contamination monitoring. The ROD allows for treatment of soils, sediments, and other debris containing elevated levels of PCBs either on-site or off-site prior to disposal.

SECTION 2

PROJECT ORGANIZATION

Figure 2-1 presents the project organization for the Remedial Design. The RCSC has retained Clean Sites, Inc., of Alexandria, Virginia, as its Remedial Design Contractor. Remedial Design quality assurance will be provided by Burns & McDonnell Waste Consultants, Inc. of Overland Park, Kansas. Analytical support will be provided by EMS Heritage Laboratories, Inc. of Indianapolis, Indiana, and Kansas City, Missouri. Technical consultants may be identified and retained on an "as needed" basis.

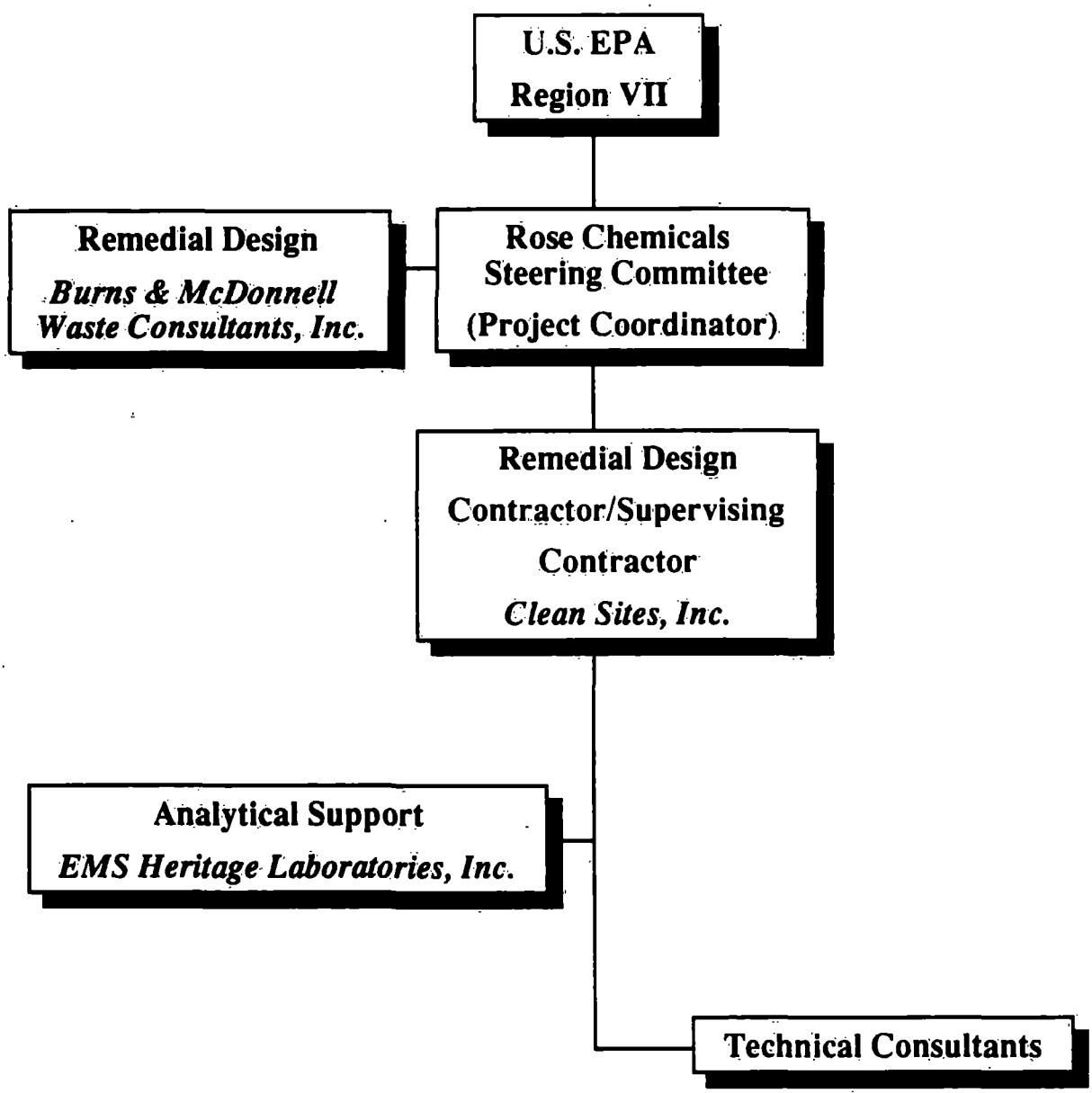


Figure 2-1. Remedial Design Project Organization

SECTION 3

REMEDIAL DESIGN SAMPLING AND ANALYSIS PLAN

This section consists of a Remedial Design Sampling and Analysis Plan (RD SAP) to characterize the PCBs in the concrete floor slabs in the Main Building and the South Warehouse. Sampling of other media during the Remedial Design is not anticipated.

3.1 Concrete

3.1.1 Sampling Objectives

The general objective of the Remedial Design Sampling and Analysis Plan is to provide data to assist USEPA in evaluating the specific mass of the concrete floor slabs with concentrations exceeding USEPA criteria prior to being transported off-site for treatment and disposal. Any areas of the concrete floor slab exceeding the USEPA criteria will be treated prior to disposal. In these areas, the entire depth of the concrete floor slab will be removed and treated. No attempt will be made to characterize the vertical extent of the PCB levels in the concrete floor slab, as there is no practicality in removing "layers" of the slab, and because previous sampling activities (during the RI) showed no consistency in vertical distribution through the slab.

The concrete floor slab will be sampled and characterized for PCB levels in two stages:

1) Characterization of PCB levels in concrete floor slabs prior to removal.

2) Characterization of removed concrete floor slab pursuant to RCRA and TSCA disposal requirements.

The RD SAP addresses the first stage characterization. The second stage characterization will be discussed in the Remedial Action Plan.

The specific objectives of the remedial design sampling and analysis plan are detailed as follows:

- Characterize PCB levels in the concrete floor slabs within the Main Building and the South Warehouse.

- Supply PCB characterization levels in concrete floor slabs to USEPA for identification of which zones of the concrete floor slab will require treatment prior to disposal.

- Quantify the mass and volume of concrete floor slab to be treated and/or disposed off-site.

3.1.2 Sample Locations

Twenty-five sample locations will be initially selected based upon the distribution of PCBs previously defined in the RI Report. Figure 3-1 provides a schematic representation of the proposed sample locations in the zones which are considered most likely to exceed the USEPA criteria. In addition, samples will be collected in any other areas which are obviously stained, based on visual observations during the sampling activities. Figure 3-1 includes the PCB concentrations for the concrete core samples from the RI, completed in 1990. The shaded areas define the zones which may exceed the USEPA criteria. The proposed sampling locations are intended to provide USEPA with the sampling data to better define these zones.

Based on the results of the initial samples, additional sampling may be necessary. If necessary, the additional samples will be obtained to further define the areal distribution of PCBs in concrete exceeding the criteria. These samples will be collected at other locations to refine the definition of the zones by increasing the spatial resolution.

All sample locations will be approved by the USEPA Remedial Project Manager prior to initiation of any sampling and analysis activities. USEPA will define the zones exceeding the USEPA criteria.

All waste generated during the implementation of this remedial design sampling and analysis plan and subsequent decontamination procedures will be managed through existing plans approved by USEPA for implementation of the RI. Any work conducted in support of this assessment and not discussed above will be pursuant to existing previously USEPA approved plans (RI, SAP, QAPP), if relevant.

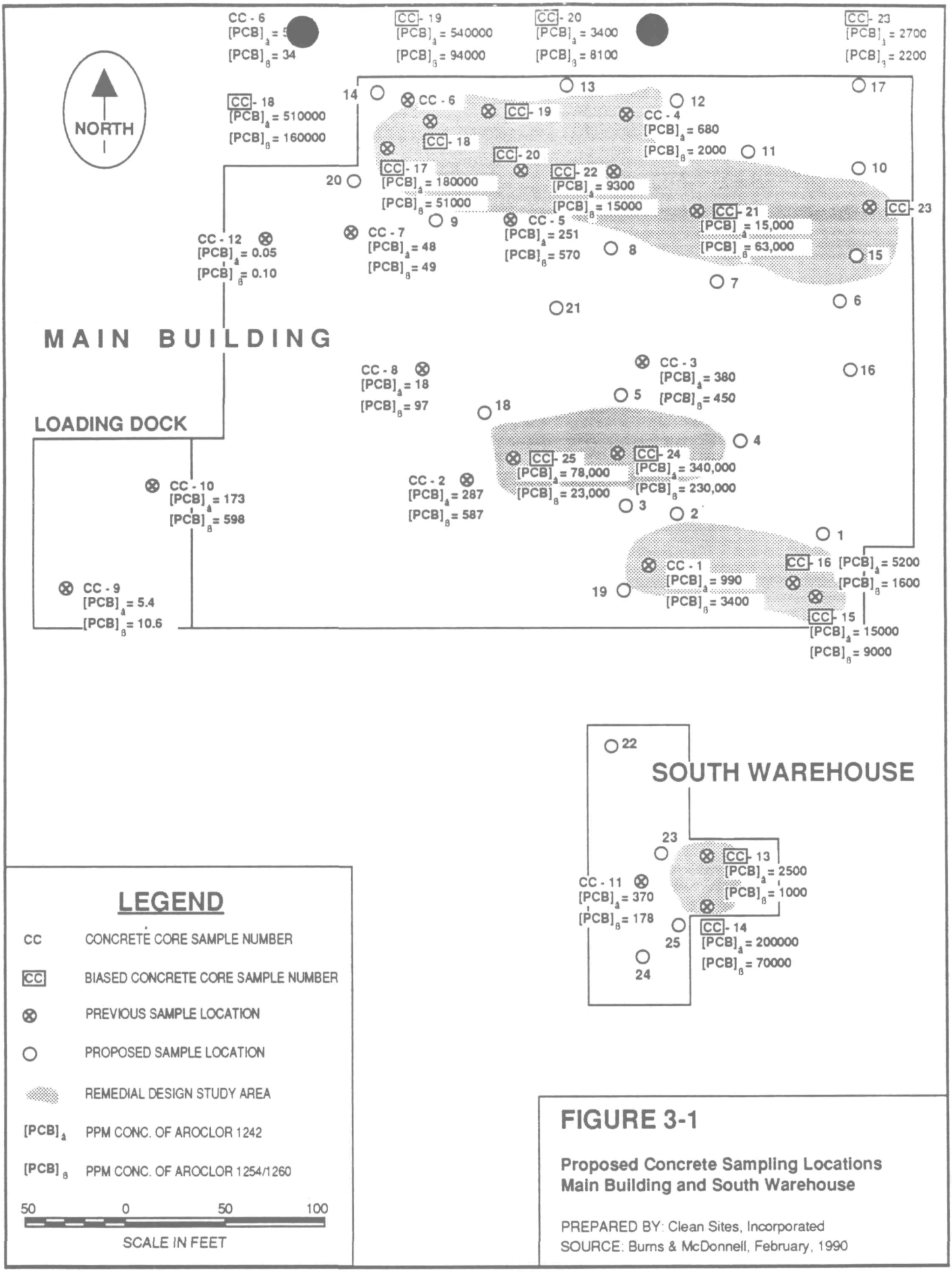


FIGURE 3-1

Proposed Concrete Sampling Locations Main Building and South Warehouse

PREPARED BY: Clean Sites, Incorporated
SOURCE: Burns & McDonnell, February, 1990

3.1.3 Sampling Methods and Standard Operating Procedures

Concrete samples will be obtained as cylindrical cores, through the depth of the floor slab. Concrete cores will be obtained by using a 1.5-inch-diameter core barrel and an electric concrete core machine. The rotating core barrel will be advanced through the concrete floor slab, cutting a cylindrical sample which will be removed from the device for subsequent analysis. Each cylindrical core sample will immediately be stored in a separate clean sample jar, labeled, and placed on ice for shipment to the laboratory. Each core sample will be entered into the chain-of-custody record.

The cylindrical cores will be pulverized at the laboratory using a "Spex" Model 4200 Jaw Crusher prior to analysis. A description of this equipment is provided in the Remedial Design Quality Assurance Project Plan (Attachment 2). All sampling and analysis work will be conducted in strict accordance with the Remedial Design Quality Assurance Project Plan, Rose Chemicals Site, Holden Missouri, (RD QAPP) prepared by Burns & McDonnell Waste Consultants, Inc. in 1993 (Attachment 2) and the Sampling and Analysis Plan, Rose Chemicals Site, Holden, Missouri, December, 1988, Burns and McDonnell Engineering Company (Attachment 1).

3.1.4 Decontamination/Cross-Contamination Prevention

A decontamination area will be established before initiation of sampling activities to reduce the possibility of contaminating media samples and cross-contaminating "clean" areas. All coring and sampling equipment will be decontaminated prior to arrival on-site and between each sample location. Since concrete sampling methodology for the design is similar to that conducted during the RI, decontamination procedures will be performed in accordance with Section III, Part E of the Sampling and Analysis Plan, Rose Chemicals Site, Holden, Missouri, December, 1988, Burns and McDonnell Engineering Company.

3.1.5 Analytical Methods

The concrete samples will be analyzed by Method No. 3540/8080 from Test Methods for Evaluating Solid Waste, SW 846, USEPA, 1986. The detailed procedures for this test method are described in the EMS Heritage Laboratories, Inc. QAPP (included in

Attachment 2). As mentioned above, the concrete core samples will be crushed using the "Spex" Model 4200 Jaw Crusher. Detailed specifications and procedures for operating the crusher are also described in the RD QAPP.

3.1.6 Analytical Laboratory

Concrete samples will be analyzed by EMS Heritage Laboratories, Inc. of Indianapolis, Indiana and Kansas City, Missouri. All laboratory analytical work will be conducted according to the RD QAPP.

3.2 Other Media

The concrete floor slab in the Main Building and the South Warehouse are expected to be the only medium sampled during the RD. Other media of concern (soils, sediment, and ground water) will be sampled during Remedial Action activities. Sampling and analysis plans and procedures for these activities will be included in the Remedial Design Submittals and the Remedial Action Work Plan. If sampling of any other media of concern is required during the Remedial Design, such sampling would be conducted according to the approved plans.

3.3 Remedial Design Quality Assurance Project Plan

The Remedial Design Quality Assurance Project Plan (RD QAPP) prepared by Burns and McDonnell Waste Consultants, Inc., 1993 is adapted from the Quality Assurance Project Plan, Rose Chemical Site, Holden Missouri, prepared by Burns and McDonnell Engineering Company in 1989 and approved by USEPA. The RD QAPP has been revised to reflect the project information concerning the RD. No other substantive changes have been made. A copy of the RD QAPP is included as Attachment 2.

The RD QAPP was developed according to the requirements of Section XVI of the Administrative Order and the Statement of Work; as well the following USEPA regulations and guidelines:

- The National Contingency Plan.

- EPA NEIC Policies and Procedures Manual, May, 1978, revised November, 1984 and May, 1986 (EPA-330/9-78-001-R).

- Guidelines and Specifications for Preparing Quality Assurance Program Documents, USEPA, June, 1987.

- Data Quality Objectives Guidance, (EPA/540/G-87/003 &/004).

SECTION 4

PRELIMINARY REMEDIAL DESIGN SUBMITTAL

The Preliminary Remedial Design Submittal will be submitted at the 60 percent completion stage.

4.1 Design Criteria

The remedial work will be designed in accordance with the Record of Decision (ROD), AO3 (which includes the Statement of Work as an attachment), applicable, relevant and appropriate requirements, and generally accepted engineering and construction practices.

Record of Decision Requirements

The ROD requires demolition of on-site buildings, disposal and treatment of materials containing PCBs at levels exceeding USEPA criteria, deed restrictions, and a ground water monitoring program. The selected remedy is detailed in Section 10.0 of the ROD. Additionally, the ROD specifies a 10-inch soil cover for the eastern portion of the Site, restoration of the stream channel with clean materials compatible with the existing stream bed material, and treatment of water generated during the remedial activities. These design criteria are discussed in Sections 4.4, 5.1 and 6.1 of this Work Plan.

Administrative Order Requirements

Primarily, AO3 focuses on schedules, submittals, and review requirements. AO3 however, addresses design criteria in Section IX, "Work to be Performed", Paragraph 35, "Remedial Design" by referencing the SOW and ROD for technical standards. Refer to Section 4.4 of this Work Plan for a discussion of these standards.

The SOW specifies that the remedy consist of certain requirements designed to technical standards. Soil, structure, and stream sediment removal, disposal or treatment, and ground water monitoring are addressed primarily in Section II of the

SOW, "Description of the Remedial Action." These aspects of the design are described in more detail in Sections 4.4, 5.1, and 6.1 of this Work Plan.

4.2 Results of Sampling and Predesign Work

Results obtained from remedial design sampling and analysis will be presented in this section. These data will be used to further characterize and delineate the extent of PCBs at the Site which, in turn, will be used to augment the drawings of the preliminary design.

4.3 Project Delivery Strategy

The delivery strategy for the Remedial Design consists of a Preliminary Remedial Design Submittal at 60 percent completion, a Prefinal Remedial Design Submittal at 95 percent completion, and a Final Remedial Design Submittal at 100 percent completion. A Health and Safety Plan will also be submitted simultaneously with this Work Plan. The schedule for the aforementioned deliverables will be in conformance with AO3 and is reflected in Section 8 of the Work Plan.

4.4 Design Plans and Specifications - Preliminary

4.4.1 Drawings and sketches

Preliminary drawings and sketches of the remedial design will be provided in the Preliminary Remedial Design Submittal.

4.4.2 Warehouse Dismantling, Demolition, and Removal Plan and Specifications - Preliminary

A preliminary version of the Warehouse Dismantling, Demolition, and Removal Plan will be provided in the Preliminary Remedial Design Submittal. The plan will include an outline of the specifications for dismantling the affected structures.

The plan will address dismantling, demolition, segregation, and removal of warehouse structures. These structures include the Main Building, the South Warehouse, and the

Storage Shed. Because parts of the concrete floor slabs, footings, and insulation in these structures have been identified as requiring treatment prior to disposal, dismantling of these components will be addressed separately in the Concrete Slabs and Footings and Building Insulation Dismantling Plan.

The plan will identify the specific measures that will be implemented to eliminate or reduce airborne particulates to the maximum extent practical during structure dismantling and removal activities.

4.4.3 Concrete Slabs and Footings and Building Insulation Dismantling Plan and Specifications - Preliminary

A preliminary Concrete Slabs and Footings and Building Insulation Dismantling Plan will be provided in the Preliminary Remedial Design Submittal. The plan will include an outline of the specifications for dismantling concrete and insulation.

The plan will address dismantling and removal of all PCB-containing concrete floor slabs and footings and building insulation on the Site. Remedial design sampling and analysis will provide PCB characterization levels in concrete floor slabs to USEPA for indentification of which zones will require treatment prior to disposal. The remaining materials will be disposed in a TSCA-approved chemical waste landfill. These materials exist in the Main Building and the South Warehouse.

The plan will identify the specific measures that will be implemented to eliminate or reduce airborne particulates to the maximum extent practical during dismantling and removal activities.

4.4.4 Surface Soils and Pond Sediments Removal Plan and Specifications - Preliminary

A preliminary Surface Soils and Pond Sediments Excavation Plan will be provided in the Preliminary Remedial Design Submittal. The plan will include an outline of the specifications for removal of all appropriate surface soils and pond sediments.

The plan will address the removal of all surface soils and pond sediments containing PCBs at concentrations in excess of 10 mg/kg. All such soils and pond sediments will

be removed to a depth of not less than 10 inches. Removal of PCB-containing subsurface soils will be addressed separately in the Subsurface Soil Contamination Excavation Plan.

Remedial action sampling and analysis will be performed following the initial removal to determine when removal of surface soils and pond sediments activities may cease in individual areas based on USEPA criteria. This verification sampling task is addressed separately in the Post-Excavation Performance Verification Plan.

The plan will identify the specific measures that will be implemented to eliminate or reduce airborne particulates to the maximum extent practical during excavation activities.

4.4.5 Subsurface Soil Contamination Excavation Plan and Specifications - Preliminary

A preliminary Subsurface Soil Contamination Excavation Plan will be provided in the Preliminary Remedial Design Submittal. The plan will include an outline of the specifications for removal of subsurface soils exceeding a 10 mg/kg PCB concentration.

The plan will address the removal of all subsurface soil containing PCBs at concentrations in excess of 10 mg/kg. All such soil will be excavated to a depth of not less than 10 inches.

Remedial action sampling and analysis will be performed following the initial removal to determine when excavation of subsurface soils activities may cease in individual areas based on USEPA criteria. This verification sampling task is addressed separately in the Post-Excavation Performance Verification Plan.

The plan will identify the specific measures that will be implemented to eliminate or reduce airborne particulates to the maximum extent practical during excavation activities.

4.4.6 Stream Sediments Dredging Plan and Specifications - Preliminary

A preliminary Stream Sediments Dredging Plan will be provided in the Preliminary Remedial Design Submittal. The plan will include an outline of the specifications for dredging all stream sediments identified in the RI, exhibiting PCB concentrations greataer than 0.18 ppm from the East Pin Oak Creek and its unnamed tributary.

The plan will address the dredging and removal of stream sediments in the creek and unnamed tributary. The stream sediment removal in any area will progress until: 1) PCB levels remaining in the sediment are determined (by post dredging sampling and analysis) to be less than 0.18 mg/kg or the Practical Quantification Limit (*PQL), whichever is greater; 2) the dredging reaches a depth of four feet; or 3) bedrock is encountered. Sampling and analysis of undisturbed sediments and bank materials is *addressed separately in the Post-Excavation Performance Verification Plan.*

The plan will identify the specific measures that will be implemented to divert stream flow during dredging, to prevent the spread of PCBs during sediment removal, and to prevent runoff from sediment de-watering, storage and other related activities.

The plan will also include specifications for site preparation prior to dredging. Site preparation activities may include removal of trees and brush to access the stream bed.

4.4.7 Contaminated Media Treatment/Disposal Plan and Specifications - Preliminary

A preliminary Contaminated Media Treatment/Disposal Plan will be provided in the Preliminary Remedial Design Submittal. The plan will include an outline of the specifications for the treatment and disposal of media at the Site contaminated with PCBs at levels exceeding USEPA criteria .

Off-site disposal of all building components will be in accordance with applicable regulations including 40 C.F.R. Part 268 and 40 C.F.R. 761. Remedial design sampling and analysis will provide sufficient information to USEPA to identify concrete and insulation that will be treated prior to off-site disposal at a TSCA-approved chemical waste landfill. The remaining building materials will not require treatment prior to disposal in a TSCA-approved chemical waste landfill.

* (PQL means the lowest concentration or level that can be reliably measured within specified limits of precision and accuracy during routine laboratory operating conditions in accordance with "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods", EPA Publication No. SW-846).

Prior to off-site disposal, representative samples of excavated surface soils and pond sediments, excavated subsurface soils, and dredged stream sediments will be analyzed to determine if any of these materials exhibit any hazardous waste characteristics, in accordance with the Toxicity Characteristic Leaching Procedure (TCLP) set forth in Appendix II of 40 C.F.R. Part 261. Materials will be disposed in accordance with 40 C.F.R. Part 268. Any soils or sediments contaminated at levels that USEPA determines constitute a principal threat will be treated prior to disposal in a TSCA-approved chemical waste landfill.

Water generated during pond and stream sediment dewatering will be treated and disposed in accordance with applicable regulations.

4.4.8 Monitoring Well Installation/Abandonment Plan and Specifications - Preliminary

A preliminary Monitoring Well Installation/Abandonment Plan will be provided in the Preliminary Remedial Design Submittal. The plan will include an outline of the specifications for the installation of additional ground water monitoring wells at the Site.

A ten-year ground water monitoring program will be designed. The plan will include the number, locations, and procedures for installation of additional ground water monitoring wells.

The plan will also include procedures for the abandonment of any monitoring wells not included in the post-RA ground water monitoring network. Abandonment procedures will be carried out in accordance with applicable State and Federal regulations.

A schedule for monitoring well installation and abandonment will be included in the Final Construction schedule as outlined in Subsection 6.4 of this Work Plan.

4.4.9 Cross-Contamination/Recontamination Prevention Plan and Specifications - Preliminary

A preliminary Cross-Contamination/Recontamination Prevention Plan will be provided in the Preliminary Remedial Design Submittal. The plan will include an outline of the specifications for the construction of any physical barriers and/or work practices to prevent cross-contamination/recontamination at the Site.

The plan will include the methods and procedures to be employed to prevent the cross-contamination or recontamination of the entire Site.

The specific measures that will be implemented to prevent the uncontrolled migration of contaminants during stream sediments dredging and to prevent uncontrolled runoff from de-watering and other activities will be covered in the Stream Sediments Dredging Plan.

4.4.10 Post-Excavation Performance Verification Plan and Specifications - Preliminary

A preliminary Post-Excavation Performance Verification Plan will be provided in the Preliminary Remedial Design Submittal. The plan will include an outline of the specifications for the sampling of environmental media for the purpose of verifying that remediation in areas containing PCBs has achieved the USEPA criteria or performance standards, and for verifying that cross-contamination or recontamination has not occurred in areas that may be impacted by remedial activities. Final sampling of environmental media will be conducted in accordance with this Plan prior to demobilization of the remedial action contractor(s).

As outlined in Subsection 6.8 of this Work Plan, complete standard operating procedures for the performance verification sampling and analysis of undisturbed surface soils and pond sediments, subsurface soils, and stream sediments will be contained in the Field Sampling and Analysis Plan developed as part of the Remedial Action Work Plan.

4.4.11 Erosion and Sedimentation Control/Site Restoration Plan and Specifications - Preliminary

A preliminary Erosion and Sedimentation Control/Site Restoration Plan will be provided in the Preliminary Remedial Design Submittal. The plan will include an outline of the specifications for erosion and sedimentation controls and for the restoration activities at the Site.

The plan will include the methods and procedures to be employed to reduce or eliminate on-site surface erosion and stream sedimentation during Remedial Action activities.

The plan will also include procedures for the restoration of the Site. Upon determining that the Site soils have contaminant levels below the USEPA criteria, a minimum 10-inch-thick soil cover will be placed over the eastern portion of the Site. All materials used in this final cover will be shown to be free of PCBs. The final grade of the cover will be a uniform surface with a slope similar to pre-construction conditions. Upon completion, the cover will be seeded and mulched.

When stream sediment removal is completed and upon determining that all areas of the stream bed have PCB levels below USEPA criteria, the stream courses will be restored with PCB-free material compatible with the existing stream bed material, and the stream bed and over bank areas will be restored to pre-excavation conditions.

4.5 Construction Quality Assurance Project Plan Objectives

The objective of the Construction Quality Assurance Project Plan (CQAPP) is to describe the approach and methods for Quality Assurance (QA) during construction activities at the site. The program will address, at a minimum, the following:

- responsibility and authority,
- personnel qualifications,
- inspection activities,
- sampling requirements, and
- documentation.

Burns & McDonnell Waste Consultants, Inc. will prepare the CQAPP and conduct the Quality Assurance activities during the construction, as the Independent Quality Assurance Team (IQAT) Leader.

The IQAT will include other parties such as geotechnical testing companies, analytical laboratories, surveyors, and other subcontractors as required to support the QA activities. The IQAT will report directly to the Rose Chemicals Steering Committee. Additional details concerning the Construction Quality Assurance activities will be included in the Remedial Action Work Plan, which will be submitted according to the requirements of AO3.

SECTION 5

PREFINAL REMEDIAL DESIGN SUBMITTAL

The Prefinal Remedial Design Submittal will be submitted at the 95 percent completion stage.

5.1 Design Plans and Specifications - Prefinal

5.1.1 Drawings

Prefinal drawings of the remedial design will be provided in the Prefinal Remedial Design Submittal. General correlation between drawings and technical specifications is a basic requirement of all working construction plans and specifications. All specifications and drawings will be coordinated, cross-checked, edited, and proofed prior to submittal.

5.1.2 Warehouse Dismantling, Demolition, and Removal Plan and Specifications - Prefinal

A prefinal Warehouse Dismantling, Demolition, and Removal Plan will be provided in the Prefinal Remedial Design Submittal. The plan will include specifications for dismantling the affected structures.

The plan will address dismantling, demolition, segregation, and removal of warehouse structures. These structures include the Main Building, the South Warehouse, and the Storage Shed. Because parts of the concrete floor slabs and footings and the insulation in these structures have been identified as requiring treatment prior to disposal, dismantling of these components will be addressed separately in the Concrete Slabs and Footings and Building Insulation Dismantling Plan.

The plan will identify the specific measures that will be implemented to eliminate or reduce airborne particulates to the maximum extent practical during structure dismantling and removal activities.

5.1.3 Concrete Slabs and Footings and Building Insulation Dismantling Plan and Specifications - Prefinal

A prefinal Concrete Slabs and Footings and Building Insulation Dismantling Plan will be provided in the Prefinal Remedial Design Submittal. The plan will include specifications for dismantling concrete and insulation.

The plan will address dismantling and removal of all PCB-containing concrete floor slabs and footings and building insulation on the Site. Remedial design sampling and analysis will provide PCB characterization levels in concrete slabs to USEPA for identification of which zones will require treatment prior to disposal. The remaining materials will be disposed in a TSCA-approved chemical waste landfill. These materials exist in the Main Building and the South Warehouse.

The plan will identify the specific measures that will be implemented to eliminate or reduce airborne particulates to the maximum extent practical during dismantling and removal activities.

5.1.4 Surface Soils and Pond Sediments Removal Plan and Specifications - Prefinal

A prefinal Surface Soils and Pond Sediments Excavation Plan will be provided in the Prefinal Remedial Design Submittal. The plan will include specifications for removal of all appropriate surface soils and pond sediments.

The plan will address the removal of all surface soils and pond sediments containing PCBs at concentrations in excess of 10 mg/kg. All such soils and pond sediments will be removed to a depth of not less than 10 inches. Removal of PCB-containing subsurface soils will be addressed separately in the Subsurface Soil Contamination Excavation Plan.

Remedial action sampling and analysis will be performed following the initial removal to determine when removal of surface soils and pond sediments activities may cease in individual areas based on USEPA criteria. This verification sampling task is addressed separately in the Post-Excavation Performance Verification Plan.

The plan will identify the specific measures that will be implemented to eliminate or reduce airborne particulates to the maximum extent practical during removal activities.

5.1.5 Subsurface Soil Contamination Excavation Plan and Specifications - Prefinal

A prefinal Subsurface Soil Contamination Excavation Plan will be provided in the Prefinal Remedial Design Submittal. The plan will include specifications for removal of subsurface soils exceeding a 10 mg/kg PCB concentration.

The plan will address the removal of all subsurface soil containing PCBs in excess of 10 mg/kg. All such soil will be excavated to a depth of not less than 10 inches.

Remedial action sampling and analysis will be performed following the initial removal to determine when removal of subsurface soils activities may cease in individual areas based on USEPA criteria. This verification sampling task is addressed separately in the Post-Excavation Performance Verification Plan.

The plan will identify the specific measures that will be implemented to eliminate or reduce airborne particulates to the maximum extent practical during excavation activities.

5.1.6 Stream Sediments Dredging Plan and Specifications - Prefinal

A prefinal Stream Sediments Dredging Plan will be provided in the Prefinal Remedial Design Submittal. The plan will include specifications for dredging all appropriate stream sediments from the East Pin Oak Creek and its unnamed tributary.

The plan will address the dredging and removal of stream sediments in the creek and unnamed tributary. The stream sediment removal in any area will progress until: 1) PCB levels remaining in the sediment are determined (by post dredge sampling and analysis) to be less than 0.18 mg/kg or the PQL, whichever is greater; 2) the dredging reaches a depth of four feet; or 3) bedrock is encountered. Sampling and analysis of undisturbed sediments and bank materials is addressed separately in the Post-Excavation Performance Verification Plan.

The plan will identify the specific measures that will be implemented to divert stream flow during dredging, to prevent the spread of PCBs during sediment excavation, and to prevent runoff from sediment de-watering, storage, and other activities.

The plan will also include specifications for site preparation prior to dredging. Site preparation activities may include removal of trees and brush to access the stream bed.

5.1.7 Contaminated Media Treatment/Disposal Plan and Specifications - Prefinal

A prefinal Contaminated Media Treatment/Disposal Plan will be provided in the Prefinal Remedial Design Submittal. The plan will include specifications for the treatment and disposal of media at the Site contaminated with PCBs at levels exceeding USEPA criteria.

Off-site disposal of all building components will be in accordance with applicable regulations including 40 C.F.R. Part 268 and 40 C.F.R. Part 761. Remedial design sampling and analysis will provide sufficient information to USEPA to identify concrete and insulation that will be treated prior to off-site disposal at a TSCA-approved chemical waste landfill. The remaining building materials will not require treatment prior to disposal in a TSCA-approved chemical waste landfill.

Prior to off-site disposal, representative samples of excavated surface soils and pond sediments, excavated subsurface soils, and dredged stream sediments will be analyzed in accordance with the Toxicity Characteristic Leaching Procedure (TCLP) set forth in Appendix II of 40 C.F.R. Part 261, and be disposed in accordance with 40 C.F.R. Part 268. Any soils or sediments contaminated at levels that USEPA determines constitute a principal threat will be treated prior to disposal in a TSCA-approved chemical waste landfill.

Water generated during pond and stream sediment dewatering will be treated and disposed in accordance with applicable regulations.

5.1.8 Monitoring Well Installation/Abandonment Plan and Specifications - Prefinal

A prefinal Monitoring Well Installation/Abandonment Plan will be provided in the Prefinal Remedial Design Submittal. The plan will include specifications for the installation of additional ground water monitoring wells at the Site.

A ten-year ground water monitoring program will be designed. The plan will include the number, locations, and procedures for installation of additional ground water monitoring wells.

The plan will also include procedures for the abandonment of any monitoring wells not included in the post-RA ground water monitoring network. Abandonment procedures will be carried out in accordance with applicable State and Federal regulations.

A schedule for monitoring well installation and abandonment will be included in the Final Construction Schedule as outlined in Subsection 6.4 of this Work Plan.

5.1.9 Cross-Contamination/Recontamination Prevention Plan and Specifications - Prefinal

A prefinal Cross-Contamination/Recontamination Prevention Plan will be provided in the Prefinal Remedial Design Submittal. The plan will include specifications for the construction of any physical barriers and/or work practices to prevent cross-contamination/recontamination at the Site.

The plan will include the methods and procedures to be employed to prevent the cross-contamination or recontamination of the entire Site.

The specific measures that will be implemented to prevent the uncontrolled migration of contaminants during stream sediments dredging and to prevent uncontrolled runoff from de-watering and other activities will be covered in the Stream Sediments Dredging Plan.

5.1.10 Post-Excavation Performance Verification Plan and Specifications - Prefinal

A prefinal Post-Excavation Performance Verification Plan will be provided in the Prefinal Remedial Design Submittal. The plan will include specifications for the sampling of environmental media for the purpose of verifying that remediation in areas containing PCBs has achieved the USEPA criteria or performance standards, and for verifying that cross-contamination or recontamination has not occurred in areas that may be impacted by remedial activities. Final sampling of environmental media will be conducted in accordance with this Plan prior to demobilization of the remedial action contractor(s).

As outlined in Subsection 6.8 of this Work Plan, complete standard operating procedures for the performance verification sampling and analysis of undisturbed surface soils and pond sediments, subsurface soils, and stream sediments will be contained in the Field Sampling and Analysis Plan developed as part of the Remedial Action Work Plan.

5.1.11 Erosion and Sedimentation Control/Site Restoration Plan and Specifications - Prefinal

A prefinal Erosion and Sedimentation Control/Site Restoration Plan will be provided in the Prefinal Remedial Design Submittal. The draft plan will include the specifications

for erosion and sedimentation controls and for the restoration activities at the Site.

The plan will include the methods and procedures to be employed to reduce or eliminate on-site surface erosion and stream sedimentation during Remedial Action activities.

The plan will also include procedures for the restoration of the Site. Upon determining that the Site soils have contaminant levels below the USEPA criteria, a minimum 10-inch-thick soil cover will be placed over the eastern portion of the Site. All materials used in this final cover will be shown to be free of PCBs. The final grade of the cover will be a uniform surface with a slope similar to pre-construction conditions. Upon completion, the cover will be seeded and mulched.

When stream sediment excavation is completed and upon determining that all areas of the stream bed have PCB levels below the USEPA criteria, the stream courses will be restored with PCB-free material compatible with the existing stream bed material, and the stream bed and over bank areas will be restored to pre-excavation conditions.

5.2 Operation and Maintenance Plan - Preliminary

A Preliminary Operation and Maintenance (O&M) Plan will be prepared to provide a detailed description of the inspection and O&M activities to be performed after the completion of the RA. These actions will continue for at least 10 years. The plan will include the following elements:

1. Normal operation and maintenance, including
    a. description of tasks for operation
    b. description of tasks for maintenance
    c. description of prescribed treatment or operation conditions
    d. schedule showing frequency of each O&M task

2. Potential operating problems, including
    a. description and analysis of potential operating problems
    b. sources of information regarding problems
    c. common and/or anticipated remedies

3. Routine monitoring and laboratory testing, including
   a. description of monitoring tasks
   b. description of required laboratory tests and their interpretation
   c. required data collection, Quality Assurance Project Plan (QAPP)
   d. schedule of monitoring frequency and date, if appropriate, when monitoring may cease
   e. description of triggering mechanisms for implementing responses to ground water monitoring results

4. Alternate operation and maintenance, including
   a. alternate procedures, should systems fail, to prevent release or threatened releases of hazardous substances, pollutants, or contaminants which may endanger public health and the environment or exceed USEPA criteria
   b. analysis of vulnerability and additional resource requirements should a failure occur
   c. response to system failures

5. Response actions, including
   a. description of response actions to be implemented if contaminant levels in ground water experience an increase in concentration in excess of established concentratins
   b. schedule for implementing these response actions

6. Safety plan, including
   a. description of precautions and necessary equipment, etc., for Site personnel
   b. safety tasks required in the event of systems failure

7. Equipment, including
   a. equipment identification
   b. installation and monitoring components
   c. maintenance of site equipment
   d. replacement schedule for equipment and installed components

8. Records and reporting mechanisms, including
   a. daily operating logs
   b. laboratory records
   c. records for operating costs

d. mechanism for reporting emergencies
e. personnel and maintenance records
f. development and scheduling of reports to State and Federal agencies, RCSC representatives

A Ground Water Monitoring Plan will be included in the O&M Plan and implemented for the Site. The plan will address monitoring of the deep and shallow ground water for changes in ground water quality.

The O&M Plan will be submitted as part of the Prefinal Remedial Design Submittal.

5.3 Cost Estimate - Preliminary

A preliminary engineering cost estimate will be completed for construction of the remedy. The cost estimate will include capital, and operation and maintenance costs and will be based on estimated material quantities calculated from the prefinal design specifications. Cost information will be obtained from vendors or Means Cost Data and will be indexed based on the Engineering News Record Building Cost Index. The preliminary cost estimate will be submitted as part of the Prefinal Remedial Design Submittal.

5.4 Construction Schedule - Preliminary

A preliminary construction schedule will be created to estimate the time necessary to complete individual tasks required for implementation of the RA. Construction activities will be divided into discrete tasks which include time for construction (including bid preparation, bid evaluation, contractor procurement, mobilization, etc.), test requirements, agency reviews, and potential delays due to inclement weather. Installation and abandonment of monitoring wells will also be included. The preliminary construction schedule will be included as part of the Prefinal Remedial Design Submittal.

5.5 Construction Quality Assurance Project Plan - Preliminary

The objectives set forth in Subsection 4.5 of this Work Plan will be used to create a preliminary Construction Quality Assurance Project Plan (CQAPP). The CQAPP will

utilize an Independent Quality Assurance Team which will ensure that the remedial action construction conforms to the design and specifications set forth in the remedial design. This plan will be prepared in accordance with USEPA guidelines, specifically "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans". The preliminary CQAPP will be submitted as part of the Prefinal Remedial Design Submittal.

5.6 Construction Health and Safety Plan Specifications - Preliminary

Specifications for the completion of a Health and Safety Plan (HSP) will be prepared for work performed during the RA. The specifications for the HSP will recommend appropriate health and safety activities to be followed by site personnel conducting and overseeing various phases of the RA. The procedures will be designed to reduce the risk of exposure to chemical substances that may be present in water, soil, air, or building material, and to reduce physical hazards during remedial action. The HSP specifications will be used by the construction contractor in developing a final HSP which will be implemented during the RA. The preliminary HSP specifications will be submitted as part of the Prefinal Remedial Design Submittal.

5.7 Contingency Plan - Preliminary

The contingency plan will address procedures to follow in the event of a spill above a reportable quantity as outlined by the Clean Water Act. Such spills could occur from decontamination fluids and fuel for the concrete coring device. However, due to the small volumes of liquids, the possibility of a spill above the reportable quantity seems unlikely. If a spill were to occur, the procedures outlined by the Clean Water Act would be implemented.

The preliminary contingency plan will be submitted as part of the Prefinal Remedial Design Submittal.

SECTION 6

FINAL REMEDIAL DESIGN SUBMITTAL

The Final Remedial Design Submittal will be submitted at the 100 percent completion stage.

6.1 Design Plans and Specifications - Final

6.1.1 Drawings

Final drawings of the remedial design will be provided in the Final Remedial Design Submittal. General correlation between drawings and technical specifications is a basic requirement of all working construction plans and specifications. All specifications and drawings will be coordinated, cross-checked, edited, and proofed prior to submittal.

6.1.2 Warehouse Dismantling, Demolition, and Removal Plan and Specifications - Final

A final Warehouse Dismantling, Demolition, and Removal Plan will be provided in the Final Remedial Design Submittal. The plan will include specifications for dismantling the affected structures.

The plan will address dismantling, demolition, segregation and removal of warehouse structures. These structures include the Main Building, the South Warehouse, and the Storage Shed. Because parts of the concrete floor slabs and footings and the insulation in these structures have been identified as requiring treatment prior to disposal, dismantling of these components will be addressed separately in the Concrete Slabs and Footings and Building Insulation Dismantling Plan.

The plan will identify the specific measures that will be implemented to eliminate or reduce airborne particulates to the maximum extent practical during structure dismantling and removal activities.

6.1.3 Concrete Slabs and Footings and Building Insulation Dismantling Plan and Specifications - Final

A final Concrete Slabs and Footings and Building Insulation Dismantling Plan will be provided in the Final Remedial Design Submittal. The plan will include specifications for dismantling concrete and insulation.

The plan will address dismantling and removal of all PCB-containing concrete floor slabs and footings and building insulation on the Site. Remedial design sampling and analysis will provide PCB characterization levels in concrete floor slabs to USEPA for identification of which zones will require treatment prior to disposal. The remaining materials will be disposed in a TSCA-approved chemical waste landfill. These materials exist in the Main Building and the South Warehouse.

The plan will identify the specific measures that will be implemented to eliminate or reduce airborne particulates to the maximum extent practical during dismantling and removal activities.

6.1.4 Surface Soils and Pond Sediments Removal Plan and Specifications - Final

A final Surface Soils and Pond Sediments Excavation Plan will be provided in the Final Remedial Design Submittal. The plan will include specifications for removal of all appropriate surface soils and pond sediments.

The plan will address the removal of all surface soils and pond sediments containing PCBs in excess of 10 mg/kg. All such soils and pond sediments will be removed to a depth of not less than 10 inches. Removal of PCB-containing subsurface soils will be addressed separately in the Subsurface Soil Contamination Excavation Plan.

Remedial action sampling and analysis will be performed following the initial removal to determine when removal of surface soils and pond sediments activities may cease in individual areas based on USEPA criteria. This verification sampling task is addressed separately in the Post-Excavation Performance Verification Plan.

The plan will identify the specific measures that will be implemented to eliminate or reduce airborne particulates to the maximum extent practical during removal activities.

6.1.5 Subsurface Soil Contamination Excavation Plan and Specifications - Final

A final Subsurface Soil Contamination Excavation Plan will be provided in the Final Remedial Design Submittal. The plan will include specifications for removal of all appropriate subsurface soils exceeding 10 mg/kg PCBs.

The plan will address the removal of all subsurface soil containing PCBs in excess of 10 mg/kg. All such soil will be excavated to a depth of not less than 10 inches.

Remedial action sampling and analysis will be performed following the initial removal to determine when removal of subsurface soils activities may cease in individual areas based on USEPA criteria. This verification sampling task is addressed separately in the Post-Excavation Performance Verification Plan.

The plan will identify the specific measures that will be implemented to eliminate or reduce airborne particulates to the maximum extent practical during excavation activities.

6.1.6 Stream Sediments Dredging Plan and Specifications - Final

A final Stream Sediments Dredging Plan will be provided in the Final Remedial Design Submittal. The plan will include specifications for dredging all appropriate stream sediments from the East Pin Oak Creek and its unnamed tributary.

The plan will address the dredging and removal of stream sediments in the creek and unnamed tributary. The stream sediment removal in any area will progress until: 1) PCB levels remaining in the sediment are determined (by post dredge sampling and analysis) to be less than 0.18 mg/kg or the PQL, whichever is greater; 2) the dredging reaches a depth of four feet; or 3) bedrock is encountered. Sampling and analysis of undisturbed sediments and bank materials is addressed separately in the Post-Excavation Performance Verification Plan.

The plan will identify the specific measures that will be implemented to divert stream flow during dredging, to prevent the spread of PCBs during sediment removal, and to prevent runoff from sediment de-watering, storage, and other activities.

The plan will also include specifications for site preparation prior to dredging. Site preparation activities may include removal of trees and brush to access the stream bed.

6.1.7 Contaminated Media Treatment/Disposal Plan and Specifications - Final

A final Contaminated Media Treatment/Disposal Plan will be provided in the Final Remedial Design Submittal. The plan will include specifications for the treatment and disposal of media at the Site contaminated with PCBs at levels exceeding USEPA criteria.

Off-site disposal of all building components will be in accordance with applicable regulations, including 40 C.F.R. Part 268 and 40 C.F.R. Part 761. Remedial design sampling and analysis will provide sufficient information to USEPA to identify concrete and insulation that will be treated prior to off-site disposal at a TSCA-approved chemical waste landfill. The remaining building materials will not require treatment prior to disposal in a TSCA-approved chemical waste landfill.

Prior to off-site disposal representative samples of excavated surface soils and pond sediments, excavated subsurface soils, and dredged stream sediments will be analyzed in accordance with the Toxicity Characteristic Leaching Procedure (TCLP) set forth in Appendix II of 40 C.F.R. Part 261, and be disposed in accordance with 40 C.F.R. Part 268. Any soils or sediments contaminated at levels that USEPA determines constitute a principal threat will be treated prior to disposal in a TSCA-approved chemical waste landfill.

Water generated during pond and stream sediment dewatering will be treated and disposed in accordance with applicable regulations.

6.1.8 Monitoring Well Installation/Abandonment Plan and Specifications - Final

A final Monitoring Well Installation/Abandonment Plan will be provided in the Final Remedial Design Submittal. The plan will include specifications for the installation of additional ground water monitoring wells at the Site.

A ten-year ground water monitoring program will be designed. The plan will include the number, locations, and procedures for installation of additional ground water monitoring wells.

The plan will also include procedures for the abandonment of any monitoring wells not included in the post-RA ground water monitoring network. Abandonment procedures will be carried out in accordance with applicable State and Federal regulations.

A schedule for monitoring well installation and abandonment will be included in the final construction schedule as outlined in Subsection 6.4 of this Work Plan.

6.1.9 Cross-Contamination/Recontamination Prevention Plan and Specifications - Final

A final Cross-Contamination/Recontamination Prevention Plan will be provided in the Final Remedial Design Submittal. The plan will include specifications for the construction of any physical barriers and/or work practices to prevent cross-contamination/recontamination at the Site.

The plan will include the methods and procedures to be employed to prevent the cross-contamination or recontamination of the entire Site.

The specific measures that will be implemented to prevent the uncontrolled migration of contaminants during stream sediments dredging and to prevent uncontrolled runoff from de-watering and other activities will be covered in the Stream Sediments Dredging Plan.

6.1.10 Post-Excavation Performance Verification Plan and Specifications - Final

A final Post-Excavation Performance Verification Plan will be provided in the Final Remedial Design Submittal. The plan will include specifications for the sampling of environmental media for the purpose of verifying that remediation in areas containing PCBs has achieved the USEPA criteria or performance standards, and for verifying that cross-contamination or recontamination has not occurred in areas that may be impacted by remedial activities. Final sampling of environmental media will be conducted in accordance with this Plan prior to demobilization of the remedial action contractor(s).

As outlined in Subsection 6.8 of this Work Plan, complete standard operating procedures for the performance verification sampling and analysis of undisturbed surface soils and pond sediments, subsurface soils, and stream sediments will be contained in the Field Sampling and Analysis Plan developed as part of the Remedial Action Work Plan.

6.1.11 Erosion and Sedimentation Control/Site Restoration Plan and Specifications - Final

A final Erosion and Sedimentation Control/Site Restoration Plan will be provided in the Final Remedial Design Submittal. The plan will include specifications for erosion and sedimentation controls and for the restoration activities at the Site.

The plan will include the methods and procedures to be employed to reduce or eliminate on-site surface erosion and stream sedimentation during Remedial Action activities.

The plan will also include procedures for the restoration of the Site. Upon determining that the Site soils have contaminants levels below the USEPA criteria, a minimum 10-inch-thick soil cover will be placed over the eastern portion of the Site. All materials used in this final cover will be shown to be free of PCBs. The final grade of the cover will be a uniform surface with a slope similar to pre-construction conditions. Upon completion, the cover will be seeded and mulched.

When stream sediment excavation is completed and upon determining that all areas of the stream bed have PCB levels below the USEPA criteria, the stream courses will be restored with PCB-free material compatible with the existing stream bed material, and the stream bed and over bank areas will be restored to pre-excavation conditions.

6.2 Operation and Maintenance Plan - Final

A Final Operation and Maintenance (O&M) Plan will be prepared to provide a detailed description of the inspection and O&M activities to be performed after the completion of the RA. These actions will continue for at least 10 years. The plan will include the following elements:

1. Normal operation and maintenance, including
    a. description of tasks for operation
    b. description of tasks for maintenance
    c. description of prescribed treatment or operation conditions
    d. schedule showing frequency of each O&M task

2. Potential operating problems, including
    a. description and analysis of potential operating problems
    b. sources of information regarding problems
    c. common and/or anticipated remedies

3. Routine monitoring and laboratory testing, including
   a. description of monitoring tasks
   b. description of required laboratory tests and their interpretation
   c. required data collection, Quality Assurance Project Plan (QAPP)
   d. schedule of monitoring frequency and date, if appropriate, when monitoring may cease
   e. description of triggering mechanisms for ground water monitoring results

4. Alternate operation and maintenance, including
   a. alternate procedures, should systems fail, to prevent release or threatened releases of hazardous substances, pollutants, or contaminants which may endanger public health and the environment or exceed USEPA criteria
   b. analysis of vulnerability and additional resource requirements should a failure occur
   c. response to system failures

5. Response actions, including
   a. description of response actions to be implemented if contaminant levels in ground water experience a significant increase in concentration
   b. schedule for implementing these response actions

6. Safety plan, including
   a. description of precautions and necessary equipment, etc., for Site personnel
   b. safety tasks required in the event of systems failure

7. Equipment, including
   a. equipment identification
   b. installation and monitoring components
   c. maintenance of site equipment
   d. replacement schedule for equipment and installed components

8. Records and reporting mechanisms, including
   a. daily operating logs
   b. laboratory records
   c. records for operating costs
   d. mechanism for reporting emergencies
   e. personnel and maintenance records
   f. reports to State and Federal agencies, RCSC representatives

A Ground Water Monitoring Plan will be included in the O&M Plan and implemented for the Site. The plan will address monitoring of the deep and shallow ground water for changes in ground water quality.

The final O&M Plan will be submitted as part of the Final Remedial Design Submittal.

6.3 Cost Estimate - Final

A final engineering cost estimate will be completed for construction of the remedy. The cost estimate will include capital, and operation and maintenance costs and will be based on estimated material quantities calculated from the final design specifications. Cost information will be obtained from vendors or Means Cost Data and will be indexed based on the Engineering News Record Building Cost Index. The final cost estimate will be submitted as part of the Final Remedial Design Submittal.

6.4 Construction Schedule - Final

A final construction schedule will be created to estimate the time necessary to complete individual tasks required for implementation of the RA. Construction activities will be divided into discrete tasks which include time for construction (including bid preparation, bid evaluation, contractor procurement, mobilization, etc.), test requirements, agency reviews, and potential delays due to inclement weather. Installation and abandonment of monitoring wells will also be included. The final construction schedule will be included as part of the Final Remedial Design Submittal.

6.5 Construction Quality Assurance Project Plan - Final

The objectives set forth in Subsection 4.5 of this Work Plan will be used to create a final Construction Quality Assurance Project Plan (CQAPP). The CQAPP will be employed by an Independent Quality Assurance Team which will ensure that the remedial action construction conforms to the design and specifications set forth in the remedial design. This plan will be prepared in accordance with USEPA guidelines, specifically "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans." The final CQAPP will be submitted as part of the Final Remedial Design Submittal.

6.6 Construction Health and Safety Plan - Final

Using the specification developed in Section 5.6 of this Work Plan, a Construction Health and Safety Plan (HSP) will be prepared. The HSP will recommend appropriate health and safety activities to be followed by site personnel conducting and overseeing various phases of the RA. The procedures will be designed to reduce the risk of exposure to chemical substances that may be present in water, soil, air, or building material, and to reduce physical hazards during remedial action. The final HSP will be submitted as part of the Final Remedial Design Submittal.

6.7 Contingency Plan - Final

The final contingency plan will address possible course of action for work to be performed for the RD. The contingency plan for implementation of the RA will be submitted with the RA Work Plan.

The final plan will contain procedures to follow in the event of a spill as outlined by the Clean Water Act. Such spills could occur from decontamination fluids and fuel for the concrete coring device.

The final contingency plan will be submitted as part of the Final Remedial Design Submittal.

6.8 Remedial Action Field Sampling and Analysis Plan - Preliminary

A preliminary Field Sampling and Analysis Plan (FSAP) will be prepared to address sampling conducted during removal of PCB-containing media (soil and sediment). This sampling would be conducted to determine if USEPA criteria have been met at various stages during the removal. The FSAP will follow USEPA guidelines (sampling techniques, Data Quality Objectives, Contract Laboratory Program, QA/QC, etc.) where applicable and will include, as a minimum:

1. Sampling objectives
2. Sample collection procedures,
3. Sample documentation,
4. Equipment decontamination, and
5. Analytical procedures.

The preliminary FSAP will be submitted with the Final Remedial Design Submittal.

SECTION 7

COMPLIANCE WITH OTHER LAWS

Section 121(e) of CERCLA states that no Federal, State, or local permits are required for any remedial actions conducted entirely on-site, although remedial actions must meet the substantive requirements of any applicable or relevant and appropriate requirements (ARARs). As defined in AO3, the Site includes the property within the boundaries of Martha C. Rose Chemicals Inc., in Holden, Missouri, and all contiguous areas to which PCBs have been released as a result of facility operations. This would encompass the areas of East Pin Oak Creek and its unnamed tributary. Therefore, these areas are considered part of the Site and must comply with the substantive requirements of ARARs during the remedial action. Any action that extends beyond the Site boundary is subject to the full administrative and substantive requirements of the ARARs.

The required permits, approvals, and access agreements for the project will be pursued early in the design process so that any potential delays in implementing the RA will be minimized. This section describes ARARs and to-be-considered (TBCs) that were identified in the ROD and Feasibility Study, and access agreements as they apply to Site activities. This section also identifies potential permits required.

7.1 Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) regulates the use of PCBs. The regulations establishing the prohibitions of and requirements for the manufacturing, storage and disposal of PCBs are found at 40 C.F.R. Part 761. Subparts C and D of these regulations are ARARs for the Site and address marking, and storage and disposal of PCBs, respectively. Subpart G of these regulations is a TBC that establishes PCB exposure limits for soil and building surfaces.

All required treatment and disposal of PCB-contaminated material will be performed at TSCA/RCRA permitted facilities. Manifesting of the waste will comply with Subpart K of the regulations. Pursuant to Section 121(e)(1) of CERCLA, any substantive requirements for TSCA will be followed.

7.2 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act (RCRA) regulates hazardous waste. ARARs for the Site include the Land Disposal Restrictions (LDRs), 40 C.F.R. Part 268, and Hazardous Waste Identification Criteria, 40 C.F.R. Part 261 Subpart C. Prior to off-site disposal of soils and sediment containing PCBs, the Toxicity Characteristic Leaching Procedure will be performed to ensure that the material is not a characteristic hazardous waste. If the material is a characteristic hazardous waste, it will be treated using the Best Demonstrated Available Technology and disposed in a TSCA/RCRA hazardous waste landfill. The regulations pertaining to transportation of hazardous waste (40 C.F.R. Part 263) may become ARARs and will be addressed, if appropriate. Pursuant to Section 121(e)(1) of CERCLA, any substantive requirements for RCRA will be followed.

7.3 Clean Air Act

The Clean Air Act (CAA) governs emissions of pollutants into the air. ARARs applicable to the Site include regulations for emissions from incinerators (40 C.F.R. Part 50, 52.21, 60.52, Part 61) and site activities (40 C.F.R. Part 50). The selected off-site incinerator employed for treatment of waste must comply with CAA regulations. Construction activities resulting in the disturbance of soil and concrete have the potential for generating airborne particulates which are regulated by the National Ambient Air Quality Standards. Airborne particulate levels will be limited to the maximum extent practical by the use of dust suppressants. Pursuant to Section 121(e)(1) of CERCLA, any substantive requirements for CAA will be followed.

7.4 Clean Water Act

The Clean Water Act (CWA) regulates the quality of waterways in the country. ARARs applicable to the Site include National Pollutant Discharge Elimination System (NPDES) regulations (40 C.F.R. Parts 122, 125, 136), Publicly Owned Treatment Works (POTW) pretreatment requirements (40 C.F.R. 403.5), and floodplain and wetlands management (40 C.F.R. Part 6). Wastewater generated from dewatering activities would be governed by NPDES regulations if disposal occurred via a point source discharge or POTW pretreatment requirements if effluent was conveyed to the Holden Wastewater Treatment Plant (HWTP). The type of wastewater disposal will be determined in the RD. For floodplain and wetlands management on the site, potential harm to the aquatic environment will be minimized as part of the RD. If wastewater is discharged to East

Pin Oak Creek or its unnamed tributary, the substantive requirements of an NPDES permit and stomwater management plans for construction projects greater than 5 acres will be met. If wastewater is discharged the HWTP, the substantive requirements of a POTW pre-treatment permit or authorization will be met. No other CWA permit will be required for remedial activities.

7.5 Other ARARs

This section addresses other Federal, State, and local regulations or requirements which would be followed during the RA but were not discussed above.

Federal

Occupational Safety and Health Act - This act establishes the requirements of health and safety protection and training requirements for workers at CERCLA sites. The regulations detailing the health and safety protection requirements for work at CERCLA sites are found at 40 C.F.R. Part 1910.

State

Missouri Water Quality Standards - This regulation (10 C.S.R. 20-7.031) establishes water quality criteria for state surface waters. Since the East Pin Oak Creek and its unnamed tributary are not classified by the Missouri DNR, water quality standards are not applicable. However, the unnamed tributary is used for livestock watering; therefore, livestock watering standards are applicable.

Missouri Air Quality Standards - This regulation (10 C.S.R. 10-6.060(7)(A)) governs the de minimus emissions levels of 16 compounds of which total suspended particulates and particulate matter would be applicable. Dust emissions during the remedial action are expected to be maintained below established levels by use of dust suppressants, if necessary.

Missouri Hazardous Waste Standards - This regulation (10 C.S.R. Division 25) governs hazardous waste throughout the State and is similar to RCRA. The federal regulations referenced in Section 7.2 of this Work Plan are included in 10 C.S.R. Division 25 by reference and would be an ARAR.

Missouri Solid Waste Standards - This regulation (10 C.S.R. Division 80) governs non-hazardous, solid waste management throughout the State. If waste material at the Site can be disposed at a solid waste landfill, then the receiving facility must be permitted with the State and these regulations would be applicable.

Other - Additional State requirements that may be applicable include a stream encroachment permit, CWA requirements, and erosion and sedimentation control plan. The substantive requirements of these plans and/or permits will be met for the RA, if applicable.

Local

City of Holden Sewer Ordinance - Prior to discharging effluent from water treatment processes, a sewer discharge permit may be required. This permit would be secured if discharge to the POTW is selected as a disposal option.

Other - Additional local requirements that may be applicable include general construction permits (demolition, digging near public utilities, well installation, etc.). The construction contractor would identify which permits are needed for the RA and the substantive requirements of those permits would be followed.

7.6 Access Agreements

Section XIX, "Access to Property not Owned by Respondents", of AO3 states that the respondents have 45 days from the effective date of the order to secure access agreements to properties bounding the Site where remedial work will be conducted. This requirement does not apply to the City of Holden. Access agreements are currently being sought with other landowners. If access agreements cannot be obtained in a timely manner, the RCSC will address access requirements with USEPA and possible time delays to the RA activities.

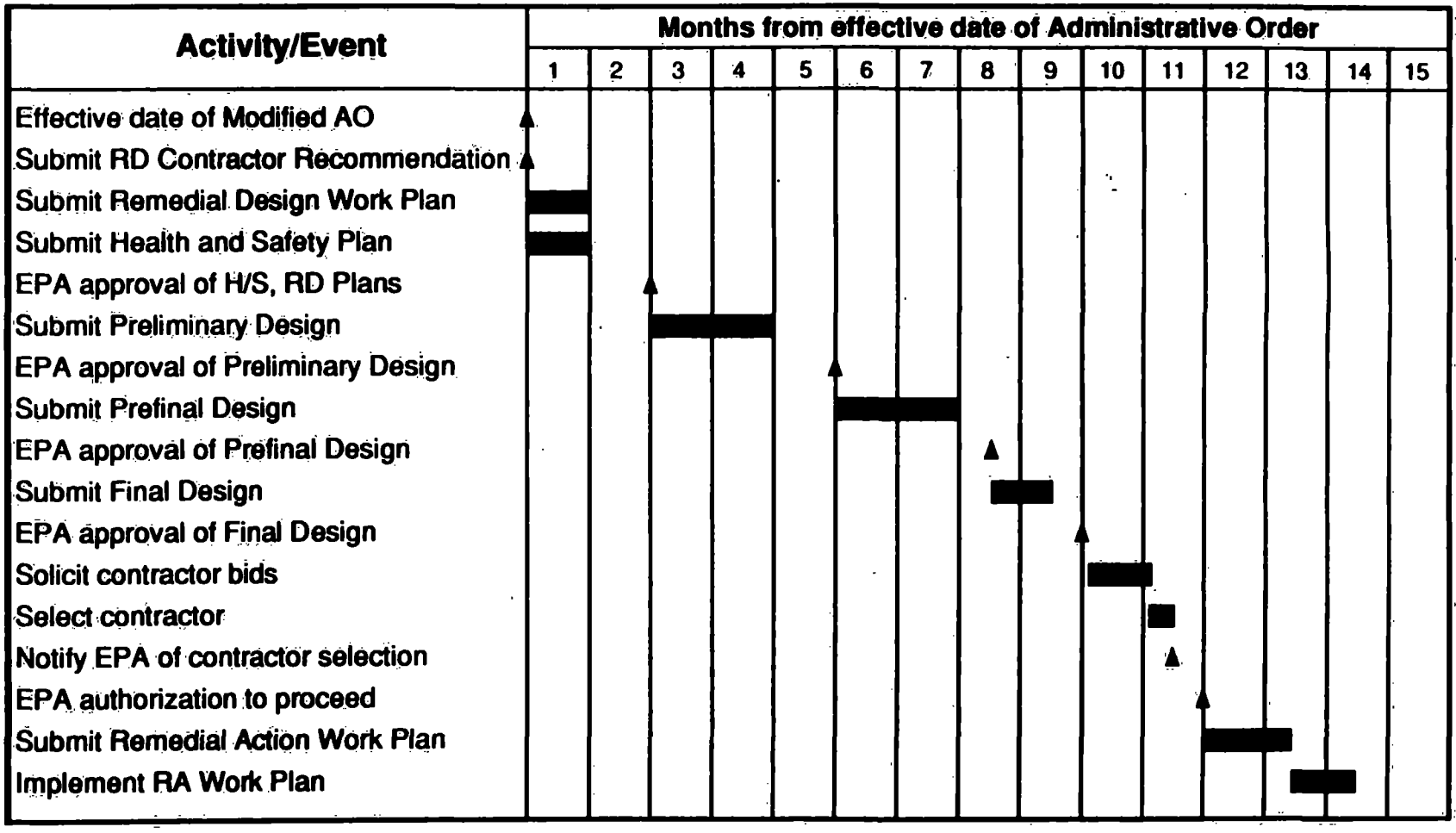
SECTION 8

SCHEDULE FOR COMPLETION OF REMEDIAL DESIGN AND REMEDIAL ACTION WORK PLANS

Figure 8-1 presents the schedule for completion of the Remedial Design Work Plan and Remedial Action Work Plan. The schedule also addresses RD and RA deliverables and presentations, including:

- Preliminary Remedial Design Submittal
- Prefinal Remedial Design Submittal
- Final Remedial Design Submittal
- Notification to USEPA of Remedial Action Contractor selection

FIGURE 8-1. ROSE CHEMICALS SITE REMEDIAL DESIGN/REMEDIAL ACTION SCHEDULE



EPA review times are assumed to be either 15 or 30 days, depending on the deliverable

Remedial Design Work Plan

Rose Chemicals Site
Holden, Missouri

Attachment No. 1
(Sampling and Analysis Plan)

SAMPLING AND ANALYSIS PLAN
ROSE CHEMICALS SITE
HOLDEN, MISSOURI

December 1988

88-025-4

Burns & McDonnell Engineering Company
Engineers-Architects-Consultants
Kansas City, Missouri

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INTRODUCTION

A summary of the Rose Chemicals Site location and history and an explanation of the purpose and scope of the Sampling and Analysis Plan (SAP) are included in this section.

A. SUMMARY OF SITE HISTORY

The Rose Chemicals Site is located in the western portion of Missouri approximately 50 miles southeast of Kansas City. Specifically, it is located in the northwestern quadrant of Holden, Missouri at 500 West McKissock Street, immediately north of and contiguous to Missouri State Route No. 58 (Figure IN-1). The approximately 13-acre property is owned by the City of Holden and leased to Lear Siegler, Inc. It was used by Martha C. Rose Chemicals, Inc. from 1982 until early 1986 to store, process and decontaminate (1) electrical transformers, capacitors and similar items that contained fluids contaminated with polychlorinated biphenyls (PCBs), (2) other PCB items, and (3) PCB fluids.

According to U.S. Environmental Protection Agency (U.S. EPA) findings, Rose Chemicals failed to manage, handle and dispose of PCBs and PCB items in accordance with its permits and applicable federal regulations (40 CFR 761). Rose Chemicals then entered into two Consent Agreements and Final Orders with U.S. EPA, and ceased operations and abandoned the facility and site on about March 1, 1986.

Since then, the Potentially Responsible Parties (PRPs) have taken removal actions and other appropriate actions at the site. The PRPs have entered into two Administrative Orders on Consent (AOC-1 and AOC-2) with U.S. EPA, Region VII. These Orders required the PRPs to conduct preliminary assessments of site conditions with regard to releases or threats of releases of PCBs; to secure and restrict access to the site; to inventory and remove PCBs and PCB items from the site; to fully investigate and evaluate the nature and extent of releases or threats of releases of hazardous substances, including PCBs, into the environment; and to evaluate alternatives to remediate any such releases. Removal operations, conducted under AOC-2, were completed in November 1988. The latter two requirements to investigate releases and to evaluate remedial alternatives constitute a Remedial Investigation/Feasibility Study (RI/FS), the scope and conduct of which are described in the "Final Work Plan for Remedial Investigation/Feasibility study at Rose Chemicals Site in Holden, Missouri" (Final Work Plan).

Sampling and analyses conducted to date have shown the presence of PCBs and volatile organic compounds (VOCs) in surface soils, subsurface soils, pond sediments, and buildings and structures.

B. PURPOSE AND SCOPE OF SAMPLING AND ANALYSIS PLAN

1. PURPOSE

The objectives of the RI at the Rose Chemicals Site are as follows:

- Verify the geologic and hydrogeologic model of the Rose Chemicals Site and identify potentially affected site areas,

- Further identify and quantify contaminants present on the site, utilizing data developed during the RI,

- Confirm or deny potential pathways of migration of contaminants from the site,

- Identify sensitive receptors of any contaminants that may migrate from the site,

- Characterize and estimate the risk associated with no remediation of any on-site contaminants in on-site media and buildings and structures, and

- Obtain adequate data to support analysis and selection of remedial alternatives.

The objectives of the Feasibility Study (FS) are to select and evaluate remedial alternatives for the Rose Chemicals Site such that a Recommended Alternative can be presented to and approved by the U.S. EPA.

In order to meet the RI/FS objectives, additional data requirements have been identified. The following additional data are required to evaluate

adequately the various remedial technologies dealing with the site conditions:

- o Concentration and distribution of PCBs and other contaminants in the subsurface soil profile, especially beneath the major buildings, and at the surface of access routes into the site,

- o Concentration and distribution of PCBs and other contaminants in the sediments of the on-site ponds, sewers, and the nearby unnamed tributary and East Pin Oak Creek, and

- o As may be necessary, the establishment of background soil chemistry in areas unaffected by activities at the site.

The following <u>additional</u> data are required for evaluating remedial technologies dealing with water:

- o Water levels in soil and bedrock strata,

- o Quantification of chemicals in groundwater at additional locations on the site, especially upgradient and downgradient of suspected source areas,

- o Quantification of chemicals in the surface water of the on-site ponds and in the nearby unnamed tributary and East Pin Oak Creek, and

- Hydrogeologic characteristics of the site.

The following additional data are required for evaluating remedial technologies dealing with building and structures:

- Types and degree of contaminants in various building surfaces and materials,

- Extent of contaminants (both areally and with depth, especially within and below floor slabs), and

- Applicability of remedial technologies to decontaminate various building materials and surfaces.

The purpose of this SAP is to define data collection objectives and methodology to be used during the RI field activities at the Rose Chemicals Site.

2. SCOPE

Part I of this SAP provides background information on the site and a description of the project. Part II describes the existing data validation and assessment plan for the data collected during previous investigations. Part III describes the detailed field investigation objectives, rationale and procedures to be used for sample collection at the Rose Chemicals Site. The procedures specified in this SAP, if followed, will provide field investigation data that will meet the

overall project quality assurance objectives as presented in the Quality Assurance Project Plan (QAPP) for the Rose Chemicals Site. The procedures are in accordance with applicable federal and state regulations and guidance.

Scope of work defined in the SAP is to provide the additional data needed to conduct the RI/FS. However, if further data gaps are identified during the RI, appropriate amendments to this SAP will be developed.

PART I

PROJECT DESCRIPTION AND BACKGROUND

A. PROJECT DESCRIPTION

Background information about the Rose Chemicals Site was obtained from the Final Work Plan. This section includes detailed site location and description and operational history.

1. SITE LOCATION AND DESCRIPTION

The Rose Chemicals Site is located in Holden, Missouri at 500 West McKissock Street as shown on Figure IN-1.

Land in the area surrounding the site is used for light industrial, commercial, and residential purposes. Industrial and commercial buildings are located within approximately 200 feet of the site. The nearest residence is within 50 feet of the eastern site boundary. Access to the site is via Highway 131 and West McKissock Street or Highway 58.

The site, which is approximately 13 acres in size and contains two existing buildings, is shown on Figure I-1. The surface of the site generally slopes to the southwest and storm water flow is controlled by on-site ditches and ponds.

2. OPERATIONAL HISTORY OF SITE

The site was previously known as the Holden Industrial Park. The South Warehouse was built in the 1930s, and the initial portions of the Main Building in the late 1940s after World War II. Reported earlier users of the site included Royal Industries who operated a farm implement assembly and painting operation through 1980; possibly a meat processing firm (1980-1982); and subsequently, a group of firms owned by W.C. Carolan. These firms included Dust Suppression, Inc.; American Steel Works, Inc.; and Martha C. Rose Chemicals, Inc.

The property which is now known as the Rose Chemicals Site is owned by the City of Holden, Missouri (City). On June 1, 1976, the City entered into a lease agreement with Royal Industries, Inc. (Royal), covering the Rose Chemicals Site. Royal was subsequently acquired by Lear Siegler, Inc. (Lear), and Lear became the assignee by merger of Royal's interest under the lease agreement. On March 3, 1980, Lear entered into a sublease agreement with W.C. Carolan Company, Inc. (Carolan), by which Lear sublet the Rose Chemicals Site to Carolan and assigned to Carolan its option to purchase the site.

Martha C. Rose Chemicals, Inc. was in business from 1982 until early 1986. During that time, approximately 23 million pounds of PCB items were received at the site. These materials were sent to Rose Chemicals by various companies, municipalities, government agencies and other institutions (i.e., the PRPs) for handling in accordance with the provisions of the Toxic Substances Control Act (TSCA). The types of

materials received at the Rose Chemicals Site included transformers, capacitors, soils, sludges, liquids and miscellaneous debris.

3. CURRENT STATUS

On or about March 1, 1986, Rose Chemicals discontinued on-site operations and abandoned the facility.

Subsequently and in response to the AOC-1, the PRP's have performed investigations at the site to obtain data to allow assessment of the degree of contaminants in various media (i.e., soil, water, air) that may have resulted from the operation of Rose Chemicals. These previous investigations have focused on air, water (surface and subsurface), soils (surface and subsurface) and buildings. Additional studies of off-site aquatic biota have been performed by the Missouri Department of Conservation and the Missouri Department of Natural Resources in Pin Oak Creek and its tributaries.

Also following issuance of AOC-1, the PRPs have instituted/completed the following response actions:

- Installed a perimeter fence and established 24-hour security personnel on-site,

- Performed a complete inventory of all drums, tanks, equipment, transformers and other materials on the site and inside the buildings,

- Regraded the site to prevent pools of standing water,

- Installed a discharge pipe and valve from the storm water retention pond to the unnamed tributary,

- Investigated potential contaminant pathways from the Main Building by trenching around the building; all identified drains from the Main Building have been plugged,

- Began removing bulk PCB-contaminated oils from the site for off-site incineration, and

- Removed non-PCB contaminated materials for off-site disposal. Materials included metallic sodium, metallic sodium flammable solids, various corrosive and flammable liquids, and various laboratory wastes.

Subsequent to issuance of AOC-2, the PRPs have:

- Prepared a Removal Work Plan for removal of 14 million pounds of PCB items identified at the site,

- Completed removal of approximately 20 million pounds of PCB items, debris, and contaminated soil from the site,

- Prepared the Final Work Plan for RI/FS activities, and

- Contracted for preparation of the RI/FS.

Preparation of the various plans required to complete the RI field activities is currently underway. This SAP details the scope and procedures that will be followed during the field sampling and analysis activities of the RI/FS. Other plans being developed include:

- Quality Assurance Project Plan (QAPP),
- Site Health and Safety Plan (HSP), and
- Data Management Plan (DMP).

B. PROJECT ORGANIZATION

The project organization for the RI/FS is illustrated on Figure I-2.

C. DOCUMENTATION

Certain records will be maintained in log books and on field forms for sampling events and daily activities during the RI. This documentation is part of and described in the companion QAPP.

D. DECONTAMINATION AND WASTE MATERIAL HANDLING

Personnel decontamination is presented in the HSP. All drilling and sampling equipment will be decontaminated following the procedures outlined in Section E of Part III. All investigation generated wastes will be disposed of according to the procedures detailed in Part IV.

* * * * *

PART II

EXISTING DATA VALIDATION AND ASSESSMENT PLAN

Because the RI/FS decision process depends on data collected at the site, quantitative evaluation of the validity of the data is essential. Validation analyses shall be performed on all existing data in order to identify suspect data and schedule resampling when required.

Before existing data are used, the data and supporting documentation shall be evaluated. Data may be considered invalid if the following information is not available.

- Sampling date
- Identity of sampling teams or person in charge
- Sampling location and description
- Sampling depth increment
- Collection technique
- Field preparation technique
- Laboratory preparation technique
- Laboratory analytical methods
- Laboratory detection limits

If the documentation described above is adequate, then all data (including quality control data) shall be assessed to determine, to the fullest extent possible, its precision, accuracy, representativeness, completeness, and

comparability. A review of these parameters shall be based upon guidance in "Data Quality Objectives for Remedial Response Activities (Development Process), EPA/540/G-87/003, March 1987."

During the assessment of the existing data, data gaps may be identified. If deficiencies in either quantity or quality of data are identified, additional data collection activities will be performed to fill the data gaps.

* * * * *

PART III

FIELD SAMPLING PLAN

A. INTRODUCTION

This section of the SAP presents a detailed description of field sampling and laboratory analysis activities planned for conducting the RI at the Rose Chemicals Site. It includes the following items:

- Detailed descriptions of sampling methodology, field sample quality control procedures, sample containers, preservation required for samples, analytical requirements, and decontamination of sampling equipment.

- Description of field organization.

- Field activities schedule.

B. SCOPE AND OBJECTIVES OF THE REMEDIAL INVESTIGATION

The purpose of the RI is to evaluate the nature and extent of the threat to human health, welfare and the environment posed by the site and to gather data to support the development and evaluation of remedial alternatives in the Feasibility Study.

The objectives of the RI are as follows:

- Verify the geologic and hydrogeologic model of the site and identify potentially affected site areas,

- Identify and quantify contaminants present on the site, utilizing data developed in the RI,

- Confirm or deny potential pathways of migration of contaminants from the site,

- Identify sensitive receptors for any contaminants that may migrate from the site,

- Conduct an Endangerment Assessment to establish whether, and if so the extent to which, any contaminants present at the site, or which may be released from the site, present a danger to the public health and welfare or the environment.

- Obtain adequate data to support analysis and selection of remedial alternatives.

To accomplish these objectives, the RI will include:

- Installation of monitoring wells.

- Collection and analysis of soil, sediment, structural solids, surface water, and groundwater samples.

In addition, the engineering properties of selected soil and sediment samples will be analyzed to assess the potential for contaminant migration and for development of remedial alternatives. This data will be used to support an endangerment assessment and evaluation of remedial alternatives in the Feasibility Study.

C. FIELD INVESTIGATION RATIONALE

1. SUBSURFACE SOIL INVESTIGATION

a. Soil Borings

A total of 28 soil borings will be drilled on the site at the approximate locations shown on Figures III-1, III-2 and III-3. At eight (8) locations, paired borings (i.e., nests) will be instrumented as groundwater monitoring wells. The remaining 12 borings will be drilled to the top of bedrock inside the existing buildings and one containment pad. Characterization of the subsurface materials will include sample collection from 20 of these soil borings. Information obtained during the soil borings will be used to further define: (1) the stratigraphy of the subsurface materials, (2) the physical properties of the soil and bedrock, and (3) the type and approximate extent of contamination in the subsurface.

Each boring, except the interior boring in Grid 23, will be drilled using hollow-stem augers or rotary wash drilling techniques. Soil samples will be obtained using standard penetration test split-spoon samplers according to ASTM D1586, or 3-inch diameter Shelby tubes according to ASTM D1587. These will be taken continuously to the top of bedrock in each of the 100 series sample borings. The interior boring in Grid 23 will be advanced and sampled below the concrete slab using a manual bucket auger to refusal at the top of bedrock. Each soil sample will be visually inspected and classified in the field and screened with a Photovac T.I.P. II (TIP) photoionization detector to detect potential volatile organics. The description of the subsurface materials and the field TIP readings will be recorded on the soil boring log. Representative samples with TIP readings of background levels will be placed in jars for subsequent testing for engineering properties. Continuous, NX-size, bedrock core samples will be collected from the eight 100 series borings below the bedrock surface to a depth of approximately 50 feet.

The 100 series borings will be the deep exterior borings extended into the bedrock for a total boring depth of 50 feet or a minimum of 40 feet penetration into the bedrock. The 200 series borings will be the shallow exterior borings drilled to auger refusal at the top of bedrock.

The deep borings (100 series) will be drilled first and geologically logged and sampled. After the deep borings have been drilled, the shallow borings (200 series) in each nested pair will be drilled and logged based on the driller's observations and drill cuttings.

In addition to stratigraphically logging the borings, selected soil samples will be collected for chemical analyses. Two samples from each of the deeper borings at each boring nest, and each of the twelve borings inside the structures, will be submitted for chemical analyses. These samples will be selected at random by a field sampling team member prior to drilling each boring. Additional soil samples may be selected for chemical analysis based on the TIP readings. The soil samples from the borings will be analyzed for PCBs, VOCs, and semivolatiles as listed on Table III-1.

Replicate soil samples will be collected from the subsurface borings to evaluate the precision of the field sampling and analytical techniques as indicated on Table III-2. The replicate samples will be analyzed for the same constituents as the soil borings. Refer to companion QAPP for discussion of quality assurance objectives.

Soil samples, considered by the sampling team to be representative of each subsurface strata encountered, will be collected from area pond and creek sediments, each deep exterior soil boring, and each interior soil boring for physical analyses. These samples will be tested for moisture content, Atterberg limits and grain size

analyses for granular samples. The results of the physical analyses will be used to describe soil parameters and the potential rate of vertical and lateral migration of contaminants. The physical analyses will also be used to assist in estimating the lateral and vertical movement of groundwater and constituents of concern and groundwater dynamics for feasibility study alternatives. The results of the analysis will be used to predict the potential lateral and vertical movement of organic and inorganic contaminants through the vadose and saturated zones.

A portion of each soil or sediment sample collected will be stored in a glass jar for possible subsequent physical properties analysis. These samples will be labeled in the same manner as the samples collected for chemical analysis and placed in a storage area in the site trailer protected from freezing. These samples do not have a holding time criteria or preservation requirements. Upon completion of the analytical tests, the physical tests will be assigned on the selected corresponding soil samples. Only samples with chemical analytical results below detection limits will be sent to the laboratory for engineering properties analysis. These samples will be delivered to Alpha-Omega Geotech in Kansas City, Kansas by a member of the field sampling team.

2. GROUNDWATER INVESTIGATION

Groundwater migration rates, recharge rates, and flow direction will be determined from validated data and data collected during the groundwater

investigation. Water samples from existing wells and proposed wells will aid in identification of contaminant plumes.

a. Monitoring Well Location and Installation

Sixteen monitoring wells will be installed at the site during the RI at the locations shown on Figure III-1. Data obtained through sampling of these wells will allow further determination of the groundwater flow dynamics, and definition of the extent and degree of contaminated groundwater migration at the site. Table III-3 presents the rational for the installation of each monitoring well.

Monitoring wells will be completed in monitoring well nests of two wells each. Each nest will consist of one shallow well (200 series well) advanced to auger refusal (at the presumed top of bedrock) at anticipated depths of 12 to 18 feet, and one deep well (100 series well) drilled to a depth of approximately 50 feet or to a minimum of 40 feet penetration into the bedrock.

b. Sample Collection and Analysis

(1) Objectives: Chemical analyses of two rounds of groundwater samples from the proposed and existing monitoring wells will provide additional data that will be used to evaluate:

o The existence and extent of any contaminant plume.

- The existence and levels of any contamination of the groundwater.

- Any changes in contaminant concentrations in the existing wells from past sampling events.

- Effectiveness of selected treatment alternatives during the feasibility study.

(2) Schedule: The two rounds of groundwater sampling will be scheduled approximately three months apart to investigate variations. The first round will be during January or February 1989 and the second round will be during May 1989.

(3) Method: Prior to well purging and sampling, groundwater elevation measurements will be obtained and referenced to the USGS topographic elevation. This data will be used to prepare a groundwater elevation map for the site.

Slug tests will be performed on three of the shallow monitoring wells (MW-205, MW-206 and MW-210) after the initial round of groundwater sampling. This testing will be evaluated to determine the in-place permeability of the overburden soils.

Three of the eight deep borings (Wells MW-104, MW-107 and MW-110) will be packer tested prior to the installation of the well materials. This

testing will be performed to determine the permeability of the shale and limestone layers encountered in the borehole as an aid in determining the probable pathways of contaminant migration. Prior to the initiation of the packer tests, the holes will be flushed with uncontaminated water. The flush water will be collected and sampled to determine appropriate disposal. Each encountered limestone and shale layer will be sealed off with the packer assembly. This determination is to assess any differential pressures within the formations as an aid in the interpretation of contaminant migration. The permeability of each limestone and shale unit will then be determined using the results of the packer tests.

In addition, prior to groundwater sampling, field measurements of pH, temperature, and conductivity will provide additional groundwater quality data. The groundwater samples will be analyzed for PCBs, VOCs, and semivolatile organics listed on Table III-1.

Two replicate groundwater samples and two equipment rinsate blanks will be collected to assure that quality control objectives are met. Replicate samples will be used to evaluate the precision of the field sampling techniques. A complete discussion of QA/QC samples is included in the QAPP.

3. <u>SURFACE SOIL AND SEDIMENT INVESTIGATION</u>

Surface soil and sediment sampling activities will obtain information on the following:

- The areal extent and level of contamination of the exposed surface soils.

- The presence and, if applicable, extent of contaminants in the on-site ponds, and off-site and adjacent ditches and creeks.

- The presence and, if applicable, extent of off-site migration of contaminants on adjacent site access routes resulting from tracking by vehicles and personnel leaving the site.

- Concentrations of contaminants in ditch and creek sediments upstream of the site.

A variety of soil and sediment sampling procedures will be utilized to obtain information. The field methods described in "A Compendium of Superfund Field Operations Methods, U.S. EPA, December 1987" will be followed in all sample collection activities. Samples will include:

- Surface soil samples from the designated grid locations shown on Figure III-4 (see back pocket).

- Surface samples will be collected on access routes immediately adjacent, but exterior, to the site to provide data as to the potential for off-site migration of contaminants resulting from tracking by vehicles and personnel leaving the site. Surface soil samples will be taken at two locations on the McKissock Street access

east of the site, at two locations on the Missouri State Route 58 access south of the site, and at two locations on a previously used temporary access route through the property to the north of the site. Surface soil samples will be collected from the travelled way of each of these access routes. At McKissock Street, which is paved with asphalt, sampling will consist of wipe samples of the surface of the pavement.

- Sediment sample locations shown and specified in the notes on Figure III-5.

The surface soil and surface tracking samples will be analyzed for PCBs. The pond and stream sediment samples will be analyzed for: VOCs, semivolatile organics, and PCBs as listed on Table III-2.

The surface soil sampling is being conducted to assess the remaining levels and extent of PCB contamination subsequent to AOC-2 activities. Spatial composite samples will be collected from the exposed soil surface as described in Section D of this Part.

Previous sediment samples from the on-site ponds and unnamed tributary to East Pin Oak Creek have indicated detectable levels of PCBs (Ref. "Sampling/Analytical Survey," Dr. Harry V. Drushel, Clean Sites, Inc., June 12, 1987). The proposed sediment sampling during the RI is to further define the extent and level of PCBs, VOCs, or semivolatiles in the on-site ponds, the unnamed tributary, and East Pin Oak Creek.

Background and Replicate Surface Soil and Sediment Samples

Background samples of the surficial soils will not be obtained during the RI since the previous grid sampling has defined PCB levels in each site grid shown on Figure III-4. This is based on the assumption that previous analytical data from the surface soil grid sampling is valid. Five field replicate samples will be obtained from the grids indicated in Table III-2.

Background and replicate sediment samples will be obtained from the following locations:

- Two samples from the unnamed tributary to East Pin Oak Creek upgradient from the site. One sample each from north and south of Missouri State Route 58 as shown on Figure III-5.

- Two samples from East Pin Oak Creek upstream of the confluence with the unnamed tributary at distances of 100 and 200 feet upstream of the confluence.

- Four field replicate sediment samples will be obtained from the locations indicated in Table III-2.

4. SURFACE WATER INVESTIGATION

The surface water samples will be analyzed for PCBs, VOCs, and semivolatiles. Surface water samples will be collected at the locations

described in Table III-2. The surface water samples will be collected concurrent with, but immediately prior to, sediment samples and most will be obtained at selected sediment sampling locations.

Three replicates and three equipment rinsate blanks will be collected for the surface water samples. The replicate samples will be used to check the precision of the field sampling technique. The equipment rinsate blanks will indicate whether contamination of the matrix sample has resulted from use of improperly decontaminated sampling equipment. The replicate samples will be analyzed for the same parameters as the surface water sample.

Two background surface water samples will be obtained during the RI. One sample will be from the unnamed tributary south of Missouri State Route 58 and the second sample will be from East Pin Oak Creek 100 feet upstream of the confluence with the unnamed tributary.

5. STRUCTURAL SURFACES AND SOLIDS INVESTIGATION

Wipe samples of structure walls, roofs, ceilings and floor slabs and core samples of insulation surfaces and concrete slabs will be obtained at the grid locations indicated on Tables III-4 and III-5 and shown in Figures III-2 and III-3. The number of biased samples and field replicates are also presented on these tables.

The biased wipe samples will be taken in order to assess the nature and extent of PCBs on visibly stained surfaces. The field replicate samples

will be taken to assess the accuracy and precision of the sampling and analytical procedures as described in the QAPP.

6. TEST TRENCH INVESTIGATION

A test trench inside the Main Building will be excavated to bedrock to gather information about the horizontal and vertical extent of contaminants which may be present beneath the floor slab. The trench will be located in Grid No. 3 shown on Figure III-2. The trench location has been selected near the previous boring performed during an earlier investigation that indicated the deepest soil discoloration and highest field instrument readings for volatile organics. The number of soil samples to be submitted for chemical analysis from the test trench is presented in Table III-2.

7. SEWER SAMPLING TEST PITS INVESTIGATION

Soil sampling adjacent to the on-site sewers will be performed to obtain information on the potential off-site migration of contaminants via leaks or cracks in the storm and sanitary sewer lines. The field methods described in "A Compendium of Superfund Field Operations Methods, U.S. EPA, December 1987" will be followed in the sample collection activities.

Shallow test pits will be excavated adjacent to on-site sewers at the five locations shown on Figure III-5 to obtain soil samples for the analyses specified on Table III-2. One replicate soil sample will be

taken from the test pit adjacent to the manhole northwest of the South Warehouse.

8. SANITARY SEWER DYE TESTING INVESTIGATION

The sanitary sewer shown on Figure III-5 flowing south from the Main Building will be dye tested to assess the integrity of the previously installed plug. This activity will consist of initiating a flow of water from the Holden water supply inside the Main Warehouse and adding powdered colored dye to the flow. The flow in the downstream sanitary sewer manhole located northwest of the South Warehouse will be visually monitored for occurrence of the dye.

D. SPECIFIC INVESTIGATION ACTIVITIES

Specific investigation procedures for the RI are discussed in the following sections:

- Subsurface Soil and Monitoring Well Installation
- Groundwater
- Surface Soil
- Surface Tracking
- Sediment
- Surface Water
- Structural Surfaces and Solids
- Test Trench
- Sewer Sampling Test Pits
- Sanitary Sewer Dye Testing

Proposed sampling locations are presented in Tables III-2, III-4, III-5, and Figures III-1 through III-5. The total number of samples, including replicates and blanks are summarized by sample matrix in Tables III-2, III-4 and III-5. All samples for chemical analyses will be kept out of the sun and will be iced immediately after sample collection. Samples will be shipped to the laboratory on the day they are collected with guaranteed overnight delivery.

All pertinent sample information will be documented in the field logbook as discussed in the QAPP. All required field logbook entries will be made by the field sampling team immediately after sample collection. Maintaining the field logbook will be the responsibility of the Field Site Manager.

Provisions for collecting and disposing of wastes generated during the sampling activities are discussed in Part IV.

1. SUBSURFACE SOIL AND MONITORING WELL INSTALLATION

Sixteen 2-inch-diameter PVC monitoring wells will be installed in boreholes by a drilling subcontractor. The locations of these wells are shown on Figure III-1. A summary of the sample matrix and sample locations, including replicates and blanks samples are presented in Table III-2. Subsurface soil samples will be collected from each of the deep (100 series) borings. Two soil samples selected at random from each deep boring prior to drilling will be submitted for chemical analyses for PCBs, VOCs and semivolatiles. Additional samples may be selected from each boring based on the field TIP readings. Only samples

with chemical analytical results below detection limits will be sent for engineering properties analysis. Approximately two soil samples from each deep boring will be tested in the laboratory for moisture content, Atterberg limits, and grain size distribution for granular soils.

One Shelby tube sample each from Borings MW-105, MW-106, and MW-110 will be obtained for laboratory determination of soil permeability. The permeability of these samples will be determined using the U.S. Army Corps of Engineers method contained in EM-1110-2-1906, Appendix VII.

In addition, twelve interior borings will be drilled at the locations indicated on Figures III-2 and III-3 in the existing Main Building, South Warehouse and concrete containment pad. Each interior boring will be drilled after the concrete slab has been cored to 8 inches in diameter with an electric concrete coring machine. The procedures for drilling and sampling these interior borings to the top of bedrock will be the same as the overburden drilling and sampling in the 100 series deep borings. Approximately two soil samples from each interior boring will be tested in the laboratory for moisture content, Atterberg limits, and grain size distribution for granular soils.

A total of 52 soil samples with at least 2 from each interior and exterior deep (100 series) boring and a total of 6 replicate samples will be selected for chemical analyses of PCBs, VOCs and semivolatiles as indicated on Table III-2. Soil samples for engineering properties analyses will be analyzed following the same procedure outlined above

for the exterior borings. The interior bore holes will be backfilled with cement-bentonite grout upon completion.

All drill cuttings generated during the drilling activities for the exterior monitoring wells and the interior borings will be disposed of as described in Part IV.

a. Boring Methods

Borings will be drilled by rotary wash and/or hollow stem auger drilling methods. The deep borings will be drilled first and geologically logged and sampled. The adjacent shallow borings in each nested pair will not be sampled, but will be logged based on driller's observations and drill cuttings. Soil and rock samples will be obtained as described below.

Drilling operations will be monitored with the TIP to assess volatile organic compounds, plus other monitoring equipment to assess health and safety conditions, as described in the HSP. The deep exterior borings will be properly sealed between the overburden soils and the bedrock to minimize the potential for cross contamination of strata. This will be accomplished by hollow stem augering to refusal in the bedrock, setting and grouting a surface casing at least 3 feet into the bedrock, and coring the bedrock to a total boring depth of 50 feet. Prior to installation of the monitoring well materials, the borings will be reamed out to a minimum diameter of 3.937 inches using rotary wash techniques.

Uncontaminated water from the Holden potable water supply will be used for all drilling activities after the source has been tested to assess the possible detectable levels of substances that could overstate the presence of other contaminants. No other drilling fluids or additives will be permitted. The drilling water used at each boring location will be recirculated during the drilling operation. A new supply of water will be used at each boring location where drilling water is required. The use of water will be minimized at all times. All water used for drilling activities will be collected for treatment and disposal as discussed in Part IV.

b. Sampling Methods for Stratigraphic Logging and Physical Analysis

Continuous overburden soil samples will be obtained to the top of bedrock in each of the deep borings (100 series) and interior borings using 2 inch outer diameter split-spoon samplers in accordance with ASTM D1586. Each split-spoon sampler will be 24 inches in length. Continuous bedrock samples will be obtained in each deep boring using an NX-size core barrel.

The interior boring in Grid 23 will be advanced to auger refusal at the top of bedrock using a stainless steel manual bucket auger. Soil samples will be collected from the bucket auger in this boring on 1-foot centers to the completed depth of the bedrock.

Samples will be logged in the field by a Burns & McDonnell geologist. In addition, each sample will be screened in the field

with the TIP to detect the presence of VOCs. These readings will be logged in the field logbook and on the geologic drilling logs.

The geologic drilling logs will be developed in the field by the Burns & McDonnell geologist observing the drilling operations. The logs will be used throughout the RI activities to prepare the geologic and hydrogeologic model of the Rose Site.

c. Sampling Methods for Chemical Analyses

Continuous subsurface soil samples will be collected in each of the deep subsurface borings for a total of approximately 80 samples. The estimated number of samples is based on approximately ten samples from each of the eight deep borings with an average depth to bedrock of approximately 15 feet. Sixteen of these samples will be selected (two per deep boring) based on visual observation and field screening for chemical analyses. The samples will be handled with clean, disposable gloves and will be removed from the samplers using a clean stainless steel sample knife. Samples collected for VOC analyses will be collected and placed in containers quickly with minimal air spaces to minimize volatilization. Subsurface soil samples will be placed into the containers specified in Table III-6. The container volumes and sample sizes are shown in Table III-7. All sampling equipment will be decontaminated as specified in Section E of this Part.

d. Replicate Samples

Two replicated samples will be prepared from the exterior subsurface borings and three from the interior subsurface borings. The replicate samples will be taken from the borings specified in Table III-2. These samples will be collected from the same section of the sampler that will be submitted for chemical analysis. The long cylindrical sample which results from a split-barrel sampler will be split longitudinally with a decontaminated knife. Sample bottles will be filled alternately with segments of the sample so that the replicate samples sent for analyses are as similar as possible. If the volume from a single split-barrel sampler is insufficient to complete the replicate sample, soil from the next adjacent split-barrel sample will be used.

The original and the replicate sample will be placed in identical containers and preserved in the same manner. The replicate samples will be identified with unique sample identification numbers and the sample station where the replicate is collected will be documented in the field logbook.

e. Monitoring Wells, Packer Testing and Slug Testing

The shallow wells will have their screens set in the saturated zone at or near the water table to monitor water table conditions in the geologic unit where it occurs. If the water table is located in the overburden soil, the well screens will be installed from

approximately 1 foot above the water table to approximately 1 foot into the weathered bedrock. The screens of the deeper wells are to be set at a lower, more permeable layer as determined by the packer testing. At least two wells will be screened in each rock stratum encountered, if possible, to evaluate the groundwater flow characteristics and groundwater quality in the different strata. It is expected that well screens will be no longer than 5 feet in order to assess potential contaminant migration in discrete hydrologic units. The length and location of the well screen at each location shall be determined by the Field Site Manager based on drilling and other data from the deep boring log.

All wells will be constructed using 2-inch diameter, Schedule 80, flush-threaded PVC casing and machine-slotted screen with 0.010-inch slots. The annular space between the well and the borehole will be backfilled with washed silica sand to approximately 2 feet above the top of the well screen, followed by a 2-foot bentonite pellet seal and a cement-bentonite grout mix to the ground surface as shown on Figure III-6 and III-7. A 4-inch or 6-inch square locking protective steel casing will be grouted in-place and finished approximately 2 feet above the ground surface covering the 2 foot monitoring well riser. All wells will be locked with locks with identical keys. A typical deep monitoring well (100 series) is shown on Figure III-6 and a typical shallow monitoring well (200 series) is shown on Figure III-7.

Prior to well placement in Borings MW-104, MW-107, and MW-110, packer tests will be performed to determine the permeability of the bedrock layers. The bore holes will be flushed with uncontaminated water prior to packer testing. The Holden potable water supply will be tested prior to use to assess possible detectable levels of substances that could overstate the presence of other contaminants. Each limestone and shale layer within the borehole will be sealed off with the packer assembly. If necessary, due to problems with swelling shale, the bore hole will be reamed out after coring and prior to packer testing to facilitate the installation of the packer test equipment.

The monitoring wells will be developed by bailing or pumping water from the wells until, in the judgment of the field sampling crew, the well has been adequately developed. During well development, pH and specific conductivity measurements will be made periodically. Well development will continue until the pH and specific conductivity measurements have stabilized. All well development fluids will be disposed of as described in Part IV.

Well drilling, installation, and development will be the responsibility of the drilling subcontractor under the direction of Burns & McDonnell. The drilling subcontractor will furnish the necessary equipment and supplies for drilling, subsurface soil sampling, well installation, well development, and decontamination of drilling equipment and drilling personnel. The HSP will specify

the levels of safety required for all drilling and sampling activities.

Upon completion of well installation and after the initial round of groundwater samples has been obtained, slug tests will be performed on shallow Monitoring Wells MW-205, MW-206 and MW-210. The slug tests will be analyzed to determine the in-place permeability of the overburden soils.

If the monitoring well to be slug tested contains at least 3 feet of groundwater, a volume of groundwater will be evacuated from the well with a decontaminated Teflon bailer to lower the groundwater level to a maximum height of 1 foot in the well. The resulting increase in groundwater depth in the well versus time will be recorded. If the monitoring well contains less than 3 feet of groundwater, a volume of potable water from the Holden water supply will be poured into the well to bring the groundwater level to within 1 foot of the ground surface. The subsequent drop in groundwater depth versus time will be recorded. The soil permeability will be calculated using the results of the slug tests according to method presented by J. D. Bredehoeft and S. S. Papadopulos in Water Resources Research, Volume 16, Number 1, pp. 233-238, February 1980, "A Method for Determining the Hydraulic Properties of Tight Formations."

The Holden potable water supply will be tested prior to use to assess possible detectable levels of substances that could overstate the presence of other contaminants.

2. GROUNDWATER

Unfiltered groundwater samples will be obtained from each of the groundwater monitoring wells listed in Table III-2. All health and safety requirements for the collection of groundwater samples are detailed in the HSP.

a. Sampling Device

A chemical-resistant Teflon bailer will be used to purge the well and obtain groundwater samples.

b. Water Level Measurement

Before purging, the static water level will be measured using a Soil-Test DR-760A or a Solinst Model 101 water level indicator. Prior to initial use the water level measuring equipment will be decontaminated following the procedures outlined in Section E of this Part.

The procedure for water level measurements is as follows:

(1) Lower instrument wire into well until indicator bulb light glows.

(2) Fine-tune the level using the survey indicator mark on the top of the monitoring well pipe.

(3) Measure the distance to the water level using the closest 5-foot division on the wire and a straight ruler with 0.01 foot divisions.

(4) Record water level to the nearest 0.01 foot in the logbook.

(5) Lower the wire until the bottom of the well is reached. Measure and record the well depth to the nearest 0.1 foot.

(6) Compare measured well depth to well depth recorded during well installation. The difference will indicate if further well development is required to remove accumulated sediment.

(7) Subtract the water level from the well depth to obtain the depth of static water. Calculate the number of gallons in one well volume. Record in logbook.

(8) After use, rinse the wire thoroughly with distilled water.

c. Well Purging

Water that stands in a well casing between sampling periods becomes stagnant, and the chemical composition may be altered. To obtain a

representative sample, the well must be purged before withdrawing the sample.

Before purging, the bailer will be washed thoroughly with nonphosphate detergent, then rinsed with tap water, distilled water, and a final rinse with pesticide-grade methanol. A new polypropylene rope will be used for each sample.

To prevent accidental contamination of the sampling equipment by surface soil, a clean plastic sheet will be placed around the well casing. Two people will perform the well purging and sampling operation to minimize possibility of surface contamination. All water generated during well purging will be retained in 55-gallon drums for subsequent disposal as described in Part IV. All waste materials generated during well purging, including plastic sheeting and polypropylene rope will be disposed of as described in Part IV.

Well purging is done in one of the following ways:

(1) If the well is located in an area of low permeability, the well will be bailed dry and allowed to refill for sampling. Preparations will generally be made to purge the well and complete sampling within 24 hours to sample wells in low permeability strata. The specific procedures are as follows:

(a) The well will be evacuated to dryness once.

(b) Water will be bailed such that it is removed from the bottom of the well screen.

(c) The well will be purged at a rate such that the recharge water does not rigorously cascade down the sides of the screen.

(d) Whenever full recovery exceeds two hours after purging, the samplers will extract the sample as soon as at least 3 liters (6 foot water depth) is available in the well. For wells which do not recover to a volume of 3 liters, the sampling crew will return every two hours to collect the required sample volume. If the two-hour sampling intervals are required to obtain the required sample volume, the sample containers will be filled in the following order: VOCs, semivolatiles, PCBs.

(e) After purging, the bailer will be washed with nonphosphate detergent, rinsed with tap water and followed by distilled water.

(2) If the well cannot be bailed dry (i.e., the well has a "fast" recovery time), a volume of water equal to at least 3 well

casing volumes below the water elevation will be removed before withdrawing a sample. The specific procedures are as follows:

(a) The well will be evacuated of at least 3 well casing volumes.

(b) The water will be bailed such that it is removed from above the well screen, if possible.

(c) The bailer will be lowered at a rate such that minimal disturbance occurs when it reaches the water.

d. Sample Collection

Unfiltered groundwater samples will be collected in order of volatilization sensitivity. Temperature, pH, and specific conductivity will be measured both before and after sample collection (within 30 minutes) as a check on the stability of the water sampled over time. The samples will be collected in the following order:

- Volatile Organic Compounds (VOCs)
- Semivolatile Organic Compounds
- PCBs

The bailer will be rinsed with the sampling effluent prior to filling the sample containers. New sample containers necessary for completing field sampling and QC requirements will be provided to

the field personnel by the laboratory. The procedures for sampling are as follows:

(1) See that all development and evacuation conditions and requirements are met for location(s) to be sampled (as described above).

(2) Have all necessary equipment and supplies prepared and available.

(3) Verify adequate respiratory safety protection if not done prior to entering field (refer to HSP).

(4) Measure and record water level (as described above).

(5) Select sample bottles and preservative, if necessary.

(6) Collect sample.

(7) Attach precleaned bailer to rope for lowering.

(8) Repeat the following steps indicated by an (*) as needed to acquire sufficient volume.

(9) Lower bailer slowly until it contacts water surface*.

(10) Allow bailer to sink and fill with a minimum of surface disturbance*.

(11) Slowly raise bailer to surface; do not allow bailer line to contact ground*.

(12) Tip bailer to allow slow discharge from top to flow gently down the side of the sample bottle with minimum entry turbulence*.

(13) Perform field analyses.

(14) Check that a Teflon-liner is present in cap if required; secure the cap tightly.

(15) Invert VOC sample container immediately after filling to check for air remaining in the container; no air should be present. If air is noted to be present, the container will be refilled and Step 14 above will be repeated.

(16) Collect semivolatile samples in the same manner as the VOC samples.

(17) Label the sample bottle with an appropriate label; be sure to complete the label with all necessary information; record the

information in the field logbook and complete all Chain-of-Custody documents.

(18) Mark liquid levels on the remainder of containers with tape or a marker; any loss of sample volume or presence of air in VOC or semivolatile samples will be noted at the laboratory.

(19) Place the properly labeled sample bottle in an appropriate carrying container (cooler) maintained on ice throughout the sample transportation period; pack VOC samples in the cooler in an inverted position.

(20) Upon arrival at the laboratory, the laboratory personnel will note any loss of sample volume or presence of air in VOC or semivolatile samples; the laboratory will notify the samplers immediately if sample loss has occurred.

All groundwater characterization samples will be iced as soon after field collection as practical. The intent is to lower the fluid temperature near to (but above) freezing as soon as possible to decrease the rate and minimize the amount of physiochemical change of the sample before submittal to the analytical laboratory.

The sample bottles will be labeled prior to filling, and a Chain-of-Custody Record will be prepared for each shipment. Each cooler will

be sealed shut with the sampler's signature on the seal tape. Chain-of-Custody procedures are discussed in detail in the QAPP.

After sampling is completed, the bailer will be washed with a nonphosphate detergent, rinsed with tap water followed by distilled water.

e. Sample Preservation

Table III-6 presents a summary of the required sample containers, preservatives and maximum holding times for each sample matrix. The container volumes and sample sizes are shown in Table III-7. The samples will be preserved on ice which will be sealed in plastic bags and placed in the cooler(s) at the start of the sampling event. The ice will be replaced before the cooler is sealed and shipped to the laboratory as described in the QAPP.

f. Replicate and Field Blank Samples

Two replicate samples and two field blanks will be collected from the sampling activities for the monitoring wells specified in Table III-2. The replicate samples will be collected in the same manner as the investigative groundwater samples described in this Section. Each replicate groundwater sample will be collected at the same time as the investigative groundwater sample from the same monitoring well. The groundwater sample volume from each bailer will be uniformly distributed between the investigation and replicate containers. The investigative and replicate samples will

be placed in identical containers and preserved in the same manner. The blanks will be prepared in the manner described in the QAPP.

g. Trip Blanks

Trip blanks for VOCs in groundwater will be prepared and shipped to the laboratory as described in the QAPP. It is estimated that 5 days will be required for groundwater sampling, and the cooler(s) will be shipped each day. Since one trip blank will be submitted per shipment of groundwater samples, a total of approximately 5 trip blanks will be submitted for analysis.

h. Decontamination

The decontamination procedures for the water sampling equipment are detailed in Section E of this Part.

3. SURFACE SOIL

Surface soil samples will be obtained from the site based on a previously defined sampling grid shown on Figure III-4. The required safety level for surface soil sampling is specified in the HSP. Figure III-4 shows the grids and portions of grids shaded to represent areas from which the surface soil layers have been previously removed. The largest shaded grids consist of 50 x 50-foot squares or quadrants within which 25 samples will be obtained and composites for analysis of PCBs. In each 50 x 50-foot quadrant samples will be taken approximately 10 feet apart and 5 feet from the edge of the quadrant. This pattern provides a 5 x 5 matrix or sampling points yielding a 25-sample

composite. For portions of grids which are larger than 25 feet by 25 feet in size, a sampling pattern will be used which yields one composite sample from 25 aliquots on an approximately equal spacing. For small portions for grids which are less than 25 feet by 25 feet in size, one composite sample will be obtained from 10 approximately equally spaced aliquots. Each composite surface soil sample will be analyzed for PCBs.

a. Sampling Methods for Surface Soil

Surface soil aliquots will be collected following the guidelines in the "Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup, EPA-56015-86-017, May 1986." The individual aliquots from each grid will be composited for the investigative surface soil grid samples. The samples within each sampling grid will be collected according to the following procedure:

(1) Locate the sampling point, remove rocks, twigs, grass or other nonsoil material with a trowel,

(2) Mark the sample area with a disposable (cardboard) 10 cm x 10 cm template,

(3) Scrape soil to a depth of approximately 1 cm with a stainless steel sample knife to yield approximately 100 grams of soil,

(4) Transfer the individual aliquot to a stainless steel sample bowl,

(5) Repeat steps 1 through 3 for each aliquot location in the sample grid,

(6) Upon collection of the final aliquot from a sample grid, the soil in the stainless steel sample bowl shall be thoroughly mixed using a clean stainless steel sample knife,

(7) The surface soil sample container will then be filled with soil from the mixing bowl.

b. Decontamination

The stainless mixing bowl and the sampling knife will be decontaminated prior to sampling the initial sample grid and between subsequent sample grids following the same procedures as outlined for the subsurface soil sampling equipment in Section E of this Part.

c. Sample Preservation

Table III-6 presents a summary of the required sample containers, preservatives and maximum holding times for each sample matrix. The container volumes and sample sizes are shown in Table III-7. The bottles will be labeled in the field according to the procedures outlined in the QAPP. The samples will be preserved on ice which will be sealed in plastic bags and placed in the cooler(s) at the start of the sampling event. The ice will be replaced before the

cooler is sealed and shipped to the laboratory as described in the QAPP.

d. Replicate Samples

Replicate surface soil samples will be obtained from 5 of the sampling grids. Replicate and original samples will be subsampled from the same sample. The sample volume will be collected in a decontaminated stainless steel bowl. The soil in the bowl will be mixed and divided into quarter volumes. Two quarters from opposite sides of the bowl will be placed in one set of sample containers. The remaining quarters will be placed in the replicate containers. The original and the replicate sample will be placed in identical containers and preserved in the same manner. The replicate samples will be identified with unique sample identification numbers and the sample station where the replicate is collected will be documented in the field logbook.

4. SURFACE TRACKING

a. Sampling Methods

Surface tracking samples will be obtained at the locations indicated on Table III-2. Collection, storage and decontamination of the sampling equipment of the surface tracking samples will follow the same procedures outlined for the individual surface soil aliquots. The health and safety requirements for surface tracking sampling are outlined in the HSP.

Wipe samples may be obtained at any proposed surface tracking sample locations which are paved. Wipe samples will be collected according to the procedures outlined in Paragraph 7 of this Section.

b. Collocated Sample

One collocated surface tracking sample will be obtained at the McKissock Street east access sampling location as indicated on Table III-2. Since McKissock Street is paved at the east site access surface tracking sample location, the investigative and collocated samples will be wipe samples.

The collocated sample will be taken by placing another template directly adjacent to the investigative sample location. The collocated and investigative sample will be taken at the same time using two separate gauze pads. The first pad is wiped horizontally on the original sampling grid, and the second pad is wiped horizontally on the collocated sampling location. Then, the first pad is wiped vertically on the collocated sampling location, and the second pad is wiped vertically on the investigative sampling location. The pads will be placed in identical containers, identified with unique sample identification numbers, and sample stations.

5. SEDIMENT

Sediment samples will be obtained at the locations specified in Table III-2 and shown on Figure III-5. Each sediment sample location

from the unnamed tributary and East Pin Oak Creek not shown on Figure III-5 is specified in the figure notes. If possible, the sediment samples will be obtained from a portion of the stream where there is laminar flow. The sampling shall begin downstream on East Pin Oak Creek, working upstream, and shall continue on the unnamed tributary from downstream to upstream. The health and safety requirements for collection of sediment samples are outlined in the HSP.

Each sediment sample will be analyzed for PCBs, VOCs, and semivolatile organic compounds.

a. Sampling Methods for Dry Sediment

Dry sediment samples will be collected according to the procedure outlined above in Paragraph 3 of this Section for the individual aliquots of the surface soil composite samples.

If more soil is required to fill the sample containers, the 10 cm x 10 cm sample area will be expanded without increasing the approximate 1 cm depth of the soil obtained.

b. Sampling Methods for Sediment Under Water

It is anticipated that sediment at some sample locations in the sewers or creeks will be under water. If the depth of water in any of the drainage channels is over 12 inches, an effort will first be made to adjust the sampling locations to avoid the deep water. If this is not feasible, these areas will be sampled using the

techniques described in this subsection. The approximate locations of the samples are listed in Table III-2. The samples will be collected using a decontaminated Petite Ponar. The Ponar will be decontaminated between each composite sample location or point, but not between incremental samples. The samples will be collected according to Method II-6 from "Characterization of Hazardous Waste Sites, a Methods Manual; Volume 2, Available Sampling Methods (Second Edition)," EPA 600/4-84-076, December 1984. The procedure is as follows.

(1) Attach a precleaned Ponar to the necessary length of sample line. Solid braided 5 mm (3/16-inch) nylon line is usually of sufficient strength; however, 20 mm (3/4-inch) or greater nylon line allows for easier hand hoisting.

(2) Measure and mark the distance to bottom on the sample line. A secondary mark, 1 meter shallower, will indicate proximity so that lowering rate can be reduced, thus preventing unnecessary bottom disturbance.

(3) Open sampler jaws until latched. From this point on, support sampler by its lift line or the sampler will be tripped and the jaws will close.

(4) Tie free end of sample line to fixed support to prevent accidental loss of sampler.

(5) Begin lowering the sampler until the proximity mark is reached.

(6) Slow rate of descent through last meter until contact is felt.

(7) Allow sample line to slack several centimeters. In strong currents more slack may be necessary to release mechanism.

(8) Slowly raise dredge clear of water surface.

(9) Place Ponar into a stainless steel or Teflon tray and open. Lift Ponar clear of the tray.

(10) Excess water will be decanted from the pan. Sticks, rocks, and other debris will be removed with a stainless steel sample knife.

(11) Collect a suitable aliquot with a stainless steel lab spoon or equivalent and place sample into appropriate sample bottle.

(12) Check for a Teflon liner in cap if required and secure cap tightly.

(13) Label the sample bottle with the appropriate sample tag. Be sure to label the tag carefully and clearly, addressing all the

categories or parameters. Complete all Chain-of-Custody documents and record in the field logbook.

(14) Decontaminate sampling equipment.

c. Replicate Samples

It is anticipated that a total of 5 sediment replicate samples will be collected. The locations where these replicates will be collected are specified in Table III-2.

Replicate and original samples will be subsampled from the same sediment sample. The sample volume will be collected in a decontaminated stainless steel or Teflon tray. The soil in the tray will be divided into quarter volumes. Two quarters from opposite sides of the tray will be placed in one set of sample containers. The remaining quarters will be placed in the replicate containers. The original and the replicate sample will be placed in identical containers and preserved in the same manner. The replicate samples will be identified with unique sample identification numbers and the sample station where the replicate is collected will be documented in the field logbook.

d. Decontamination of Sampling Equipment

Sampling equipment will be decontaminated by procedures identical to those specified for the subsurface soil sampling equipment in Section E of this Part.

6. SURFACE WATER

A total of 11 discrete unfiltered surface water samples will be collected from the locations specified in Table III-2. All surface water sampling will be scheduled at a time during the RI when water is present at the surface water sample locations. Sampling shall begin at the downstream station of East Pin Oak Creek, working upstream, and shall continue on the unnamed tributary from downstream to upstream. Samples will be submitted for the same analyses as the groundwater samples. The health and safety requirements for collection of the surface water samples are contained in the HSP.

a. Sampling Methods

Unfiltered surface water grab samples will be collected using a clean polyethylene ladle or beaker on a 6- or 12-foot extension handle. The surface water sample will be collected prior to collecting the sediment sample from the ponds and creeks. If feasible, the depth of the water will be measured using a disposable wooden yard stick. Unfiltered surface water samples will be collected according to Method III-2 from "Characterization of Hazardous Waste Sites, a Methods Manual; Volume 2, Available Sampling Methods (Second Edition)," EPA 600/4-84-076, December 1984. The procedure is as follows:

(1) Take grab samples by slowly submerging the precleaned ladle or beaker with minimal surface disturbance until the surface water

begins to run into it. Slowly turn ladle or beaker upright keeping the lip just under the water surface so that the entire sample is collected from the surface.

(2) Retrieve the pond sampler from the surface water with minimal disturbance.

(3) Remove the cap from the sample bottle and slightly tilt the mouth of the bottle below the dipper/device edge.

(4) Empty the sampler slowly, allowing the sample stream to flow gently down the side of the bottle with minimal entry turbulence.

(5) Continue delivery of the sample until the bottle is almost completely filled.

(6) Select appropriate sample bottles and preserve the sample if necessary.

(7) Check that a Teflon liner is present in the cap if required. Secure the cap tightly.

(8) Label the sample bottle with an appropriate sample tag. Be sure to label the tag carefully and clearly, addressing all the

categories of parameters. Record the information in the field logbook and complete the Chain-of-Custody documents.

(9) Properly clean and decontaminate the equipment prior to reuse or storage.

The surface water samples to be submitted for VOC, semivolatile organic compounds, and PCB analyses will be preserved in the same manner described for the groundwater samples in Paragraph 2 of this Section.

b. Field Measurements

Field measurements for temperature, pH, and specific conductivity will be obtained on a representative sample at each sample location.

c. Background Samples and Replicates

One background surface water sample will be collected from the unnamed tributary upstream of the site south of Missouri State Route 58. The second background surface water sample will be collected from East Pin Oak Creek 100 feet upstream of the confluence with the unnamed tributary. The surface water sample will be collected prior to collecting the sediment sample, if a sediment sample is to be collected at the same location. The background surface water samples will be collected using the same sampling procedure previously outlined.

Three replicate surface water samples will be obtained as indicated on Table III-2. Each replicate surface water sample will be collected at the same time as the investigative surface water sample from the same location. The surface water sample volume from the ladle or beaker will be uniformly distributed between the investigative and replicate containers. The investigative and replicate samples will be placed in identical containers and preserved in the same manner.

d. Field Blanks

Three surface water field blanks (equipment rinsate blanks) will be prepared after the surface water sample is collected at the locations specified in Table III-2. These blanks will be prepared in the manner described in the QAPP.

e. Trip Blanks

Trip blanks for VOCs in surface water will be prepared and shipped to the laboratory as described in the QAPP. It is estimated that 5 days will be required for surface water and sediment sampling, and the cooler(s) of surface water samples will be shipped each day.

Since one trip blank will be submitted per shipment of surface water samples, a total of approximately 5 trip blanks will be submitted for analysis.

f. Decontamination of Sampling Equipment

The decontamination procedures for the surface water sampling equipment are detailed in Section E of this Part.

7. STRUCTURAL SURFACES AND SOLIDS

a. Wipe Sampling

Wipe samples of structural surface shall be obtained from within the Main Building and South Warehouse, and from the roofs, extension walls and other horizontal surfaces of these two buildings. Grid systems have been established in the Main Building and South Warehouse to designate specific areas for wipe sampling. The Health and Safety procedures for all wipe sampling activities are outlined in the HSP.

Interior floor, wall, ceiling, and horizontal surface wipes shall be taken in designated grids shown in Figures III-2 and III-3. The number and location of interior wipe samples are shown in Table III-4. Floor wipes are to be taken from the approximate center of each grid. For all walls greater than 5 feet in height in grids designated for wall wipe sampling, one wipe sample will be taken at the approximate center of the grid at a height of

approximately 5 feet above the floor. An additional sample will be taken directly above the 5-foot height sample at the approximate midpoint between the 5-foot height sample and the building roof.

Four wall wipe samples will be taken each from the belowgrade pits designated as Grids 23 and 27. One wipe sample will be taken from the midpoint of each pit wall.

If the wall surface to be sampled is insulated, then a core of the insulation is taken (see Paragraph 7.b), and the wall wipe shall be taken of the surface behind the insulation. Wipes of the ceilings and one type of horizontal (above grade) surface shall be taken from the approximate center points of the designated grids. A total of 36 biased samples, 12 each on wall, floor, and horizontal surfaces, shall be taken. The biased samples will be taken in order to assess the nature and extent of PCBs on visibly stained surfaces. Also, a total of 5 field replicates shall be prepared.

Table III-5 presents the number and distribution of unbiased, biased, and collocated samples which shall be taken from the exterior walls and roofs of the main building and the south warehouse. The unbiased wall samples shall consist of wipes taken at the vertical mid-point of the walls every 150 feet horizontally. The unbiased roof samples shall consist of wipes taken from the center of each grid in an approximate 150 feet by 150 feet grid

system laid out on each roof. A total of 12 biased and 4 collocated samples shall also be collected.

All wipe samples shall be analyzed for PCBs. The analytical method 3540/8080 from the reference, "Test Methods for Evaluating Solid Waste," U.S. EPA, 1986b, SW-846, Third Edition, November, shall be utilized. The results shall be reported in units of ug/100 cm^2.

The method of wipe sampling to follow is presented in the reference, "Verification of PCB Spill Cleanup by Sampling and Analysis," U.S. EPA, EPA-560/5-85-026, August, 1985. Using a clean pair of stainless steel forceps, or by using a hand covered with a clean surgical glove, a filter paper (Whatman 4D ashless, Whatman "50" smear tabs, or equivalent) or gauze pad is wetted with hexane. The paper or gauze should be wet but not dripping. The paper or gauze is used to swab a 100-cm^2 area. One side of the gauze will be used to wipe the area horizontally. The other side will be used to wipe the area vertically. A disposable (cardboard) template shall be used for each wipe so as to avoid cross contamination. After wiping, the paper or gauze is stored in a clean jar, iced and labeled.

Prior to collecting a wipe sample, the surface to be sampled shall be photographed and logged. The materials of surface construction, and any other observations shall also be recorded in the field log book.

b. Structural Sampling

Sampling and analysis of structural materials in the Main Building and South Warehouse will yield information concerning the depth of PCB concentrations in those materials. Structural samples shall be taken from both buildings. The structural solids to be sampled are (1) concrete, (2) insulation, and (3) nonimpervious surface material. The health and safety procedures for the structural sampling activities are outlined in the HSP.

(1) Concrete samples shall be taken as cylindrical concrete cores. The number and location of the concrete cores are presented in Table III-4 and Figures III-2 and III-3. Concrete cores shall be taken using a minimum 1.5-inch diameter core barrel and an electric concrete coring machine. The rotating core barrel will be advanced through the concrete floor slab cutting a cylindrical sample which will be removed for subsequent analysis. The upper 0.5-inch of each core shall be separated from the rest of the core using a hacksaw. The blade shall be replaced with a clean blade between core samples. The top 0.5-inch of each concrete core and the remaining cylindrical core sample shall then be immediately stored in separate clean jars on ice and labeled for overnight shipment to the laboratory. The 0.5-inch core section will be pulverized at the laboratory using a clean mortar and pestle or ceramic ball mill prior to analysis. The remainder of each core sample will be

stored in a clean jar and refrigerated to 4 degrees C in the laboratory. The remaining samples will be discarded upon determination that further analyses are not needed. Each core sample will be individually labeled and entered onto the Chain-of-Custody Record.

After the 1.5-inch-diameter core is removed, an 8-inch-diameter hole will be cored through the floor slab to facilitate the interior boring to be advanced in the same location as described in Section 1 of this Part.

(2) Insulation cores shall be taken where a wall surface to be wipe sampled is covered with insulation material. The number and location of the insulation cores are shown in Table III-4. Twelve biased and two replicate insulation core samples shall be taken. The biased samples will be taken in order to assess the nature and extent of PCBs on visible stained surfaces. A decontaminated hand corer shall be used to obtain the samples. The sample shall be pulverized and then stored in a clean jar on ice. Destructive surface samples shall be taken of each type of nonimpervious surface construction material to 0.5-inch depth.

(3) One destructive sample of each nonimpervious surface material in the warehouses shall be taken to a depth of 0.5-inch. The samples shall be obtained using an appropriate decontaminated

tool (e.g., chisel, saw, knife). One replicate sample shall also be prepared.

All structural samples shall be analyzed for PCBs. The analytical method 3540/8080 from the reference, "Test Methods for Evaluating Solid Waste," U.S. EPA, 1986b, SW-846, Third Edition, November, shall be followed.

Prior and subsequent to collecting a structural sample, the structures to be sampled shall be photographed and logged. The materials of surface construction and any other observations shall also be recorded.

c. Decontamination

To avoid cross-contamination between structural surface samples, the nondisposable sampling equipment shall be decontaminated between each sample according to the procedures in Section E of this Part.

d. Replicate and Collocated Samples

A total of thirteen replicate and/or collocated samples of structural solids and surfaces will be taken. As described above, and as shown in Tables III-4 and III-5, collocated wipe samples will be taken from nine sampling grids. Four replicate structural samples will be taken as well.

Collocated wipe samples will be taken by placing another template directly adjacent to the original sample grid. The collocated and original sample will be taken at the same time using two separate gauze pads. The first pad is wiped horizontally on the original sampling grid, and the second pad is wiped horizontally on the collocated sampling grid. Then, the first pad is wiped vertically on the collocated sampling grid, and the second pad is wiped vertically on the original sampling grid. The pads will be placed in identical containers, identified with unique sample identification numbers, and sample stations where collocates are collected will be documented in the field logbook.

Replicate structural samples (concrete, insulation, destructive) will be taken by placing the entire original sample volume in a decontaminated bowl, homogenizing the sample in an appropriate manner (i.e., mixing, grinding, etc.), and then dividing the sample volume in half. The two halves are placed in identical containers, identified with unique identification numbers, and sample stations where collocateds are collected will be documented in the field logbook.

8. <u>TEST TRENCH</u>

The test trench will be excavated to the top of bedrock within Grid No. 3 in the Main Building as shown on Figure III-2. The approximate trench dimensions will be 2 feet by 30 feet and 12 feet deep and will be

oriented in an east-west direction. The health and safety requirements for the test trench excavation are detailed in the HSP.

a. Excavation Procedure

The concrete floor slab at the proposed trench location will be saw-cut and removed. The overburden soil will then be excavated with a backhoe and stockpiled inside the building on plastic sheeting. The soil materials will be removed to the top of the underlying bedrock.

b. Soil Sampling

Sixteen soil samples will be obtained from the excavated soils at the discretion of the engineer or geologist to provide a representative cross-section of the trench. Eight of the 16 samples will be analyzed for the parameters listed in Table III-2. All 16 samples will be stored and shipped to the laboratory in the containers specified in Table III-1. The determination for which samples to submit for analysis will be based on visual discoloration organic vapor readings, and spatial distribution. The samples will be obtained from soil in the bucket which has not come into contact with the bucket of the backhoe and placed into the sample containers using a stainless steel sample knife. No personnel will enter the trench during the excavation, sampling or backfilling activities.

c. Photographic Log

A complete photographic log of the trench sides and bottom will be made prior to backfilling.

d. Decontamination

The soil sample knife and the backhoe bucket will be decontaminated following the procedures outlined in Section E of this Part.

e. Replicate Sample

One replicate sample will be collected from the investigative samples from the test trench as indicated in Table III-2. The investigative and replicate sample will be obtained from the same soil sample. The investigative and replicate sample containers will be filled alternately using a stainless steel sampling knife with portions of the sample so that the replicate samples sent for analyses are as similar as possible.

f. Trench Backfilling

Upon completion of sampling, the trench will be backfilled with clean, uncontaminated material from an on-site area which has been previously sampled and found to be uncontaminated or an off-site source of granular material mixed with bentonite. The backfill shall be placed in individual compacted lifts. The material will be placed and compacted with the backhoe bucket.

9. SEWER SAMPLING TEST PITS

Five test pits will be excavated adjacent to the on-site sewers at the locations shown on Figure III-5. The health and safety requirements for all test pit sampling is detailed in the HSP. One soil sample will be

obtained from each test pit and analyzed for the parameters listed in Table III-2.

a. Excavation Procedure

A backhoe will be used to excavate a test pit approximately 5 feet by 5 feet in plan dimensions to the sewer invert elevations. All excavated material will be stockpiled on and covered with plastic sheeting.

b. Soil Sampling

One soil sample will be obtained from the backhoe bucket at the sewer invert elevation and will be placed directly into the sample containers using a stainless steel sample knife.

c. Decontamination

The backhoe bucket and stainless steel sample knife will be decontaminated between test pits following the procedure outlined in Section E of this Part.

d. Test Pit Backfilling

Upon completion of sampling, the test pits will be backfilled with clean, uncontaminated material from an on-site area which has been previously sampled and found to be uncontaminated or an off-site source of granular material mixed with bentonite. The backfill shall be placed in individual compacted lifts. The material will be placed and compacted with the backhoe bucket.

e. Replicate Sample

One replicate soil sample from the sewer sampling test pits will be obtained from the location specified in Table III-3. The investigative and replicate sample will be obtained from the same soil sample. The investigative and replicate sample containers will be filled alternately using a stainless steel sampling knife with portions of the sample so that the replicate samples sent for analyses are as similar as possible.

10. SANITARY SEWER DYE TESTING

The sanitary sewer shown on Figure III-5 flowing south from the Main Building will be dye tested to assess the integrity of the previously installed plug. This activity will consist of initiating a flow from the Holden water supply into the interior sanitary sewer inlet nearest the southwest corner of the Main Building at a rate of approximately 2 to 4 gallons per minute. Approximately 1 ounce of powdered dye will be added to the flow at the sanitary sewer inlet inside the Main Building, and the supplied flow of water will be maintained for a minimum of 15 minutes after the dye is added. The flow in the downstream sanitary sewer located northwest of the South Warehouse will be visually monitored from the ground surface for the presence of the colored dye for a minimum of 20 minutes after the dye is added.

E. DECONTAMINATION

All decontamination procedures for the drilling and sampling equipment are described in this Section. A decontamination area will be set up by the drilling subcontractor prior to drilling consisting of a metal open-top livestock tank underlain by plastic sheeting. All waste generated during the decontamination procedures will be disposed of as described in Part IV. The safety levels required for personnel engaged in decontamination activities are designed in the HSP.

1. DRILLING AND EXCAVATION EQUIPMENT

All drilling equipment, sampling equipment, and PVC well construction material will be decontaminated by the drilling subcontractor prior to any drilling operations and between borings. All augers, drill rod and the backhoe bucket will be placed in the open-top tank and cleaned using a high-pressure hot water sprayer. All exposed exterior and interior surfaces of the augers and drill rods will be cleaned until all visible soil is removed. The backhoe bucket will be decontaminated subsequent to removing each 5 linear foot section of trench or after encountering stained soil, odors or elevated TIP readings.

After all visible soil is removed from the drilling and excavating equipment the following decontamination procedure will be followed:

a. The augers, drill rod and backhoe bucket will be scrubbed with an Alconox solution consisting of one tablespoon of Alconox per one gallon of water.

b. The equipment will then be rinsed with a supply of pesticide-grade methanol contained in 1-quart plastic squeeze bottles or sprayers that will be labeled using duct tape strips.

c. A final rinse of the equipment will be made using deionized water.

2. SOIL, WATER AND STRUCTURAL SOLIDS SAMPLING EQUIPMENT

All split-barrel soil samplers, stainless steel sample knives, sampling bowls, groundwater sampling equipment, surface water sampling equipment, water level measuring equipment, and structural solids sampling equipment will be decontaminated by prior to the collection of each sample.

The following decontamination set-up for sampling equipment will be provided:

(1) The Holden potable water will be identified and tested prior to use.

(2) A galvanized wash tub or a clean 5-gallon plastic container will be filled with potable water. An Alconox solution will be mixed in the container consisting of one tablespoon of Alconox per one gallon of water.

(3) A supply of pesticide-grade methanol will be placed in 1-quart plastic squeeze bottles or sprayers that will be labeled using duct tape strips.

(4) An empty container will be provided to contain the methanol rinsings.

(5) Deionized water will be provided in 1-quart plastic squeeze bottles or sprayers that will be labeled using duct tape strips.

Prior to sampling, the sampling equipment will be scrubbed visually clean using the Alconox solution and a stiff long bristle scrub brush. After the solution scrub, the device will be rinsed with deionized water. The device will then be sprayed with methanol over the second container. After the methanol rinse, the devices will be stacked over the top of the second container, and allowed to dry. All decontamination fluids will be retained and disposed of as described in Part IV.

F. CHAIN-OF-CUSTODY PROCEDURES

The Chain-of-Custody program will provide for the tracking of possession and handling of the samples from the time of field collection through laboratory analysis. The Chain-of-Custody program will consist of sample labeling, sample numbering, sample seals, the field logbook, and the Chain-of-Custody Records. The Chain-of-Custody procedures are detailed in the QAPP.

G. FIELD ORGANIZATION

The complete organizational structure of the field team, illustrating how this team will interact with Clean Site's Site Manager and the various subcontractors, is presented in Figure III-8, Field Organization Chart. The Field Site Manager and Site Health and Safety Supervisor will be advised by the RI Manager and the Health and Safety Officer.

H. FIELD ACTIVITIES SCHEDULE

A preliminary schedule for conducting field activities is shown on Figure III-9. Time frames listed on the schedule are keyed to the date for initiation of field activities. The schedule, assumes that normal weather patterns will prevail during field work and that validated analytical data will be available within approximately four weeks of the conclusion of field activities. Delays due to severe weather conditions will be minimized by floating the schedule of the interior sampling activities.

* * * * *

PART IV

INVESTIGATION GENERATED WASTES

Field investigation activities will result in the generation of contaminated materials that must be properly managed. Management of the wastes generated during the investigation requires compliance with federal and state requirements for generation, storage, transportation, and disposal. Contaminated materials generated during the field investigation will include such materials as decontamination fluids, disposable clothing and equipment, drill cuttings and well-development and purging water.

All investigation generated solid wastes will be disposed of off-site at Chemical Waste Management's TSCA/RCRA landfill in Emelle, Alabama. All decontamination fluids, and well-development and purging waters will be collected and treated on site using an activated carbon adsorption system.

Wastes generated by the field operations will consists of:

- Decontamination Fluids. These fluids include wash waters used to decontaminate personal safety equipment and drilling and sampling equipment. The wash waters will be collected and pumped to an on-site open-top tank for treatment.

- Well Development and Purging Water. These RI generated wastes include the groundwater obtained from monitoring well development and pre-sampling well purging activities. These fluids will be collected and treated in the same manner as the decontamination fluids described above.

- Personal Protective Clothing and Equipment. This category includes the disposable work clothing such as boot covers, gloves, tyvek coveralls, and spent respirator cartridges worn on-site by field personnel during the field investigation. The procedure for handling disposable personal protective clothing will be to place such articles in DOT-approved 55-gallon drums which will be stored on-site until the completion of the field investigation.

- Drill Cuttings and Test Pit and Trench Material. These are soil and rock generated during the drilling of the boreholes and potentially from the excavation of test pits and the interior trench. These drill cuttings and soil materials will be covered in plastic sheeting for subsequent off-site disposal.

* * * * *

TABLES

Table III-1
SUMMARY OF CHEMICAL COMPOUNDS FOR ANALYSIS

Polychlorinated Biphenyls (PCBs)

Aroclor 1016
Aroclor 1221
Aroclor 1232
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260

Volatile Organic Compounds (VOCs)

Benzene
Bromodichloromethane
Bromoform
Bromomethane
Carbon tetrachloride
Chlorobenzene
Chloroethane
2-Chloroethylvinyl ether
Chloroform
Dibromochloromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
Trans-1,2-Dichloroethene
1,2-Dichloropropane
cis-1,3-Dichloropropane
trans-1,3-Dichloropropene
Ethyl benzene
Methylene chloride
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Toluene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Trichlorfluoromethane
Vinyl chloride

Semivolatile Organic Compounds

Benzal chloride
Benzotrichloride
Benzyl chloride
2-Chloronaphthalene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclohexane
Hexachlorocyclopentadiene
Hexachloroethane
Pentachlorohexane
Tetrachlorobenzenes
1,2,4-Trichlorobenzene

Table III-2
SUMMARY OF SOIL, SEDIMENT, AND WATER SAMPLES

Sampling Category	Sample Location	Sample Matrix	Parameters to be Analyzed	Number Investigative of Samples	Field Replicate	Field Blank	Total Samples
Groundwater Monitoring Wells	MW-101	Water	P, V, S	1	0	0	1
	MW-102	Water	P, V, S	1	0	0	1
	MW-103	Water	P, V, S	1	0	0	1
	MW-104	Water	P, V, S	1	0	0	1
	MW-105	Water	P, V, S	1	0	0	1
	MW-106	Water	P, V, S	1	0	0	1
	MW-107	Water	P, V, S	1	0	0	1
	MW-108	Water	P, V, S	1	1	1	3
	MW-109	Water	P, V, S	1	0	0	1
	MW-110	Water	P, V, S	1	0	0	1
	MW-111	Water	P, V, S	1	0	0	1
	MW-201	Water	P, V, S	1	0	0	1
	MW-202	Water	P, V, S	1	0	0	1
	MW-203	Water	P, V, S	1	0	0	1
	MW-204	Water	P, V, S	1	0	0	1
	MW-205	Water	P, V, S	1	0	0	1
	MW-206	Water	P, V, S	1	0	0	1
	MW-207	Water	P, V, S	1	1	1	3
	MW-208	Water	P, V, S	1	0	0	1
	MW-209	Water	P, V, S	1	0	0	1
	MW-210	Water	P, V, S	1	0	0	1
	MW-211	Water	P, V, S	1	0	0	1
			Subtotal	22	2	2	26
Exterior Soil Borings	MW-104	Soil	P, V, S, C	2	0	0	2
	MW-105	Soil	P, V, S, C	2	0	0	2
	MW-106	Soil	P, V, S, C	2	1	0	3
	MW-107	Soil	P, V, S, C	2	0	0	2
	MW-108	Soil	P, V, S, C	2	1	0	3
	MW-109	Soil	P, V, S, C	2	0	0	2
	MW-110	Soil	P, V, S, C	2	0	0	2
	MW-111	Soil	P, V, S, C	2	0	0	2
			Subtotal	16	2	0	18

Notes:
P – PCBs
V – Volatile Organic Compounds
S – Semivolatiles
C – Soil Classification Tests (Two Samples per Boring)

Table III-2
SUMMARY OF SOIL, SEDIMENT, AND WATER SAMPLES (Continued)

Sampling Category	Sample Location	Sample Matrix	Parameters to be Analyzed	Number Investigative of Samples	Field Replicate	Field Blank	Total Samples
Surface Tracking	McGasock Street East Access	Soil	P	2	1	0	3
	Missouri State Route 58 South Access	Soil	P	2	0	0	2
	Temporary Access Route	Soil	P	2	0	0	2
			Subtotal	6	1	0	7
Sewer	Manhole Northwest of South Warehouse	Sediment	P, V, S	1	1	0	2
	Manhole East of Western Boundary	Sediment	P, V, S	1	0	0	1
	Upgradient Manhole at McGasock St.	Sediment	P, V, S	1	0	0	1
	Upgradient Manhole at Missouri State Route 58	Sediment	P, V, S	1	0	0	1
	Western Boundary Sewer Line	Backfill	P, V, S	1	1	0	2
	20' Downstream of Manhole NW of South Warehouse	Backfill	P, V, S	1	0	0	1
	Southern Boundary Sewer Line	Backfill	P, V, S	1	0	0	1
	Intersection of Disconnected Storm Sewer and Ditch to Storm Water Retention Pond	Backfill	P, V, S	1	0	0	1
	Main Building Sanitary Sewer	Backfill	P, V, S	1	0	0	1
			Subtotal	9	2	0	11
Sediment	Center of Spill Containment Pond	Sediment	P, V, S, C	1	1	0	2
	Ditch Draining Into Storm Water Pond	Sediment	P, V, S, C	2	0	0	2
	Storm Water Retention Pond	Sediment	P, V, S, C	3	0	0	3
	Unnamed Tributary to East Pin Oak Creek (Includes 2 background samples upgradient of site and north and south of Missouri State Route 58)	Sediment	P, V, S, C	15	2	0	17
	East Pin Oak Creek	Sediment	P, V, S	10	1	0	11
			Subtotal	31	4	0	35
Surface Soil	Designated Sampling Grids Are Shown on Figure II-9	Soil	P	49	5	0	54

Notes:
P – PCBs
V – Volatile Organic Compounds
S – Semivolatiles
C – Soil Classification Tests (Two Samples per Boring)

Table III-2
SUMMARY OF SOIL, SEDIMENT, AND WATER SAMPLES (Continued)

Sampling Category	Sample Location	Sample Matrix	Parameters to be Analyzed	Number Investigative of Samples	Field Replicate	Field Blank	Total Samples
Surface Water	Unnamed Tributary South of Missouri State Route 58	Water	P, V, S	1	0	1	2
	Unnamed Tributary Downstream of Abandoned Sewer Outfall	Water	P, V, S	1	0	0	1
	Last Sediment Sampling Station Prior to Confluence with East Pin Oak Creek	Water	P, V, S	1	0	0	1
	East Pin Oak Creek Upstream of the Confluence of the Unnamed Tributary	Water	P, V, S	1	1	0	2
	East Pin Oak Creek Upstream of Sewage Treatment Plant Outfall	Water	P, V, S	1	0	0	1
	East Pin Oak Creek 500 Feet Downstream of Sewage Treatment Plant Outfall	Water	P, V, S	1	0	0	1
	East Pin Oak Creek Immediately Downstream of Sewage Treatment Plant Outfall	Water	P, V, S	1	0	0	1
	Spill Containment Pond	Water	P, V, S	2	1	1	4
	Main Building Pit Water	Water	P, V, S	2	1	1	4
			Subtotal	11	3	3	17
Interior Soil Borings (See Figures II-5 and II-6 for grid locations)	Grid No. 1	Soil	P, V, S, C	4	1	0	5
	Grid No. 7	Soil	P, V, S, C	4	0	0	4
	Grid No. 10	Soil	P, V, S, C	4	0	0	4
	Grid No. 12	Soil	P, V, S, C	4	0	0	4
	Grid No. 19	Soil	P, V, S, C	4	0	0	4
	Grid No. 21	Soil	P, V, S, C	4	1	0	5
	Grid No. 23	Soil	P, V, S, C	2	1	0	3
	Grid No. 25	Soil	P, V, S, C	4	0	0	4
	Grid No. 28	Soil	P, V, S, C	4	0	0	4
	Grid No. 32	Soil	P, V, S, C	4	0	0	4
	Grid No. 34	Soil	P, V, S, C	4	0	0	4
	Grid No. 39	Soil	P, V, S, C	4	1	0	5
			Subtotal	46	4	0	50
Test Trench	Grid No. 3	Soil	P, V, S	8	1	0	9
			Subtotal	8	1	0	9

Notes:
P – PCBs
V – Volatile Organic Compounds
S – Semivolatiles
C – Soil Classification Tests (Two Samples per Boring)

Table III-3
PROPOSED MONITORING WELL INFORMATION

Well Number	Location	Rationale
MW-104, 204	West side of South Warehouse	Assess South Warehouse as possible source of contaminants in MW-201
MW-105, 205	Southeast of Main Building	Assess Main Building as a possible source of contaminants in MW-201
MW-106, 206	Southwest of Main Building	Downgradient of large area of soil discoloration under Main Building
MW-107, 207	Southwest of dock	Downgradient of dock area
MW-108, 208	West of dock	Downgradient of potential buried drums
MW-109, 209	West of Main Building	Downgradient of Pit 1 in Main Building
MW-110, 210	North of Main Building	Upgradient Well
MW-111, 211	Near unnamed tributary, southwest of Main Building	Assess potential for groundwater to discharge to unnamed tributary

Table III-4
SUMMARY OF WIPE AND CORE SAMPLING FOR PADS, DOCKS AND BUILDING INTERIORS

Grid No.	Floor Wipe	Wall Wipe	Insulation Core	Horizontal Wipe	Ceiling Wipe	Concrete Core	Destructive Sample	Totals
1	1	1	0	1	0	1	0	4
2	1	0	0	0	0	0	0	1
3	1	2	1	1	1	0	0	6
4	1	0	0	0	0	0	0	1
5	1	0	0	0	0	0	0	1
6	1	1	0	0	0	0	0	2
7	1	2	1	1	1	1	0	7
8	1	0	0	0	0	0	0	1
9	1	0	0	0	0	0	0	1
10	1	2	0	1	0	1	0	5
11	1	0	0	0	0	0	0	1
12	1	2	1	1	1	1	0	7
13	1	0	0	0	0	0	0	1
14	1	0	0	1	1	0	0	3
15	1	2	0	1	1	0	0	5
16	1	0	0	0	0	0	0	1
17	1	4	2	1	1	0	0	9
18	1	0	0	0	0	0	0	1
19	1	2	1	1	1	1	0	7
20	1	0	0	0	0	0	0	1
21	1	2	1	1	1	1	0	7
22	1	0	0	0	0	0	0	1
23	1	4	0	0	0	1	0	6
24	1	0	0	0	0	0	0	1
25	1	4	2	1	1	1	0	10
26	1	0	0	0	0	0	0	1
27	1	4	0	0	0	0	0	5
28	1	0	1	1	1	1	0	5
29	1	0	0	0	0	0	0	1
30	1	2	2	1	1	0	0	7
31	1	0	0	0	0	0	0	1
32	1	4	2	1	1	1	0	10
33	1	0	0	0	0	0	0	1
34	1	2	2	1	1	1	0	8
35	1	0	0	0	0	0	0	1
36	1	0	0	0	0	0	0	1
37	1	2	0	0	0	0	0	3
38	1	2	1	1	1	0	0	6
39	1	0	0	0	0	1	0	2
40	1	2	1	1	1	0	0	6
41	1	2	1	1	1	0	0	6
42	1	0	0	0	0	0	0	1
43	1	0	0	0	0	0	0	1
Subtotal	43	48	19	18	16	12	0	156
Field Replicates or Collocated Samples	2	1	2	1	1	1	1	9
Biased Samples	12	12	12	12	0	0	6	54
Totals	57	61	33	31	17	13	7	219

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Table III-5
SUMMARY OF WIPE SAMPLING
FOR WALLS AND ROOF EXTERIOR SURFACES

Sample Type	Unbiased Sample	Biased Sample	Collocated Samples	Totals
Main Building Wall Wipe	10	4	1	15
South Warehouse Wall Wipe	4	2	1	7
Main Building Roof Wipe	4	4	1	9
South Warehouse Roof Wipe	1	2	1	4
Totals	19	12	4	35

Table III-6
SUMMARY OF SAMPLE CONTAINERS, PRESERVATIVES, AND MAXIMUM HOLDING TIMES

Sample Matrix	Chemical Analysis[1]	Container	Preservatives	Maximum Holding Time
Groundwater	P	Glass, Teflon Lined Cap	On Ice	40 Days
	V	Glass, Teflon Lined Septum	On Ice	14 Days
	S	Glass, Teflon Lined Cap	On Ice	7 Days until Extraction 40 Days after Extraction
Surface Water	P	Glass, Teflon Lined Cap	On Ice	40 Days
	V	Glass, Teflon Lined Septum	On Ice	14 Days
	S	Glass, Teflon Lined Cap	On Ice	7 Days until Extraction 40 Days after Extraction
Surface Soil	P	Glass, Teflon Lined Cap	On Ice	40 Days
	V	Glass, Teflon Lined Septum	On Ice	14 Days
	S	Glass, Teflon Lined Cap	On Ice	7 Days until Extraction 40 Days after Extraction
Subsurface Soil	P	Glass, Teflon Lined Cap	On Ice	40 Days
	V	Glass, Teflon Lined Septum	On Ice	14 Days
	S	Glass, Teflon Lined Cap	On Ice	7 Days until Extraction 40 Days after Extraction
Sediment	P	Glass, Teflon Lined Cap	On Ice	40 Days
	V	Glass, Teflon Lined Septum	On Ice	14 Days
	S	Glass, Teflon Lined Cap	On Ice	7 Days until Extraction 40 Days after Extraction
Wipe Samples	P	Glass, Teflon Lined Cap	On Ice	40 Days
	V	Glass, Teflon Lined Septum	On Ice	14 Days
	S	Glass, Teflon Lined Cap	On Ice	7 Days until Extraction 40 Days after Extraction
Structural Solid Samples	P	Glass, Teflon Lined Cap	On Ice	40 Days
	V	Glass, Teflon Lined Septum	On Ice	14 Days
	S	Glass, Teflon Lined Cap	On Ice	7 Days until Extraction 40 Days after Extraction

Note: P–PCBs
V–VOCs
S–Semivolatiles

Table III-7

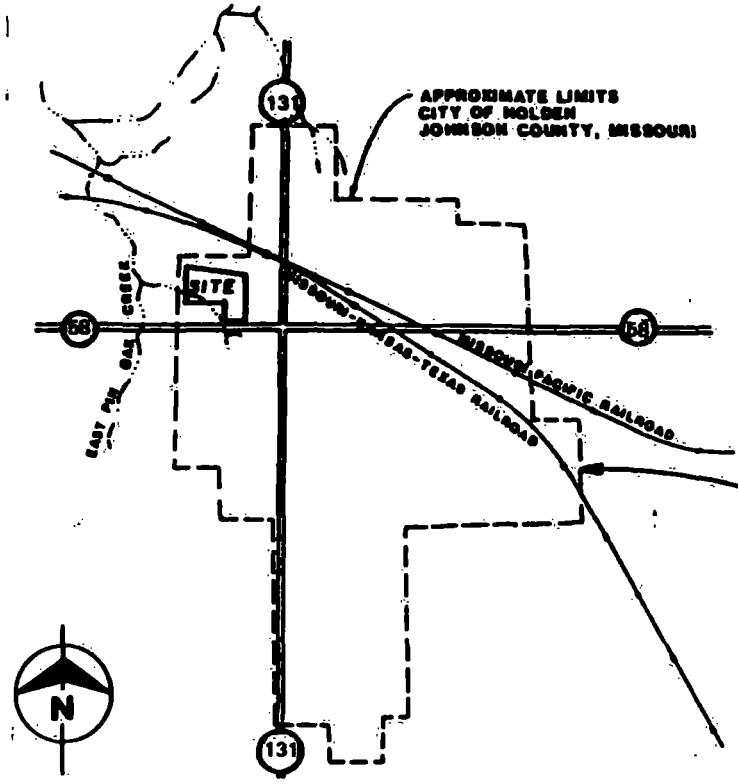
SUMMARY OF CONTAINER VOLUMES AND SAMPLE SIZES

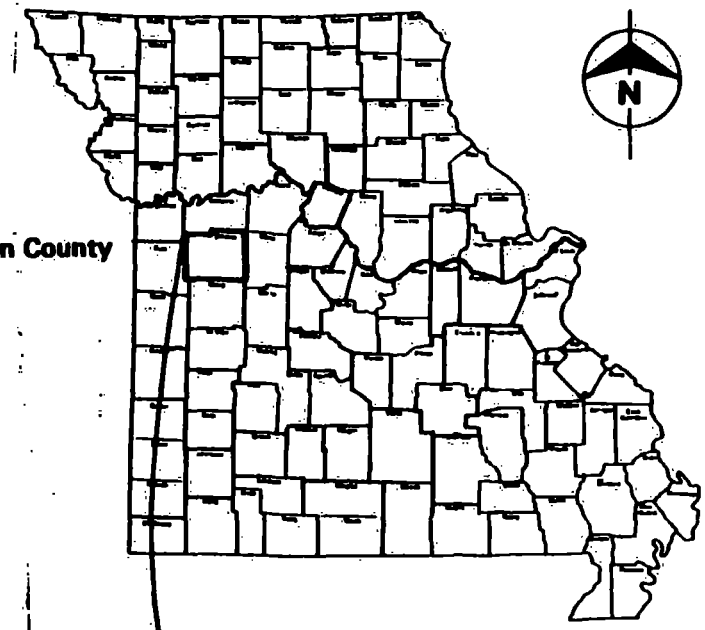
Water Samples	Required Sample Volume	Container Type
Extractable Analysis	1 Gallon	1 x 4-Liter Amber or 2 x 80-oz. Amber or 4 x 1-Liter Amber
Volatile Analysis	80 ml	2 x 40-ml Vial

Soil/Sediment Samples	Required Sample Volume	Container Type
Extractable Analysis	6 oz.	1 x 8-oz. Wide-Mouth Jar or 2 x 4-oz. Wide-Mouth Jars
Volatile Analysis	240 ml	2 x 120-ml Wide-Mouth Vials

* * * * *

FIGURES





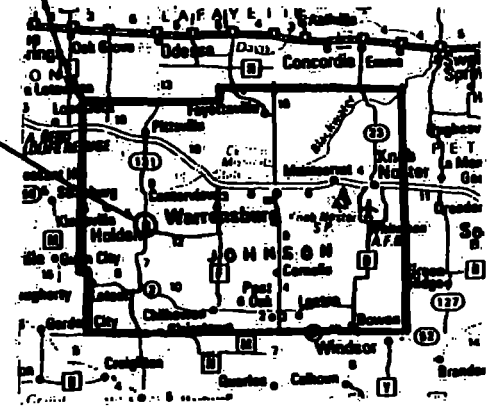


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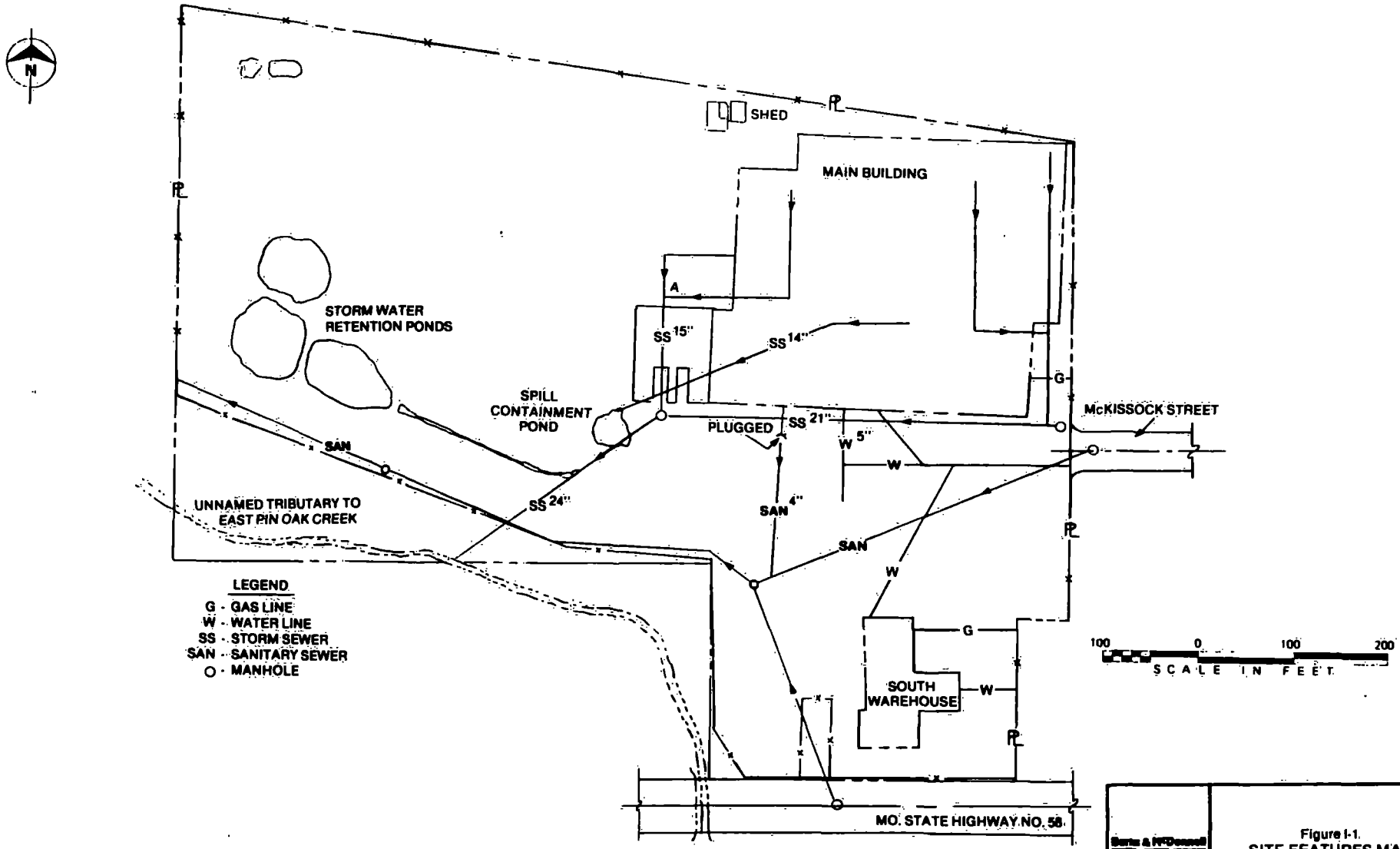
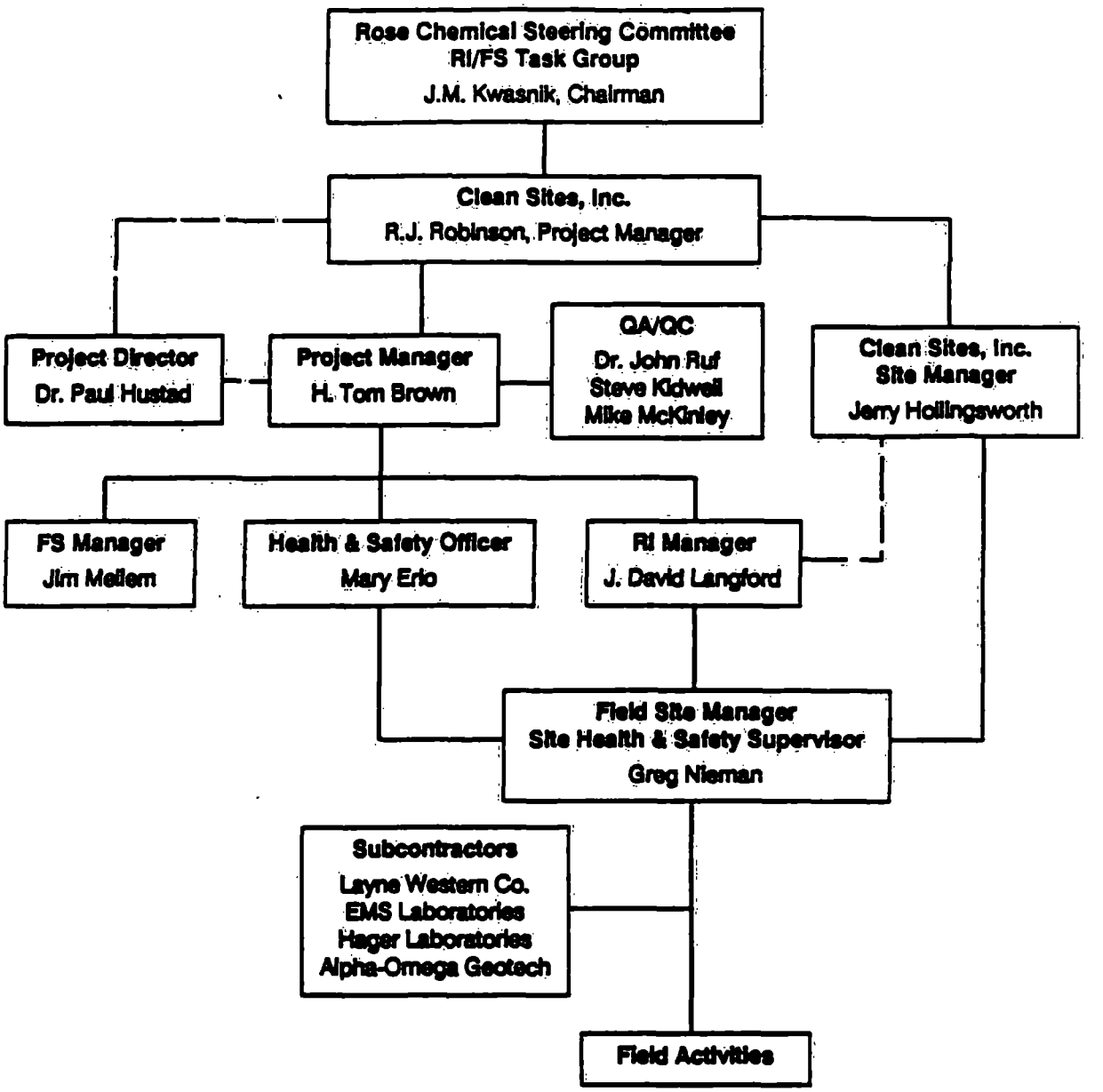
Figure IN-1
SITE LOCATION



Burns & McDonnell

Figure I-1.
SITE FEATURES MAP



Project Organization Chart
Conduct of Remedial Investigation/
Feasibility Study
Rose Chemicals Site
Burns & McDonnell
November 1988
Figure I-2

ROSCHT3 12-88

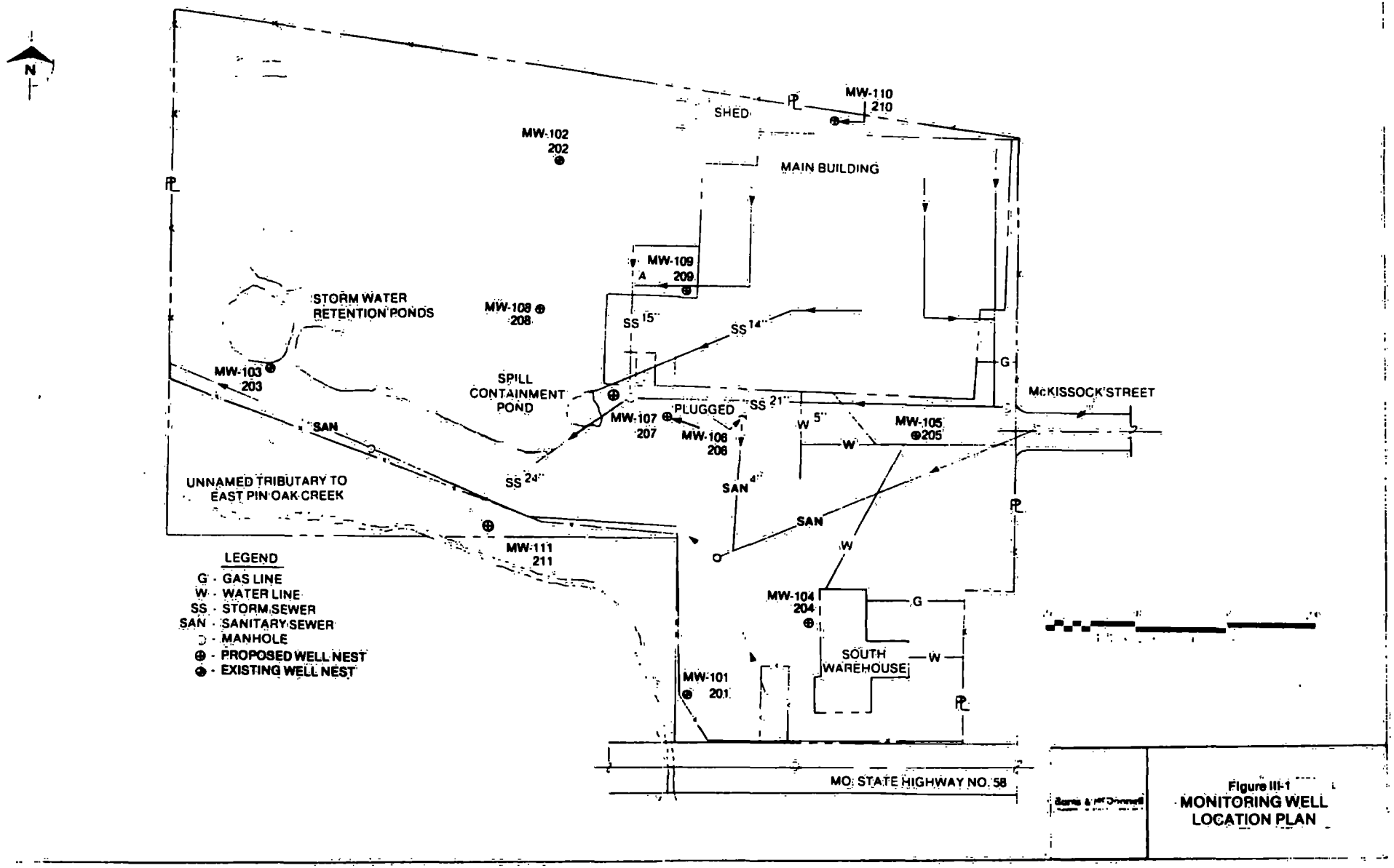


Figure III-1
MONITORING WELL
LOCATION PLAN

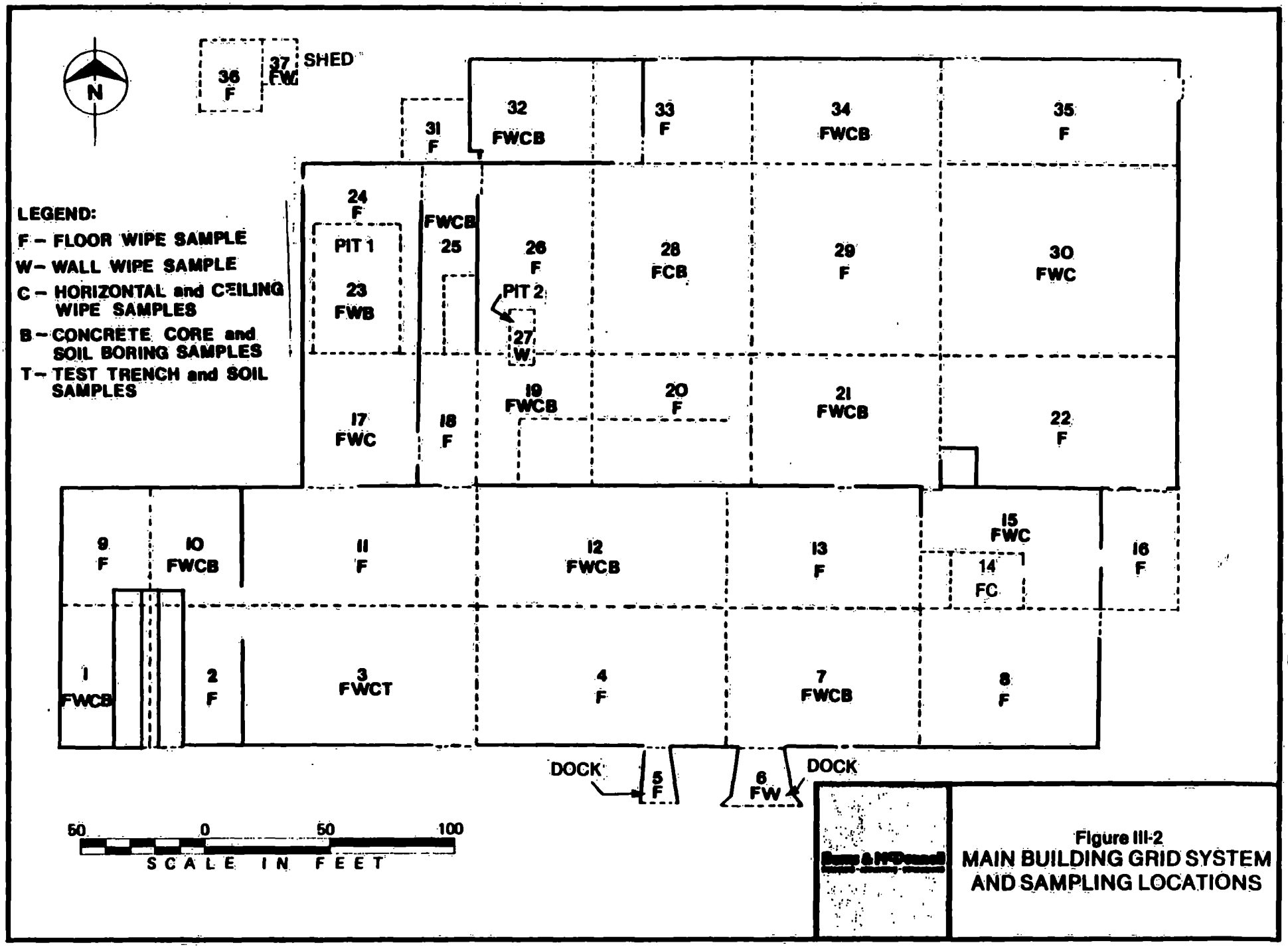
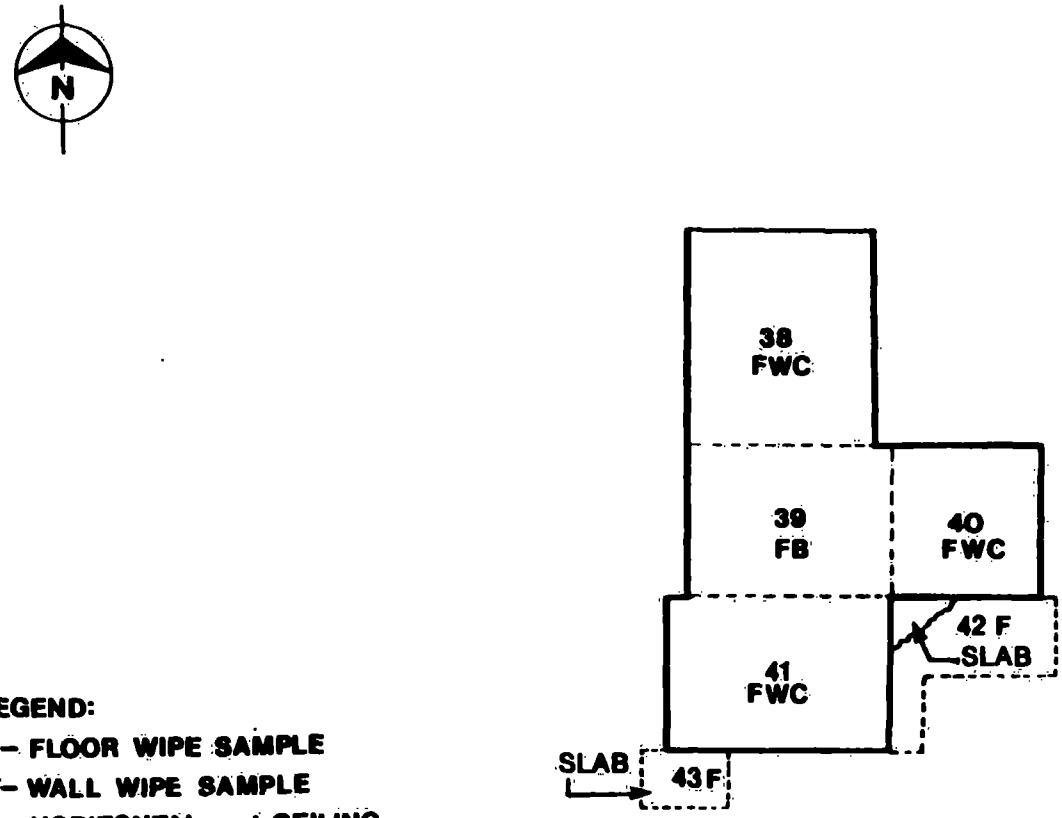


Figure III-2
MAIN BUILDING GRID SYSTEM AND SAMPLING LOCATIONS



SOUTH WAREHOUSE

LEGEND:

F – FLOOR WIPE SAMPLE

W – WALL WIPE SAMPLE

C – HORIZONTAL and CEILING WIPE SAMPLES

B – CONCRETE CORE and SOIL BORING SAMPLES

50 0 50 100

SCALE IN FEET

Figure III-3

SOUTH WAREHOUSE GRID SYSTEM AND SAMPLING LOCATIONS

NOTES:

(1) 13 SEDIMENT SAMPLES TO BE OBTAINED FROM THIS LOCATION ALONG TRIBUTARY TO CONFLUENCE AT EAST PIN OAK CREEK ON APPROXIMATE 100 FOOT CENTERS.

(2) 10 SEDIMENT SAMPLES WILL BE OBTAINED FROM EAST PIN OAK CREEK: TWO BACKGROUND SAMPLES UPSTREAM OF THE CONFLUENCE WITH THE UNNAMED TRIBUTARY, ONE SAMPLE AT THE CONFLUENCE OF EAST PIN OAK CREEK AND THE UNNAMED TRIBUTARY ONE SAMPLE MIDWAY BETWEEN THE CONFLUENCE AND THE SEWAGE TREATMENT PLANT, ONE SAMPLE IMMEDIATELY DOWNSTREAM OF THE SEWAGE TREATMENT PLANT OUTFALL, AND FIVE SAMPLES AT INTERVALS OF 100 FEET DOWNSTREAM OF THE SEWAGE TREATMENT PLANT OUTFALL.

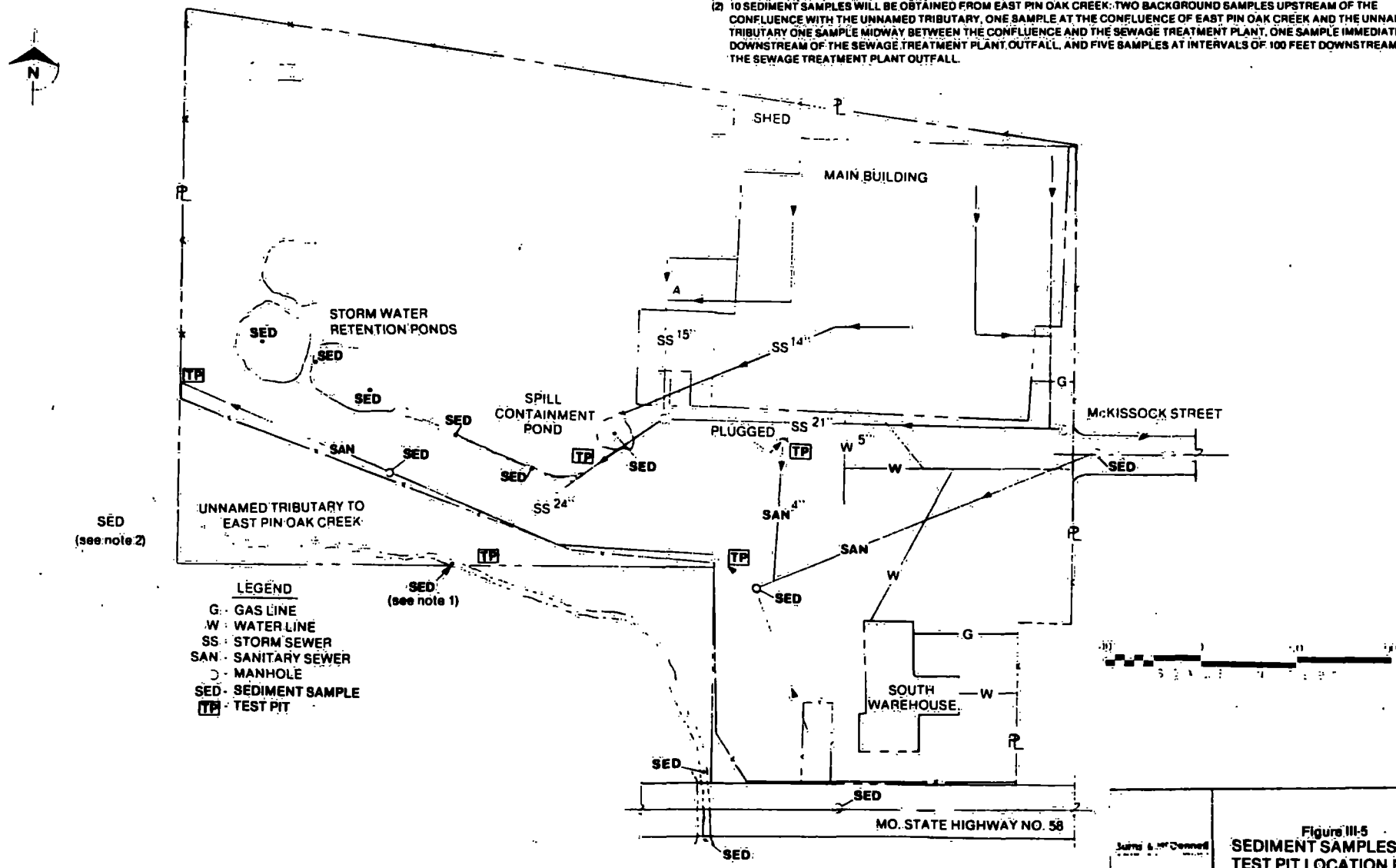
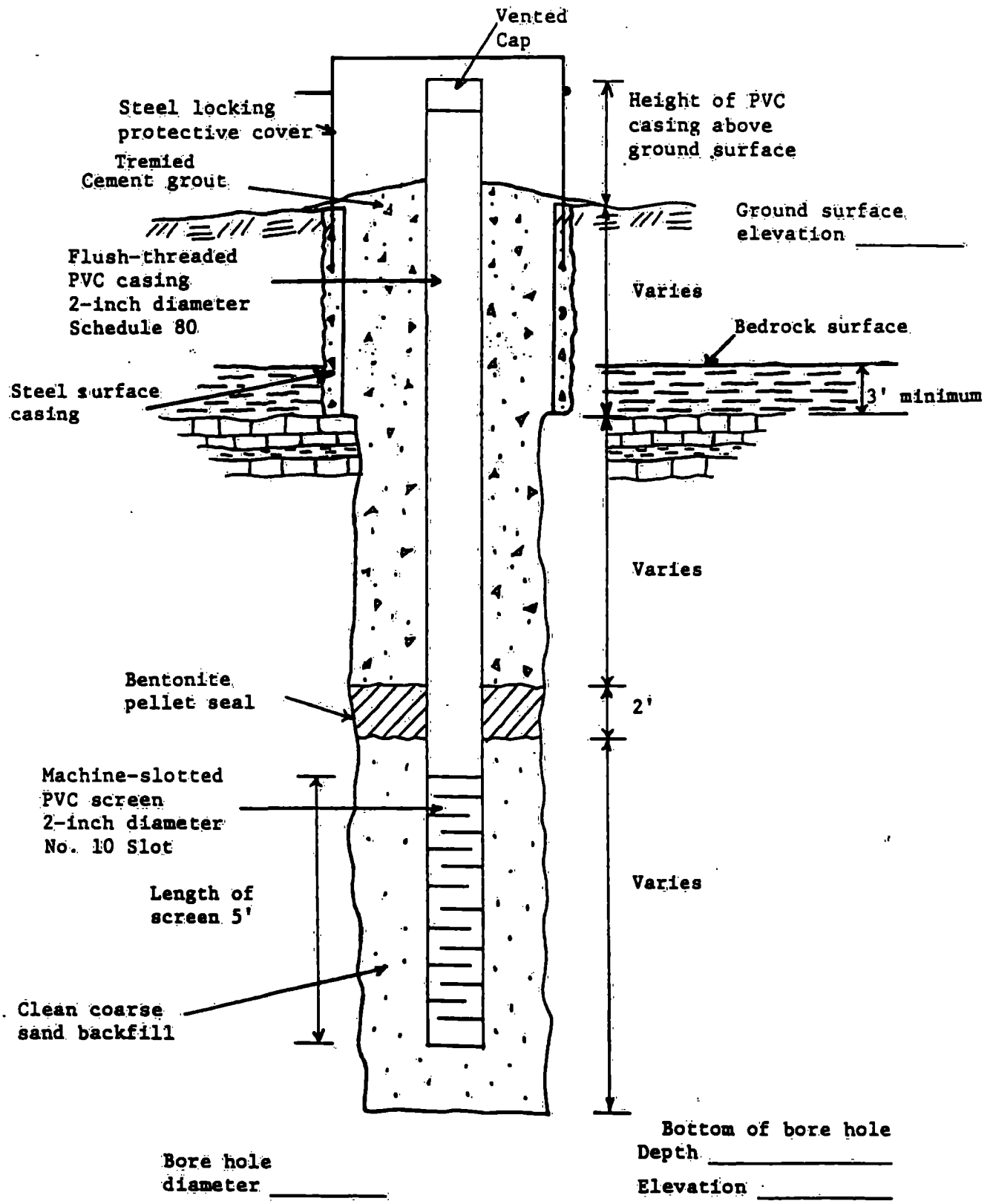


Figure III-5
SEDIMENT SAMPLES AND TEST PIT LOCATION PLAN



date

ref. dwg. no.

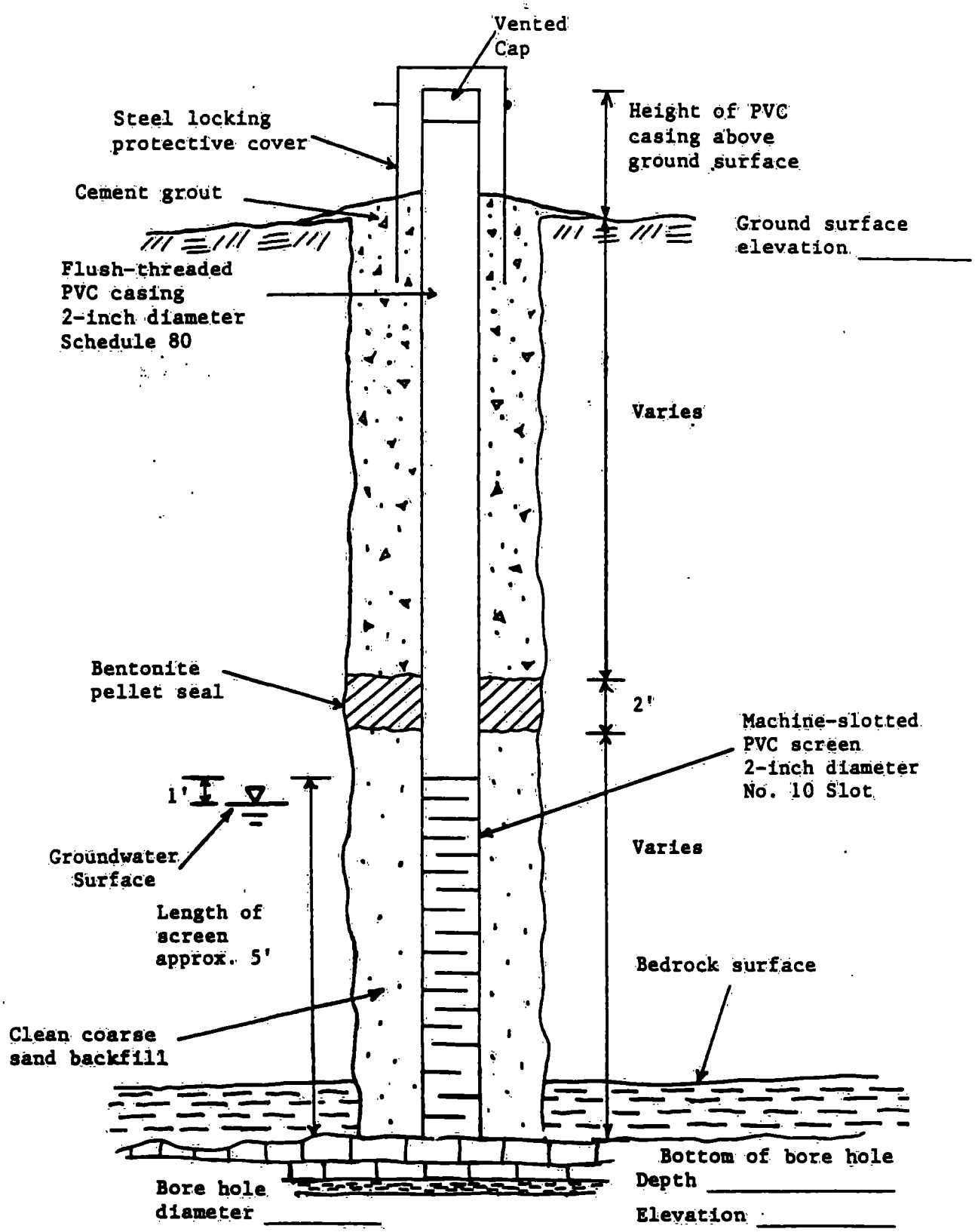
Burns & McDonnell
Engineers
Architects
Consultants
Kansas City, Missouri

MONITORING WELL
CONSTRUCTION RECORD
100 Series Well
Monitoring Well No. _____
Figure III-6

project
ROSECHEM 88-025-4
contract

SK-

Form GCO-1-8 05/1978



date

rel. dwg. no.

Burns & McDonnell Engineers Architects Consultants
Kansas City Missouri

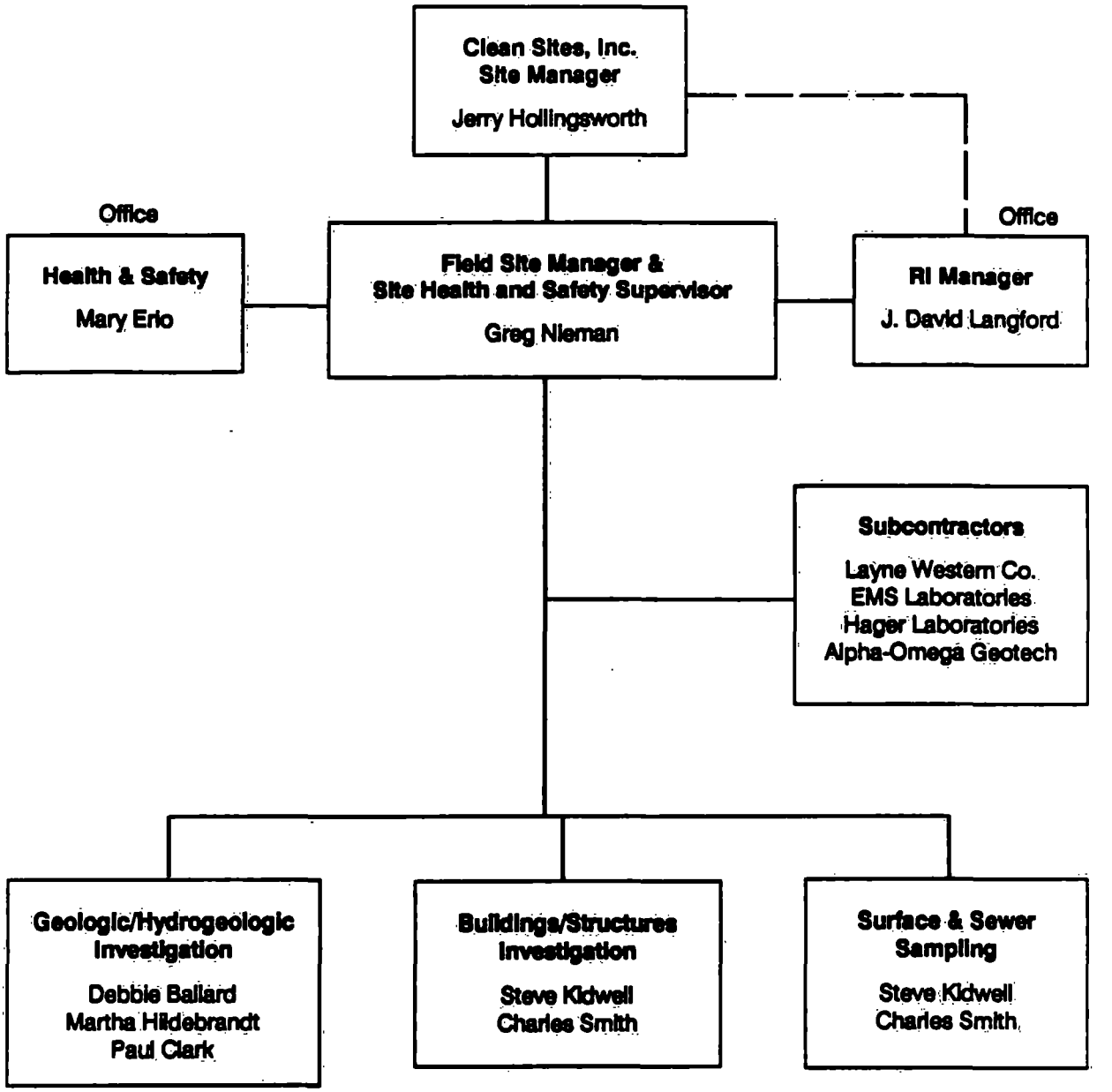
MONITORING WELL
CONSTRUCTION RECORD
200 Series Well

Monitoring Well No. _____
Figure III-7

project
ROSECHEM 88-025-4
contract

SK-

Form CCO-1-8 051978

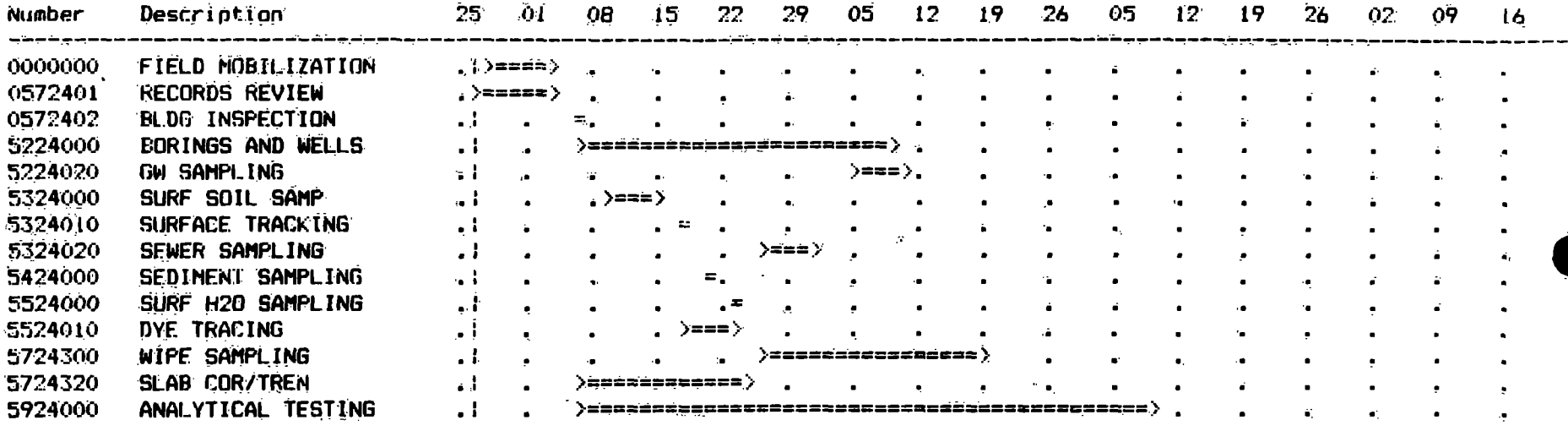


Field Organization Chart
Conduct of Remedial Investigation/
Feasibility Study
Rose Chemicals Site
Burns & McDonnell
November 1988
Figure III-8

ROSCHT1 12-88

SCHEDULE: PHASE 1 SITE INVESTIGATION
RUN DATE = 28DEC88 Rev 5
TIME SCALE REPORT by ACTIVITY NUMBER

BASE DATE = 26DEC88
DATA DATE = 26DEC88
CUT OFF DATE = 13MAR89



FIELD INVESTIGATION SCHEDULE
Figure III-9

Remedial Design Work Plan

Rose Chemicals Site
Holden, Missouri

Attachment No. 2
(Remedial Design Quality Assurance Project Plan)

prepared for:

Rose Chemicals
Steering Committee

prepared by:

Burns & McDonnell
Waste Consultants, Inc.

submitted to:

U.S. EPA Region VII
Kansas City, Kansas

January 17, 1993

CLEAN SITES

REMEDIAL DESIGN QUALITY ASSURANCE PROJECT PLAN
FOR THE
ROSE CHEMICALS SITE
HOLDEN, MISSOURI

for

ROSE CHEMICALS STEERING COMMITTEE

January 17, 1993

92-381-3

Burns & McDonnell Waste Consultants, Inc.
Engineers-Geologists-Scientists
Overland Park, Kansas

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APPENDIX B - Audit Checklists

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LIST OF ACRONYMS

BMWCI	Burns & McDonnell Waste Consultants, Inc.
CLP	Contract Laboratory Program
CompQAP	EMS's Comprehensive Quality Assurance Plan
EMS	EMS Heritage Laboratories, Inc.
FS	Feasibility Study
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated Biphenyl
PRP	Potentially Responsible Party
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RA	Remedial Action
RAS	Routine Analytical Service
RCSC	Rose Chemicals Steering Committee
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SAP	Sampling and Analysis Plan
USEPA	United States Environmental Protection Agency

* * * * *

1.0 INTRODUCTION

The Remedial Design Quality Assurance Project Plan (Remedial Design QAPP) establishes the Quality Assurance (QA) protocols and procedures which will be applied to the Remedial Design (RD) activities for the Rose Chemicals Site (Site). Documentation of conformance with these standards during the RD is necessary to produce scientifically and legally defensible data to be used throughout the RD and Remedial Action (RA) activities. The scope of the RD activities which are subject to the Remedial Design QAPP includes concrete core sampling from the Main Building and the South Warehouse and any other RD study activities which may be required, in addition to the associated laboratory analytical work.

The scope of the Remedial Design QAPP is based on United States Environmental Protection Agency (USEPA) guidelines contained in Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans, USEPA, QAMS-005/80, February 1983. Field QA procedures are presented in the body of the document. Laboratory QA procedures are included in Appendix A, which contains the Comprehensive Quality Assurance Plan (CompQAP) for EMS Heritage Laboratories, Inc. (EMS), the selected laboratory for analytical testing.

* * * * *

2.0 PROJECT DESCRIPTION

The Site is located on approximately 13 acres in the northwest part of Holden, Missouri, approximately 50 miles southeast of Kansas City (see Figure 2-1). The Site was at one time used to store, process, and decontaminate electrical transformers, capacitors, and other items containing fluids contaminated with polychlorinated biphenyls (PCBs). As a result of these operations, PCBs were released into the environment.

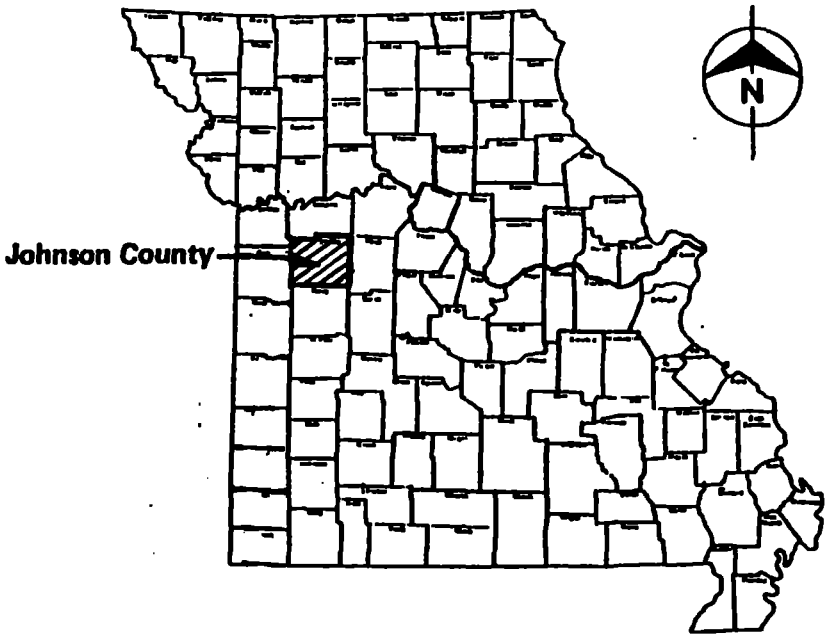
In 1987, USEPA Region VII issued an Administrative Order to remove PCB-contaminated materials from the Site. A group of potentially responsible parties (PRPs), led by the Rose Chemicals Steering Committee (RCSC), conducted the removal which was completed in 1988. In 1988, another Administrative Order was issued to conduct a remedial investigation/ feasibility study (RI/FS) at the Site. The RI/FS also was led by the RCSC and completed in September 1990.

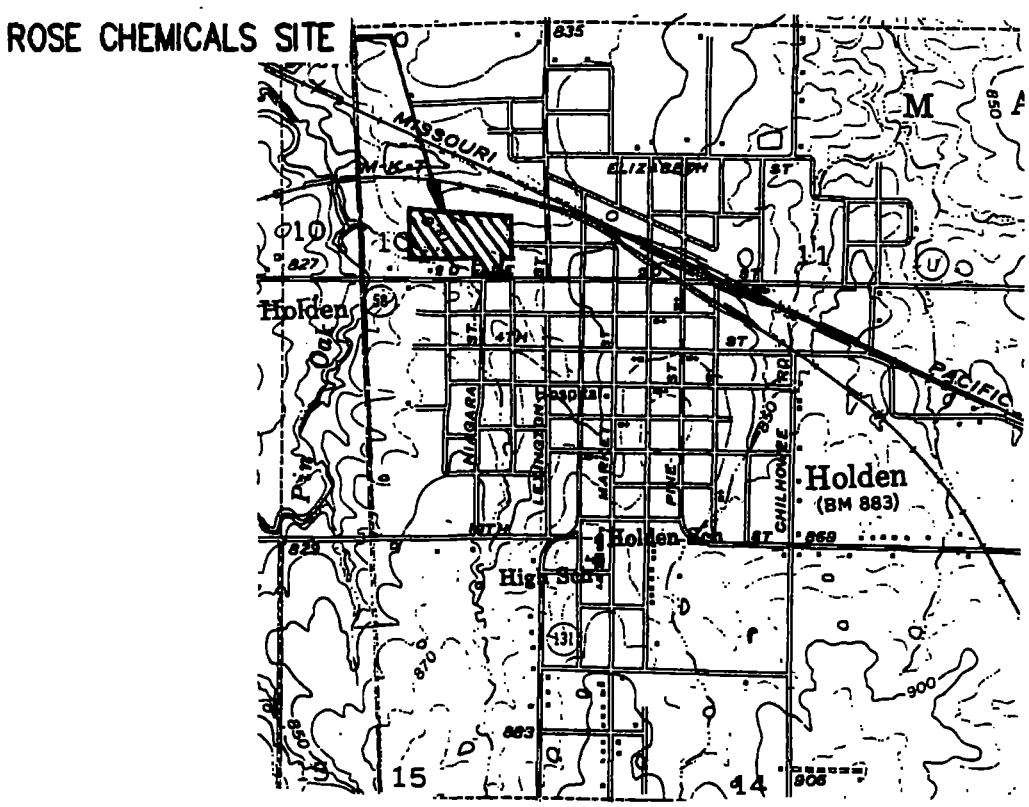
The RI identified PCB concentrations in on-site buildings, surface and subsurface soils, pond sediments, and the sediments and waters of East Pin Oak Creek and its unnamed tributary. The FS evaluated removal of the sediments greater than 0.18 mg/Kg PCBs, removal of soils greater than 10 mg/Kg PCBs, removal of the Site buildings and concrete slabs, and covering the remediated areas of the Site with clean soil.

The Record of Decision (ROD) for the Site was executed on March 6, 1992. The ROD specifies a RA which consists of:

- excavation and off-site disposal of PCB-contaminated stream sediment containing greater than 0.18 mg/Kg PCBs

- excavation and off-site disposal or treatment and disposal of soil containing greater than 10 mg/Kg PCBs





1000 0 1000 2000

SCALE IN FEET

Burns & McDonnell Waste Consultants, Inc.

Figure 2-1

SITE LOCATION

12-17-1992 13:24 TFG

ROESP001.DWG

- dismantling and disposal or treatment and disposal of all on-site buildings including underlying concrete slabs

- covering of all remediated areas with clean soil

- monitoring of groundwater for 10 years

- prohibition on the installation of groundwater wells for purposes other than monitoring.

On December 17, 1992, USEPA Region VII made effective an Administrative Order to prepare a RD and implement the design by performing a RA at the site. The RCSC is leading the RD/RA effort to conduct the required activities. The RD activities are described in the RD Work Plan, prepared by Clean Sites, Inc. (November, 1992). The RA activities will be described in the RA Work Plan, expected to be prepared in 1993.

* * * * *

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The RD work for the Site will be conducted by Clean Sites, Inc., Alexandria, Virginia, under the direction of the RCSC. Clean Sites has been involved in the Site activities for over 5 years, supporting the RCSC in a wide variety of settlement and technical matters involving the Site.

QA activities will be conducted by Burns & McDonnell Waste Consultants, Inc. (BMWCI) of Overland Park, Kansas, under the direction of the RCSC. BMWCI is a subsidiary company of Burns & McDonnell Engineering Company, Inc. (Kansas City, Missouri). Burns & McDonnell Engineering Company, Inc. conducted the RI/FS at the Site as a sub-contractor to Clean Sites.

The various organizations and their respective responsibilities for the QA work associated with the preparation of the RD are described in more detail below. Specific individuals are mentioned where appropriate. The relationships between the groups or individuals are described on Figure 3-1.

3.1 POTENTIALLY RESPONSIBLE PARTIES

The Site PRPs have been issued an Administrative Order, effective December 17, 1992, with USEPA Region VII, to conduct the RD/RA work at the Site. The RCSC Technical Subcommittee will oversee the activities of the RD/RA. Mr. Joseph Kwasnik, Chairman of the RCSC Technical Subcommittee, has also been appointed as the Project Coordinator. Mr. Harry Walton will be the Alternate Project Coordinator.

3.2 BURNS & MCDONNELL WASTE CONSULTANTS, INC.

BMWCI has been selected by the RCSC to conduct the QA activities required for the RD/RA. Mr. Steve Kidwell is the Project Manager and will report directly to the Project Coordinator on all QA matters. Mr. H. Tom Brown, will act as Project Director. Mr. Brown will be available for consultation on technical matters as well as personnel and resource issues.

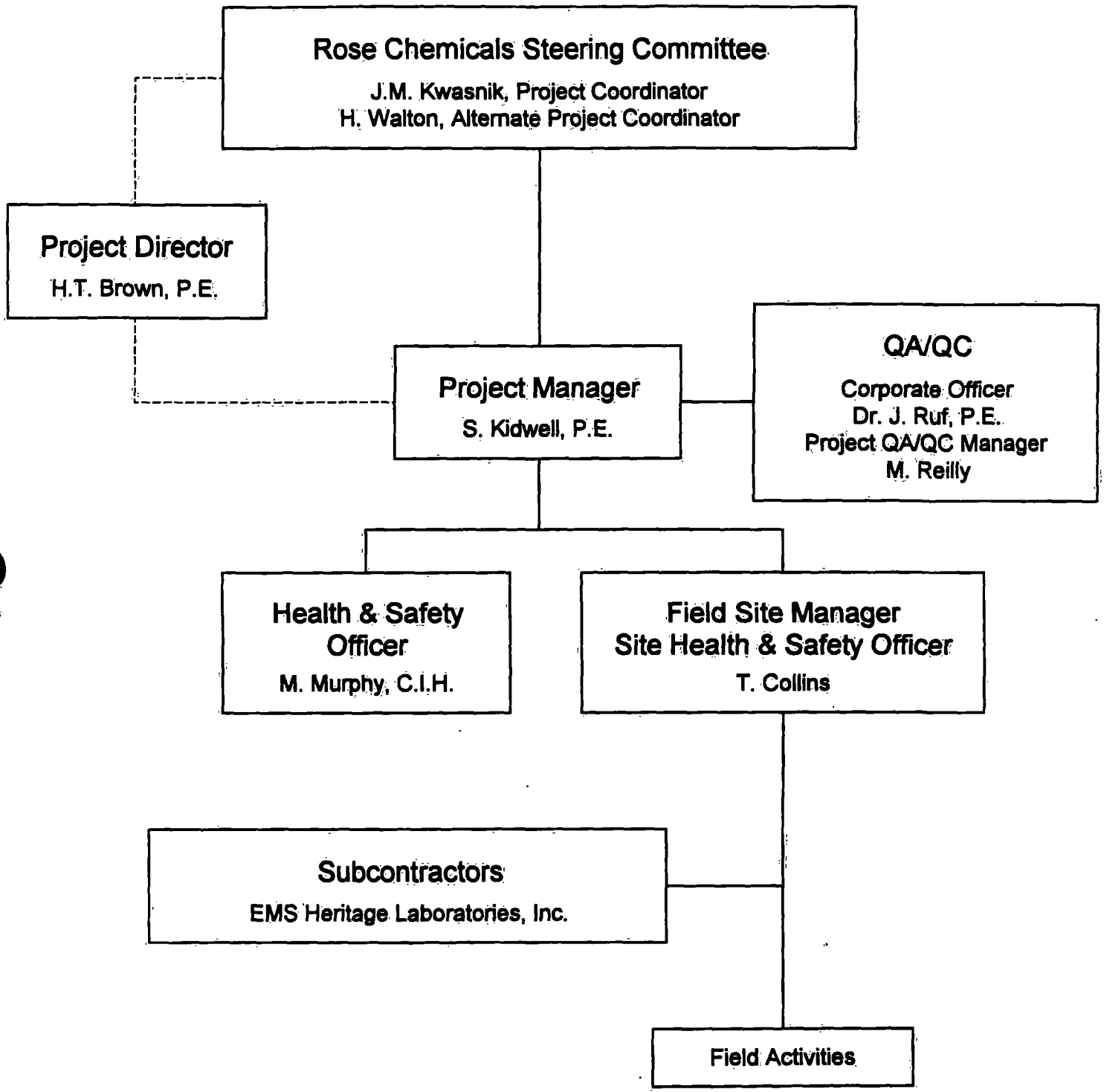


Figure 3-1
Project Organization Chart

Dr. John Ruf is the BMWCI Corporate Quality Assurance/Quality Control (QA/QC) Officer. He is responsible for the quality of all documents, reports, and designs prepared by BMWCI personnel. He is also responsible for forming, implementing, and enforcing QA/QC policies company wide.

Ms. Mary Reilly will serve as QA/QC Manager for the RD. Her responsibilities will cover QA/QC activities involving sampling, laboratory analyses, data validation, and audits of performance, systems, and laboratories. Ms. Reilly will report to the BMWCI Project Manager.

Ms. Mary Murphy is the BMWCI Health and Safety Officer. Her responsibilities include performing Occupational Safety and Health Administration (OSHA) required training on hazardous waste site operations, first aid and CPR training, and coordination of annual physicals. Ms. Murphy will be available for technical consultations regarding health and safety issues at the Site.

Mr. Tom Collins will serve as the Field Site Manager and Site Health and Safety Supervisor. He will have direct responsibility for site-specific RD activities as well as decisions concerning the immediate safety of on-site personnel. Mr. Collins will report directly to the BMWCI Project Manager.

3.3 EMS HERITAGE LABORATORIES, INC. - INDIANAPOLIS, IN

EMS of Indianapolis, Indiana, has been selected by the RCSC to perform project analytical testing. All analytical testing will be performed according to USEPA Contract Laboratory Program (CLP) QA/QC protocol. The laboratory will be responsible for all data analysis, validation, and reduction. The EMS organizational structure is described in their CompQAP. The CompQAP is reproduced as Appendix A to this QAPP.

3.4 EMS HERITAGE LABORATORIES, INC. - KANSAS CITY, MO

EMS of Kansas City, Missouri, has been selected by the RCSC to perform additional analytical testing, if required. The CompQAP described above also applies to the Kansas City facility.

* * * * *

4.0 QA OBJECTIVES

The overall objective of this QAPP is to establish quality criteria for RD study activities and documentation so that the additional data generated during the RD is scientifically and legally defensible and supports any RD or subsequent RA decisions or activities. The remainder of this section establishes specific criteria for measurement objectives, practical quantitation limits, and analytical QC parameters for the RD study activities.

4.1 MEASUREMENT OBJECTIVES

Measurement parameters vary depending on the specific sampling event, the type and concentration of the analyte, and the sampled material. All measurements will be made to yield consistent results that are representative of the sampled material and analyte measured. All data will be reported in units consistent with those of previous investigations. Refer to Table 5.1 of the EMS CompQAP (Appendix A) for specific Measurement Objectives regarding to PCB analysis.

4.2 PRACTICAL QUANTITATION LIMITS

The practical quantitation limits for the media sampled will be adequate to determine the appropriate method of disposal and whether remedial goals are achieved. The RD will require that Routine Analytical Service (RAS) analyses, as defined by the USEPA CLP procedures be employed. Refer to Table 5.1 of the EMS CompQAP (Appendix A) for a complete list of RAS detection limits.

4.3 QC PARAMETERS

To meet the QA objective stated above, the following QC parameters will be assessed: precision and accuracy, completeness, representativeness, and comparability. Each of these parameters are discussed in the sections which follow.

4.3.1 Precision and Accuracy

The precision and accuracy QC parameters provide a measure of reproducibility of the analytical results and the bias of a specific measurement method. EMS has established numerical goals for the parameters shown in Table 5.1 of their

CompQAP (Appendix A). Precision and accuracy parameters shall be within the historical limits identified in the USEPA Contract Laboratory Program Statement of Work for Organic Analysis (2/88), or within the EMS limits, whichever is more stringent.

4.3.2 Completeness

Field completeness will be assessed by comparing the number of samples collected to the number of samples planned. Laboratory completeness will be assessed by comparing the number of valid samples to the number of samples collected. The overall completeness is a comparison between the total number of valid samples to the number of samples planned. The field completeness goal for this project is 100 percent. That is, all the samples planned will be collected and shipped to the laboratory for analysis. EMS maintains a completeness goal of 99 percent.

4.3.3 Representativeness

Representativeness defines the degree to which sample data accurately and precisely represent actual site conditions. Representativeness will be determined by the BMWCI validation (see Section 9.2) which will include:

- Comparing actual sampling procedures to those presented in the Remedial Design Sampling and Analysis Plan (SAP)
- Comparing analytical results of field replicates to determine sampling reproducibility
- Examining the results of QC blanks for evidence of external or cross-contamination of samples

Only representative (validated) data will be used to characterize Site conditions. In addition, questionable or qualitative data will be identified. Further discussion of QC procedures related to representativeness are included in Section 10.0.

4.3.4 Comparability

Comparability is a qualitative parameter used to express the confidence with which one data set may be compared with another. Other data sets which may be used for comparison purposes are applicable hazard criteria and, where appropriate, data available from other studies conducted previously in the area. The analytical results obtained will be compared to those produced during the RI/FS. To produce comparable data, analytical methods consistent with previous investigations will be used. Consistent units will be used for reporting data.

* * * * *

5.0 SAMPLING PROCEDURES

For a detailed description of sampling techniques, containers, holding times, etc., refer to the associated project Remedial Design Sampling and Analysis Plan (SAP), which is in Section 3 of RD Work Plan.

* * * * *

6.0 SAMPLE CUSTODY AND DOCUMENTATION PROCEDURES

6.1 CUSTODY

The custody of the physical samples collected during the RD study will be the responsibility of the BMWCI Field Site Manager. Each sample will be in the possession of the field sampling crew after collection until it is shipped to the laboratory. Samples shall be shipped at the end of each day. The samples will be cooled on ice from collection throughout shipment and receipt at the laboratory.

During the field studies, samples will be received at the laboratory by the sample custodian who verifies the following:

- sample containers are not damaged,
- documentation is complete and adequate, and
- samples have been preserved properly and stored on ice during shipment.

The sample custodian's signature on the Chain-of-Custody Record will indicate that the criteria has been verified.

In the field, sample containers will be placed in coolers and securely packed to prevent damage. The EMS sample custody procedures are detailed in Section 7.0 of their CompQAP (Appendix A).

A sample will be in the custody of BMWCI if one of the following occurs:

- It is in the possession of BMWCI.
- It is in the view of a BMWCI employee after being in the possession of BMWCI.

- It was in BMWCI's possession and placed in a secure area by a BMWCI employee.

- It is in a BMWCI-designated secure area.

The chain-of-custody program will track the possession and handling of the samples from the time of field collection through laboratory analysis. The chain-of-custody program will consist of the items described in Sections 6.1.1 through 6.1.4.

6.1.1 Sample Labels and Sample Numbering System

Sample labels (Figure 6-1) will be affixed to the sample containers at the time of sampling. They will contain the following information:

- Sample identification number

- Signature of collector

- Date and time of collection

- Preservatives used, if any (including preservatives added by laboratory)

- Analysis to be conducted

- Type of sample (concrete core sample)

The sample labels will remain on the containers throughout the time that the samples are retained.

A sample numbering system will be used to identify each sample for chemical analysis and the management of data. The sample identification numbers allocated for this sampling effort will be used on all sample labels, field logs, Chain-of-Custody Records, and applicable documentation used during the RD study activities. A listing of sample identification numbers will be

ROUTE TO	Burns & McDonnell WCI 10881 Lowell, Suite 200 Overland Park, KS 66210 Phone: (816) 333-8787	ANALYSIS:

Sample Group: _____

Sample Point: _____

Sample Designator: _____

Sample Round: _____ Year: _____

Sample Depth From: _____ To: _____

Date Sampled: _____

Time Sampled: _____

Preservation: _____

Burns & McDonnell Waste Consultants, Inc.

Figure 6-1

SAMPLE LABEL

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maintained in the field logbook. The sample numbering system consists of a code denoting the type of sample and a number identifying the specific sample; the numbers will be assigned consecutively. The following system is used:

Type of Sample	Form of Number	Example
Concrete	CC-No.	CC-1

6.1.2 Sample Seal

When the samples leave the custody of the sample collector, sample seals (Figure 6-2) are used to eliminate sample tampering during transportation. The seal will include the sampler's signature, time, and date. The laboratory will note if the sample seal has been broken before arrival and record the observations.

The following protocol will be followed for sample sealing and packing:

- Seal all sample containers with electrical (or other as appropriate) tape.
- Seal each sample container with a sample seal.
- Use a cooler (e.g., Coleman type) for shipping. Seal the drain plug with tape both inside and out, and line the cooler with a plastic bag. Place approximately 1 inch of packing material (e.g., styrofoam beads) in the bottom of the liner.
- Place the bottles in the lined cooler so that they do not touch. Cardboard separators may be used.
- Pack ice around the samples.
- Fill the cooler with packing material. Complete the Chain-of-Custody, place it in a plastic bag, and attach it to the inside of the cooler lid.

Burns & McDonnell

Date: _____ Time: _____

Signature: _____

Burns & McDonnell Waste Consultants, Inc.

Figure 6-2

SAMPLE SEAL

ROESF002.D 12-17-1992 14:24 PCS

- Close and seal the cooler with strapping and/or evidence tape and a sample seal. Deliver the cooler to the shipper with a completed shipping bill.

6.1.3 Field Logbook

Bound, site-specific field logbooks with prenumbered pages will be maintained to document the following daily field activities or information where applicable:

- Identification of sample
- Type of sample
- Location of sample
- Depth of sample
- Sample withdrawal procedure/equipment
- Date and time of collection
- Types of sample containers and sample identification numbers
- Parameters requested for analysis
- Calibration record of field test equipment
- Field test equipment (Photovac) screening data
- Sample shipment method
- Field observations on sampling event
- Name of collector(s)

- Weather conditions
- Sample description (color, odor, etc.)
- Date of shipment and carrier with shipping information for tracing
- Signatures of data recorder(s) and performance audit team leader

The logbooks will be the responsibility of the BMWCI Field Site Manager during the Site activities. A QA/QC review of the field logbook will be performed during each performance audit.

6.1.4 BMWCI Chain-of-Custody Record

The BMWCI Chain-of-Custody Record (Figure 6-3) will trace sample possession from the time of collection and serve as physical evidence of sample custody. It will include the following information written in black, permanent, waterproof ink:

- Sample numbers
- Signature of collector
- Date and time of collection
- Sample type
- Identification of sampling point
- Number of containers
- Analyses requested
- Signature of person(s) involved in the chain of possession
- Inclusive dates and times of possession

Request for Chemical Analysis and Chain of Custody Record

Burns & McDonnell
Waste Consultants, Inc.
10881 Lowell Avenue, Suite 200
Overland Park, Kansas 66210
Tel: (816) 333-8787
Fax: (816) 822-3463

Attention:

Laboratory

Address

City/State/Zip

Telephone

Document Control No.:

Lab. Reference No. or Episode No.:

Project Number:

Project Name:

Site, Group, or SWMU Name:

Sample Number		Sample Event		Sample Depth (in feet)		Samples Collected		Sample Type					Number of Containers	Analysis							Remarks
								Matrix													
Sample Point	Sample Designator	Round	Year	From	To	Date	Time	Liquid	Solid	Gas	Composite	Grab									

Sampler (signature):

Sampler (signature):

Special Instructions:

Relinquished By:	Date/Time	Received By:	Date/Time	Condition of Shipping Container:	Ice Present in Container:
1. (signature)		(signature)		Good ☐ Fair ☐ Poor ☐	Yes ☐ No ☐
Relinquished By:	Date/Time	Received By:	Date/Time	Comments:	
2. (signature)		(signature)			

Burns & McDonnell Waste Consultants, Inc. 110892 form WCI-OP1

Burns & McDonnell Waste Consultants, Inc.

Figure 6-3

CHAIN OF CUSTODY RECORD

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Each Chain-of-Custody Record will be filled out and signed in black, permanent, waterproof ink by a BMWCI field team member prior to sealing the container. A carbon copy of the Chain-of-Custody Record will be retained and the original placed inside the sample cooler prior to shipment to the analytical laboratory.

6.2 DOCUMENTATION

Each sample must be properly documented to allow timely, correct, and complete analyses. These factors are critical to support decisions concerning the Site. The documentation system provides the means to identify, track, and monitor each sample from the point of collection through final data reporting.

6.2.1 Documentation Procedures

A suitable work area will be established for processing forms. After all sample documentation has been completed, a project team member will check the data on all forms, comparing them to the logbook entries.

6.2.2 Corrections to Documentation

All original data will be recorded with black, permanent, waterproof ink. No accountable serialized documents are to be destroyed or thrown away, even if they are illegible or contain inaccuracies requiring a replacement document. If an error is made on an accountable document assigned to one individual, that individual shall make corrections by making a line through the error and entering the correct information. The erroneous information should not be obliterated. Any subsequent error discovered on an accountable document should be corrected by the person who made the entry. All subsequent corrections must be initialed and dated.

6.2.3 Document Control

It is essential that all documents for samples are accounted for when the project is completed. The QA Officer will schedule audits of project files, a process in which each document submitted is checked for accountability. Written explanations must be present concerning documents for which an account cannot be made.

6.2.4 Project File

Upon completion of the project, the individual files will be assembled, organized, and securely stored as the final file for the project. This will be completed by the project team.

* * * * *

7.0 CALIBRATION PROCEDURES

BMWCI manages a routine calibration and preventive maintenance program for all field instruments. This program is administered by the BMWCI Equipment Manager and the field team members. The Equipment Manager performs any monthly and annual calibration required. Trained staff members will perform field calibrations, checks, and instrument maintenance prior to use. Each piece of equipment has a unique serial number for tracking during field use and calibration and maintenance records. All field calibrations will be documented in the field logbook. Table 7-1 presents the maintenance schedules for instruments to be used specifically on this project. Calibration instructions for the safety equipment (Photovac T.I.P. II and combustible gas/oxygen monitor) are included in the Remedial Design Site Health and Safety Plan.

Team members are familiar with the field calibration and operation of the equipment. They will maintain proficiency and perform the prescribed field operating procedures outlined in the equipment manuals accompanying the respective instruments. Records of all field instrument calibrations and field checks will be kept in logbooks. If on-site monitoring equipment should fail, the Field Site Manager and Site Health and Safety Supervisor or the Equipment Manager will be contacted immediately. They will either provide replacement equipment or have the malfunction repaired immediately.

Calibration procedures used by EMS on their analytical equipment will be in accordance with CLP guidelines and are detailed in Section 9.0 of the CompQAP (Appendix A).

* * * * *

Table 7-1
Calibration and Field Check Frequency Schedules

Field Instrumentation	Regular Calibration and Maintenance	Field Calibration Daily
PhotoVac T.I.P. II/HNu	Annual	Yes
Combustible Gas/Oxygen Monitor	Monthly	Yes

8.0 ANALYTICAL PROCEDURES

Laboratory analysis of concrete core samples will be performed by EMS Heritage Laboratories, Inc. of Indianapolis, Indiana. The specific analytical method to be used for sample analysis is shown in Table 8-1. EMS analytical methods will conform with the USEPA CLP QA/QC procedures for all analyses.

Section 8.0 of the EMS CompQAP details the sample preparation technique, analytical procedures, and instrument operating procedures available at EMS.

* * * * *

Table 8-1
Parameters for Sample Analyses

Parameter	Sample Matrix	Analytical Method	Reference[1]
PCBs Aroclor 1232 Aroclor 1242 Aroclor 1248 Aroclor 1254 Aroclor 1260	Solids	3540/8080	SW-846

Note:

[1]Analytical methods are from the following sources:

SW-846 - U.S. EPA, 1986. Test Methods for Evaluating Solid Waste, SW-846, Third Edition.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

9.1 DATA REDUCTION

Laboratory analytical reports, sample labels, and/or field logbooks will include the sample identification information listed in Section 6.1.

All field data will be entered into bound notebooks or files. Field logbooks, Chain-of-Custody Records, field data sheets, and lab reports will be filed and stored as part of the final evidence file at the BMWCI office in Overland Park, Kansas.

Refer to Section 12.0 of the EMS CompQAP (Appendix A) for specific discussions of data reduction procedures and calculations.

9.2 DATA VALIDATION

EMS performs data validation of analytical data within their organization. See Section 12.0 of the EMS CompQAP and for their validation criteria and procedures. These activities are performed prior to reporting the analytical data.

The analytical data will also be validated by BMWCI after it has been reported. For every sample, BMWCI personnel will review, where appropriate:

- Chain-of-custody
- Analyses requests
- Holding times
- Laboratory method blank results
- Equipment rinsate blank results
- Surrogate recoveries

- Matrix spike/matrix spike duplicate results
- Collocated sample results
- Quantitation limits
- Tentatively identified compounds
- Equipment calibrations

Other criteria not listed above are analysis specific. BMWCI uses the USEPA guidelines, Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses, February 1988, for data validation activities.

9.3 REPORTING

EMS will provide a summary of analytical and associated QA/QC results. They will maintain the raw analyses and calculation data on their premises for 5 years unless notified otherwise.

Data collected during the RD study and the laboratory analyses will be included in a report prepared by BMWCI.

* * * * *

10.0 INTERNAL QUALITY CONTROL

To monitor sampling and laboratory performance and potential transport anomalies, QC samples, (equipment rinsate blanks and collocated samples) will be submitted with the samples collected in the field. The combined laboratory and field QC procedures will provide an adequate data base for evaluation of analytical data.

In lieu of providing the USEPA with splits of all non-QC samples, splits of between 5 to 10 percent of the planned non-QC samples will be taken and submitted to the USEPA Region VII laboratory in Kansas City, Kansas. The results of analyses of these split samples will be provided to BMWCI and will serve as a further QC check.

Unless noted otherwise, the QA/QC samples will be collected and analyzed for the same constituents as all the other samples of the particular matrix. Specific internal QC check information for EMS can be found in Section 11.0 of their CompQAP (Appendix A).

10.1 EQUIPMENT RINSATE BLANKS

Equipment rinsate blanks are prepared by collecting a volume of distilled water rinsate following sampling equipment decontamination. Analysis of these blanks serves as a check for cross-contamination from nondedicated sampling equipment. One equipment rinsate blank will be obtained for each 20 samples collected or one per sample lot, whichever is greater.

10.2 COLLOCATED SAMPLES AND REPLICATES

Collocated concrete samples will be collected. Collocated samples are collected from locations immediately adjacent to one another. Locations where collocated samples are to be obtained are defined in the RD Work Plan. The collocated sample analytical results give an indication of analytical consistency and spatial variation of analytes within the concrete. One set of collocated samples will be collected for every 20 samples collected or per sample lot, whichever is greater. The number of collocated samples to be prepared are detailed in the Remedial Design SAP.

Replicate concrete core samples are to be prepared and analyzed by EMS. Replicate samples are prepared by splitting one sample into two homogenous portions, producing two replicates. One set of replicates will be prepared for every 10 samples collected or per sample lot, whichever is greater. These results provide an indication of analytical reproduceability within the laboratory.

* * * * *

11.0 PERFORMANCE AND SYSTEMS AUDITS

Performance audits are performed by BMWCI employees with no other project responsibilities. One performance audit will be conducted during the RD study. The audit will be performed to document that proper and consistent procedures are being followed and therefore subsequent data will be valid. Additional unscheduled audits may be performed.

The audits will focus on the details of the QA program and will evaluate:

- Field Team
- Field logbook documentation
- Field Site Manager

The performance audit checklists for field procedures are shown in Appendix B; these documents serve as a guide for the audit.

EMS conducts periodic performance and system audits as outlined in Section 14.0 of their CompQAP (Appendix A).

* * * * *

12.0 PREVENTIVE MAINTENANCE

Preventive maintenance of equipment is essential if project resources are to be used in a cost-effective manner. Spare parts and a back-up system will be available, to the extent anticipated. BMWCI is responsible for contracting and documenting all preventive maintenance on BMWCI field equipment. See Table 7-1 for maintenance frequencies of applicable equipment.

Preventive maintenance procedures and frequencies for EMS laboratory and analytical equipment is detailed in Section 10.0 of the EMS CompQAP (Appendix A).

* * * * *

13.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA

For a detailed description of specific routine procedures used to assess data precision, accuracy, and completeness, refer to Section 11.0 of the EMS CompQAP (Appendix A). Quality assessment of field data will be based upon duplicate measurments, manufacturer's specifications, or historical data.

* * * * *

14.0 CORRECTIVE ACTION

Corrective actions for laboratory analyses will be handled either internally by EMS or by consultation between the Laboratory QA/QC Officer and BMWCI. EMS internal corrective action procedures are detailed in Section 13.0 of their CompQAP (Appendix A). Based on the review of the laboratory results and QA data submitted, BMWCI will identify results that do not meet the QA objectives. BMWCI will then make immediate decisions with the Laboratory QA/QC Officer on corrective actions to be taken, including new protocols to be followed. BMWCI and the laboratory QA/QC officer will develop the revised protocols in checklist format. A copy of all revised protocol checklists will be stored in the project files and reported in the final report.

Corrective action on a day-to-day basis for field sampling will be handled between the team members and the Field Site Manager. The Field Site Manager will make immediate decisions with the team members on new protocols to be followed. If appropriate, the Field Site Manager will develop the revised protocol in checklist format. A copy of all revised protocol checklists will be stored in the project files. In addition, all changes in field sampling procedures will be documented in the field logbooks and reported in the final report.

* * * * *

15.0 QA REPORTS

A QA/QC report will be issued by BMWCI as part of the field sampling report. The QA/QC report will include the results of the performance and document audits and any necessary corrective action procedures. In addition, a data quality assessment will be incorporated into the field report.

Upon completion, the QA report will be reviewed by the QA/QC Officer. In addition, the QA Report will undergo a final review by the RCSC.

* * * * *

APPENDIX A
EMS Heritage Comprehensive Quality Assurance Plan

COMPREHENSIVE QUALITY ASSURANCE PLAN

HERITAGE

EMS HERITAGE LABORATORIES, INC.

SECTION 1.0

EMS HERITAGE LABORATORIES, INC.

7901 West Morris Street
Indianapolis, IN 46231
Phone: 317/243-0811
FAX: 317/243-0360

November 1, 1991

To Whom It May Concern:

In order to more adequately serve the needs of our clients, EMS Heritage Laboratories, Inc. has adopted a Comprehensive Quality Assurance Plan (CompQAP) according to the guidelines established in EPA document number QAMS-005/80 and Florida DER-QA-001/90. This CompQAP will be implemented and all EMS Heritage divisions will be in substantial compliance by December 31, 1992.

This CompQAP covers such laboratory functions as data acquisition, review and reporting, and establishes QA objectives and mechanisms by which these objectives are measured, documented and reported. In addition, such functions as training and safety are covered.

It is our intention that all who use our services be provided with the opportunity to understand the procedures used in acquiring, reviewing and reporting laboratory results.

It is our requirement that all laboratory personnel read, review and understand the procedures and requirements established by this document.

Sincerely,

EMS HERITAGE LABORATORIES, INC.

C. Steven Gohmann
President

CSG/ps

7901 West Morris Street
Indianapolis, IN 46231
Phone: 317/243-0811
FAX: 317/243-0360

Comprehensive Quality Assurance Plan

EMS Heritage Laboratories, Inc.
Two Environmental Plaza
7901 West Morris Street
Indianapolis, Indiana 46231

Issued to: Ellen Fitzpatrick / Class Site

Date: November 12, 1992

Copy Number: # 159

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SECTION 3.0

3.0 Statement of Policy

It is our policy that all who use our services be provided with the opportunity to understand the procedures used in acquiring, reviewing and reporting laboratory results.

It is our requirement that all laboratory personnel read, review, have free access to and understand the procedures and requirements established by this document as they relate to their job function. It is to be used as a basic reference in the laboratory. Each staff member is obligated to comply with the stated requirements of this Comprehensive Quality Assurance Plan (Comp QAP).

The United States Environmental Protection Agency (EPA) requires that laboratories generating data implement minimum procedures which assure that the precision, accuracy, completeness and representativeness of its data are known and documented. In addition, the laboratory must specify the minimum quality levels which data must meet in order to be acceptable for a specific regulatory program.

To insure that EMS Heritage Laboratories (EMS) meets these responsibilities, the following Comprehensive Quality Assurance Plan has been adopted by the company.

The EPA has established specific requirements for the development of Quality Assurance Project Plans. All Quality Assurance Project Plans must address sixteen specific areas which are outlined in QAMS-005/80 "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans". This Comprehensive Quality Assurance Plan covers those 16 points and also applies to environmental monitoring and measurement efforts which are outlined in Rule 17-160 Part III, F.A.C. of the State of Florida. This Comp QAP is generic in nature and summarizes the criteria/procedures used under standard operating conditions. Different Data Quality Objectives (DQO's) may require a specific project plan utilizing the basic procedures set forth in this comprehensive plan. This Comp QAP covers all samples submitted to the laboratory <u>except</u> those samples requiring different DQO's as specified by the client. All exceptions to this Comp QAP must be approved in writing by the Laboratory Director, QA Unit, Chief Chemist or the QA Officer. The certificate of analysis will contain a statement to reflect this deviation from the Comp QAP.

EMS Heritage Laboratories, Inc. is a nationally integrated network of commercial testing laboratories specializing in the analysis of groundwater, surface and wastewater as well as solid and hazardous wastes. EMS Heritage operates laboratories in Indianapolis, Indiana; Charlotte, North Carolina; Kansas City, Missouri; and Chicago, Illinois. Each of these laboratory divisions operates under the same Standard Operating Procedures Manuals (SOPs). All laboratory divisions are in direct communication with each other through a single Laboratory Information Management System (LIMS) which incorporates data from

all divisions and generates the Quality Assurance Targets for all laboratories. All data from each laboratory is accessible through the LIMS to all other divisions.

EMS utilizes a system of project managers in charge of specific projects. Each project manager is responsible for receiving and approving completeness of final data reports relating to their assigned project even if the data is generated by another laboratory division. The Quality Assurance Unit at each division is responsible for reviewing and signing all final certificates of analysis. Employees from other branches are under supervision of the project manager in charge of the project, even if that manager is located in another division office. This system of dedicated project managers and quality assurance staff insures that the client's specific DQO's are met.

As outlined in the EMS Heritage Statement of Operations and Quality Assurance Policy, procedures must be uniquely defined in operation specific SOPs. These SOPs are subject to change without notice, but will not be less stringent than the requirements of this QAP. Where appropriate, these SOPs have been summarized in this document.

This Comp QAP will be reviewed and revised as necessary and at least annually. Major revisions will be forwarded to appropriate copy holders.

SECTION 4.0

4.0 Organization and Responsibility

4.1 Introduction

EMS Heritage Laboratories is primarily an environmental analytical chemistry laboratory. Bacteriological testing is not specifically covered under this comp QAP. Field operations consist primarily of sample pick-up services. EMS Heritage does perform composite and grab wastewater sampling for those clients desiring this service. Other types of sampling may be offered depending on the equipment required and the hazards involved.

4.2 President's Duties

EMS Heritage Laboratories, Inc. currently operates laboratories in four locations. The President of EMS Heritage Laboratories, Inc. serves as the Chief Operating Officer (COO). Furthermore, the President shall:

4.2.1 Designate a Laboratory Director at each laboratory.
4.2.2 Replace Laboratory Directors promptly should such replacement become necessary.
4.2.3 Assure that there is a Corporate Quality Assurance Officer.
4.2.4 Assure that the Vice-President of Operations, Quality Assurance Officer and Corporate Sales Personnel clearly understand their functions and responsibilities.
4.2.5 Establish and revise company policy.

4.3 Vice-President of Operations' Duties

The Vice-President of Operations (VPO) is the only additional operating officer of the company. The VPO shall nominate Laboratory Directors to the President who will promptly act to confirm or reject their nomination. The VPO is charged with the overall coordination of all the laboratory locations so that they perform as one cohesive and integrated network of laboratories. Furthermore, the VPO shall:

4.3.1 Assure that personnel, resources, facilities, equipment, materials, and methodologies are known and available as scheduled.
4.3.2 Assure that any deviations from policy reported by the Quality Assurance Officer are communicated to the President and to the Laboratory Directors and that corrective actions are taken and documented.

4.4 Quality Assurance Officer Duties

The Corporate Quality Assurance Officer is responsible for assuring that all QA policies and procedures are followed and that the Data Quality Objectives of this QA Plan are met. Management will provide the QAO with the support and tools necessary to achieve this goal.

Several principles underlie the Quality Assurance Policy. These principles are:

- Defensible Data
- Documented Analytical Methods
- Sample Control
- Equipment Calibration
- Training and Training Documentation
- Internal and External Assessments
- QA/QC Policy

4.4.1 Defensible Data

Data shall be generated, recorded and archived in such a way that it will withstand challenge. All reported information shall be accurate and properly documented. By correct use of traceable calibration standards, verification standards, blanks, method blanks, duplicates, spikes and spike duplicates, the Company shall obtain and record data necessary to demonstrate that analytical systems remain in control for all sample data reported.

4.4.1.1 Computerized data records must follow strict guidelines for security and defensibility. These guidelines are established in the QAP.

4.4.1.2 Defensible data includes the use of analytical methods which are appropriate and adequate. Analytical methods used will be strictly adhered to and any deviations will be documented and reported; these deviations are subject to approval of the QAO and the Chief Chemist.

4.4.1.3 Defensible data includes adherence to pre-analytical holding time requirements. Wisconsin Administrative Code NR149.11(s) specifically requires flagging of any holding time violation. The State of Wisconsin further considers "recommended" holding times as required holding times.

EMS Heritage will adhere to the requirement for the flagging of any holding time violation for those states or organizations requiring such flagging.

4.4.1.4 Defensible data includes the laboratory analysts demonstration of their ability to generate data of acceptable precision and accuracy, in addition to the laboratory demonstration of detection limits. IDLs and MDLs must be approved, performed at the required frequency and kept on file by the QA Unit. See Section 11.0, Figure 11.3, IDL/MDL Reporting Form.

4.5 Organization Charts/Job Descriptions (Appendix E)

Job Descriptions of all key personnel within EMS Heritage Laboratories, Inc. are contained in Appendix E. Company Organization Charts are provided in the figures listed below.

Corporate Organization	Figure 4.1
Indianapolis Division	Figure 4.2
Charlotte Division	Figure 4.3
Chicago Division	Figure 4.4
Kansas City Division	Figure 4.5
Heritage Environmental Services, Inc.	Figure 4.6

4.6 Deputies to Cover Absences

In the event of the absence of a key person, the authority for that position will generally rest with the next in line, most senior staffer as per the EMS Heritage Organizational Charts.

Specific lines of authority exist for the following positions:

4.6.1 In the absence of the Chief Chemist the Senior Chemists will be in charge until the return of the Chief Chemist, unless otherwise delegated by the Vice-President of Operations.

4.6.2 In the absence of the Quality Assurance Officer, the senior staffer from the Indianapolis QA Unit will be in charge until the return of the QA Officer. In the absence of all QA Unit staff from the Indianapolis Division, the QA Unit from another EMS Heritage Division as appointed by the President of EMS Heritage will be in charge until the return of the QA Officer or the QA Unit staff of the Indianapolis Division.

4.6.3 In the absence of all QA Unit staff from any EMS Heritage Division, the QA Unit from another EMS Heritage Division as appointed by the QA Officer or the President of EMS Heritage will be in charge until the return of the absent QA Unit staff.

FIGURE 4.1
EMS HERITAGE LABORATORIES, INC.
CORPORATE ORGANIZATION CHART

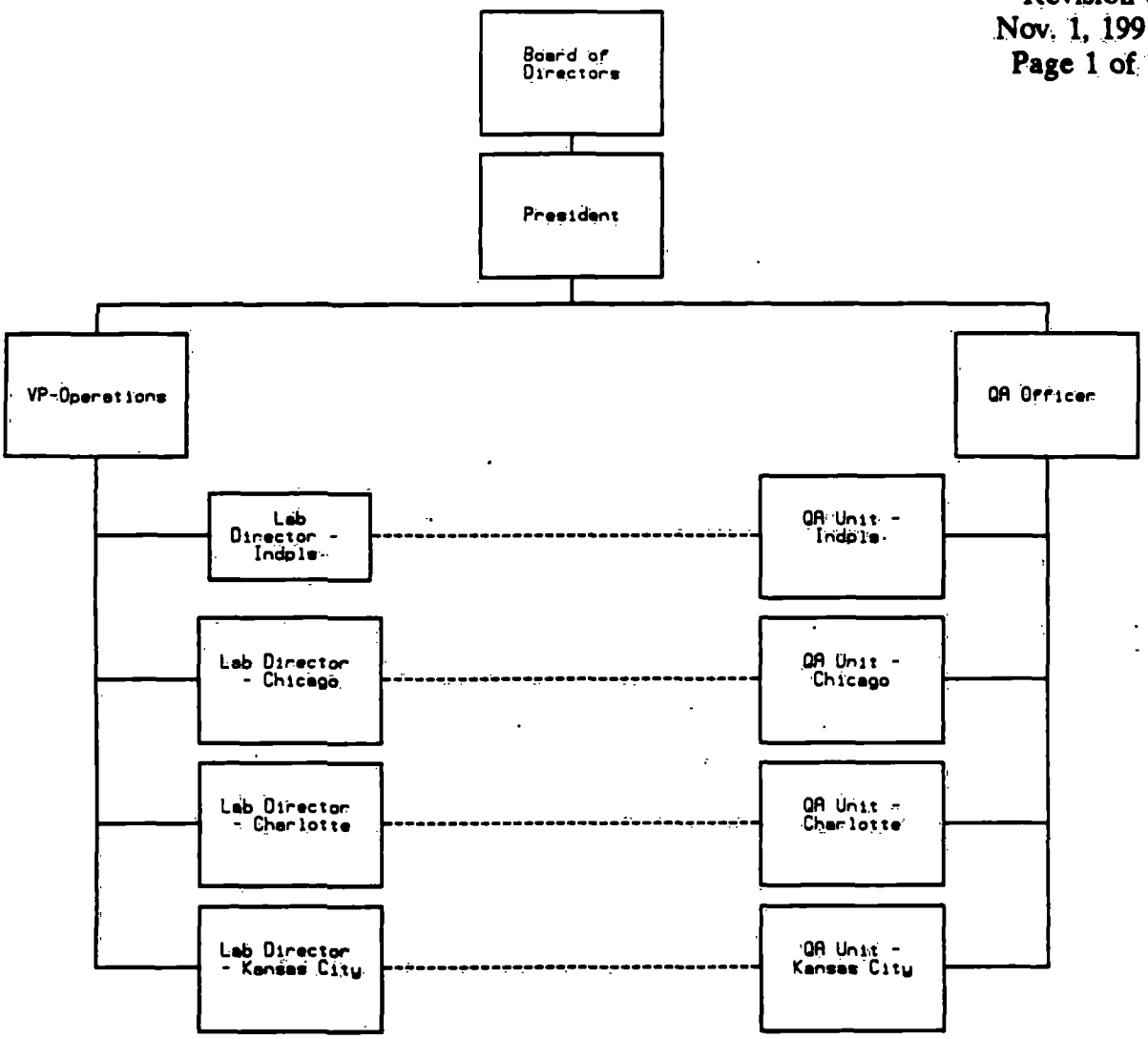
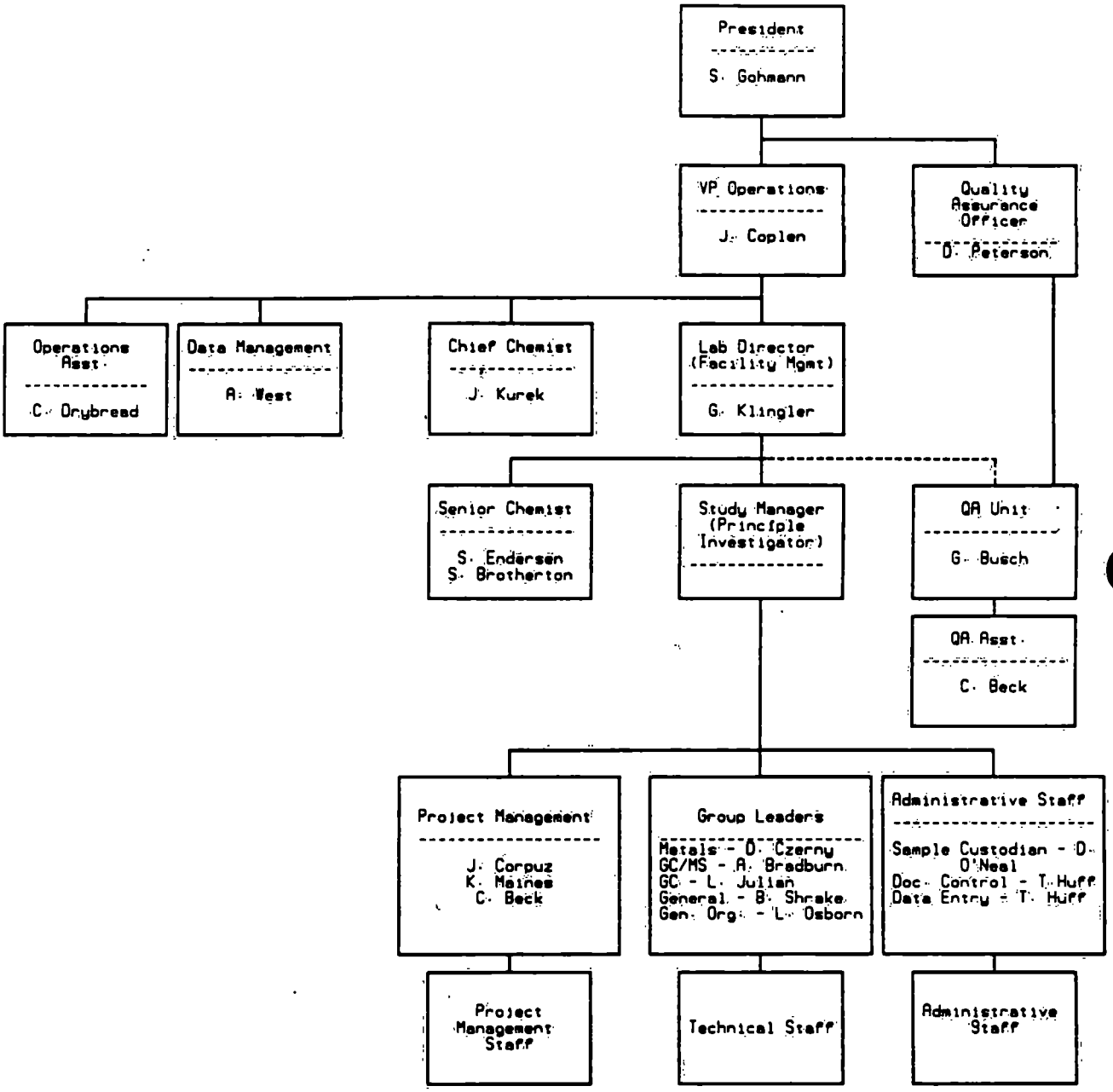


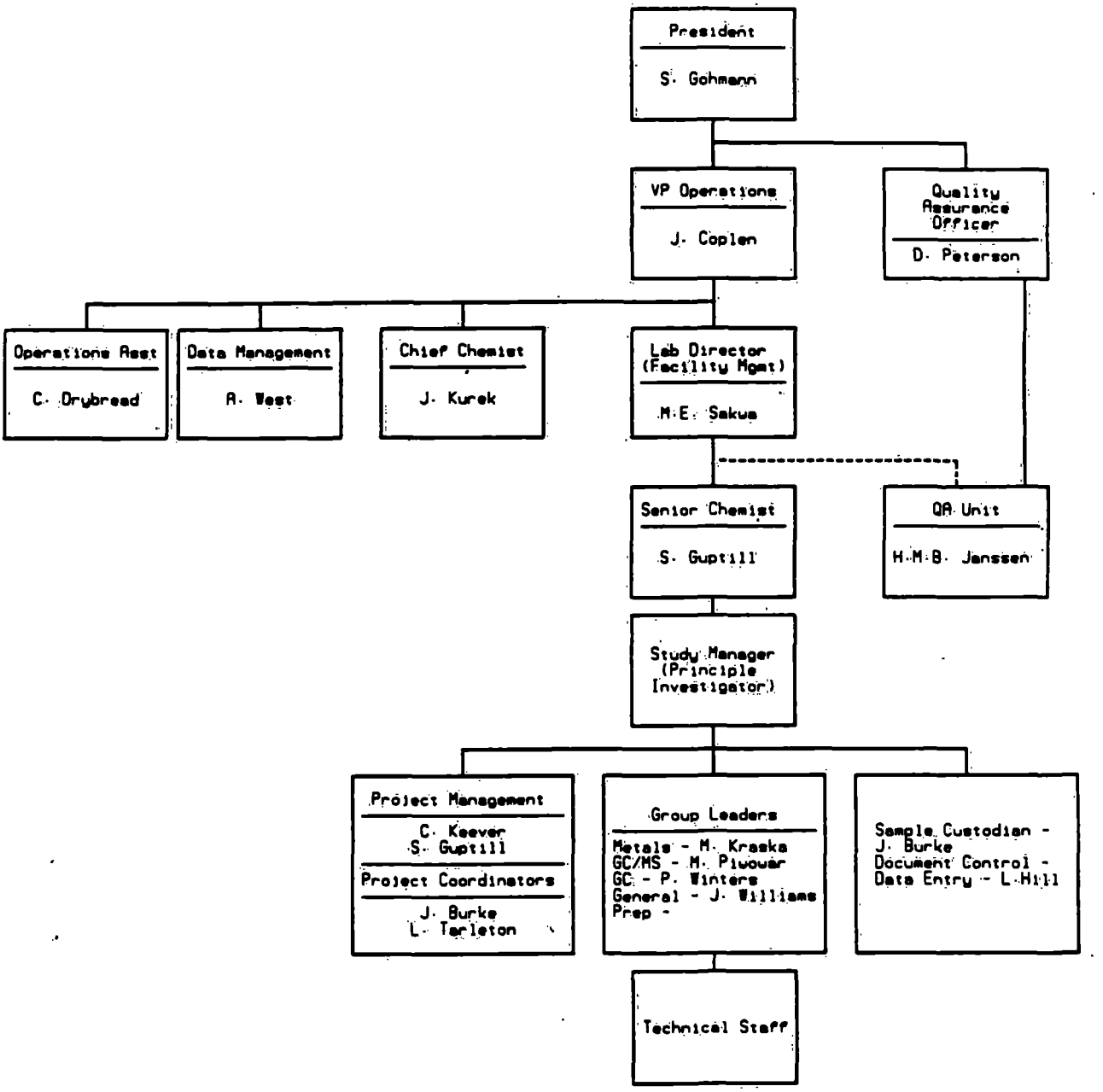
Figure 4.1 - Management and Quality Assurance Structure

FIGURE 4.2
ORGANIZATIONAL CHART
EMS HERITAGE LABORATORIES, INC.
INDIANAPOLIS, INDIANA



NOTE: For non-GLP work, delete study manager position.

FIGURE 4.3
ORGANIZATIONAL CHART
EMS HERITAGE LABORATORIES, INC.
CHARLOTTE, NORTH CAROLINA



NOTE: For non-GLP work, delete study manager position.

FIGURE 4.4
ORGANIZATIONAL CHART
EMS HERITAGE LABORATORIES, INC.
CHICAGO (ROMEOVILLE), ILLINOIS

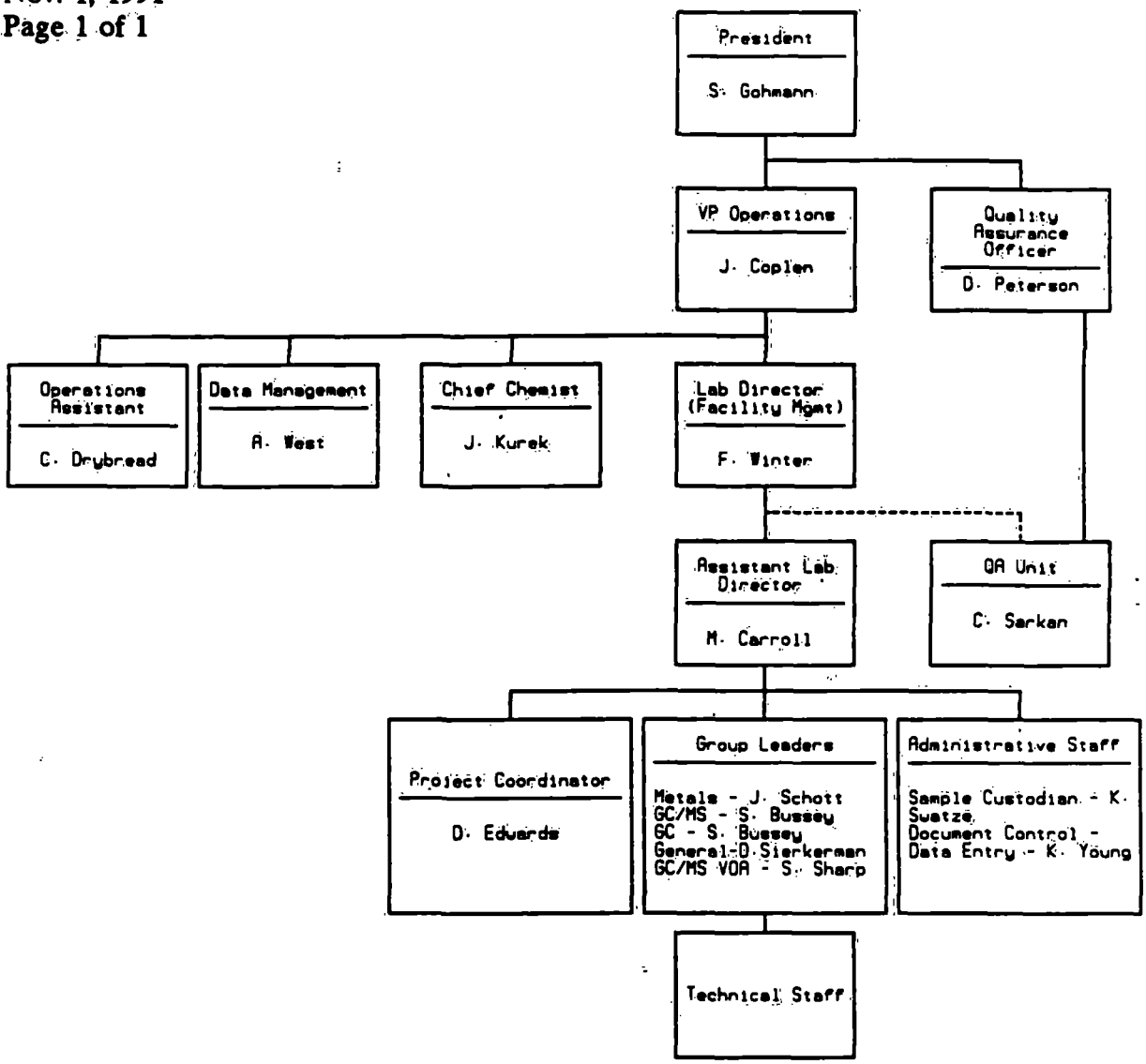


FIGURE 4.5
ORGANIZATIONAL CHART
EMS HERITAGE LABORATORIES, INC.
KANSAS CITY, MISSOURI

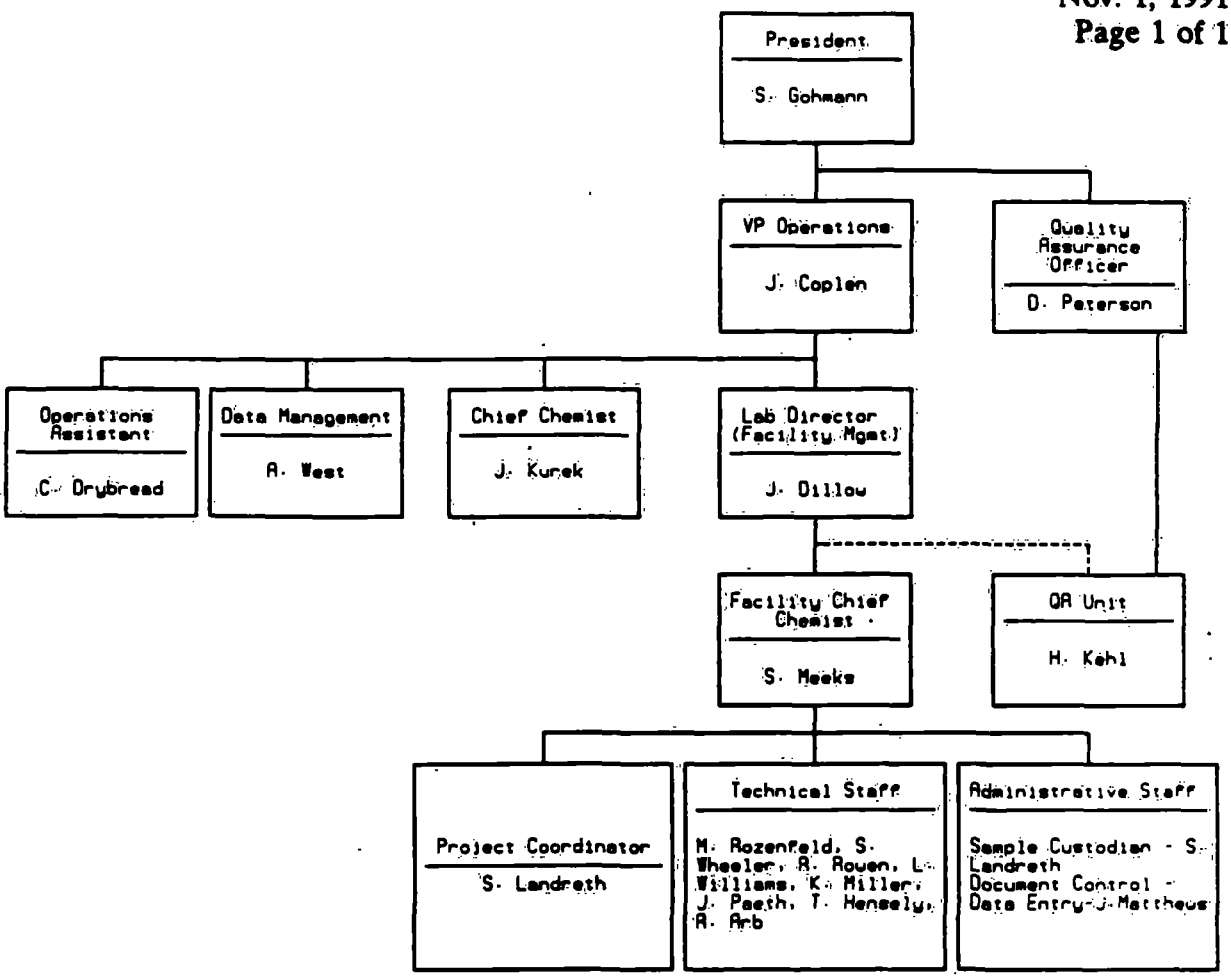
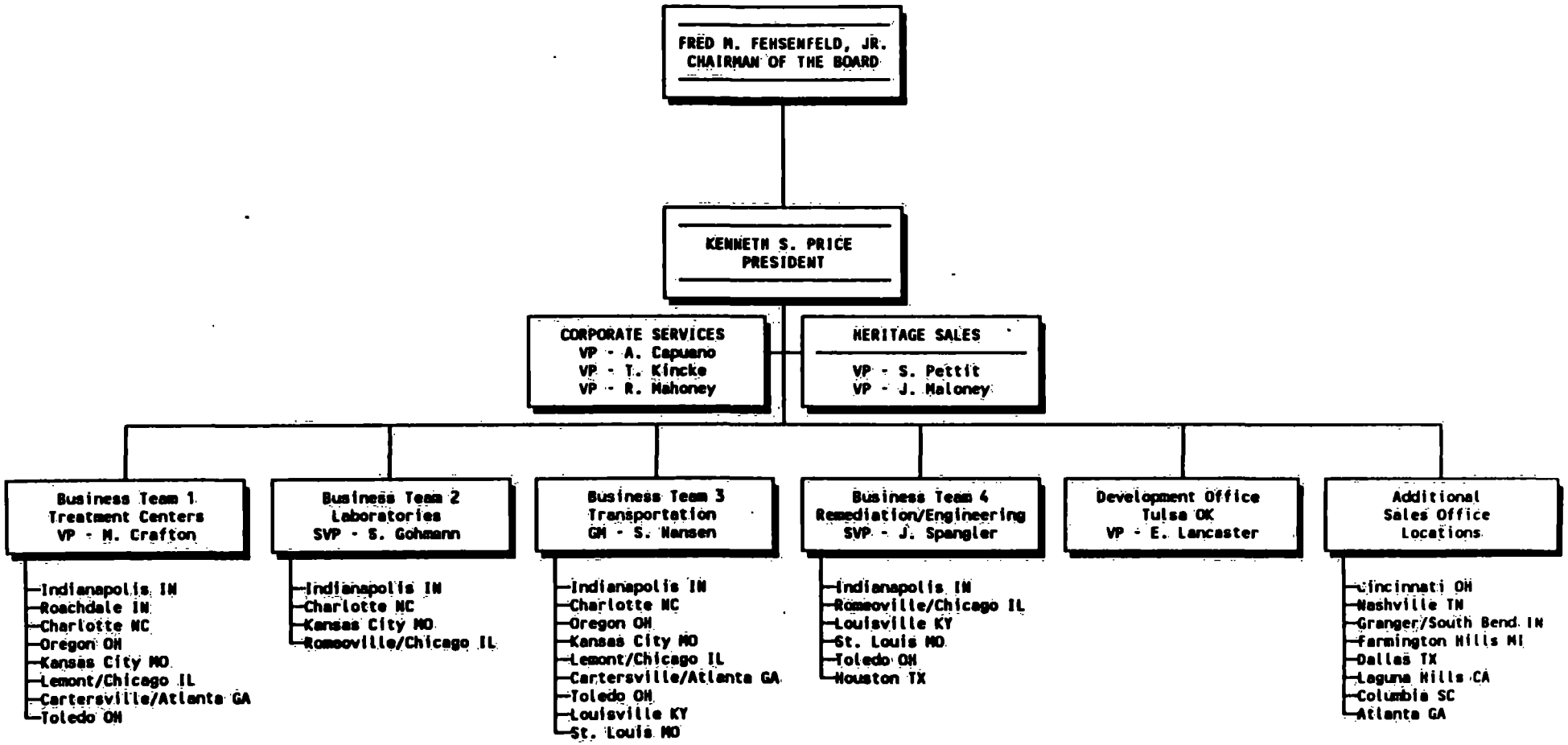


FIGURE 4.6

Heritage Environmental Services, Inc.
("HERITAGE")



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SECTION 5.0

5.0 QA Targets for Precision, Accuracy and Method Detection Limits

The targets for precision (duplicates), accuracy (spikes), and practical (reporting) detection limits for each sample matrix are given for each method performed by EMS Heritage in Table 5.1, Quality Assurance Targets for Precision, Accuracy and Method Detection Limits. Precision and accuracy targets and detection limits are developed from in-house data when possible. Precision and accuracy data are compiled continuously and reported quarterly using the Quality Control Tracking System (QCTS). The goals for precision and accuracy are reviewed quarterly by the QA Officer. The precision, accuracy, and detection limits presented in this CompQAP are routine target values. Deviations from these criteria must be addressed in individual project plans if required.

The QCTS specifies sample matrix as well as preparation procedures in summarizing QA data. Using this system, it is possible to insure that the QA Objectives for the analytical procedures using various sample matrices and preparation procedures are being met and are "representative of the media".

When precision and accuracy data are not available due to the newness or infrequency of use of a method, the literature or method values will be used until such time as in-house data can be accumulated sufficient to establish control limits. In any case those in-house control limits must be as stringent as the literature or method control limits given for the particular matrix. Some methods and testing programs specify control limits which will be used; these are identified in Section 12.0.

Since sample precision and accuracy data are matrix dependent, these criteria are "targets or goals". Out of control sample results may be reported with comments only after a determination is made by the QA Officer and/or QA Unit that based on the Laboratory Control Sample (LCS, an extracted or digested standard) results, a reanalysis of the out of control sample or best professional judgment that matrix problems prevent performance of the particular method within the established criteria. When out of control results are reported by the above protocol the QA Officer and/or the QA Unit will make the determination as to whether to enter the data into the QC data base (QCTS) or determine that the results are true outliers which will not be entered into the data base. The validity and the "completeness" of the results will be left for the sample submitter to evaluate in the few cases (less than 1% of all data reported) where interference and other matrix problems cannot be overcome by the methods employed.

The laboratory defines completeness as a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under current normal conditions. The QA objective for completeness is 99%.

The following tables are compiled from the QCTS where data is available and contain:

a. Component
b. Matrix
c. Method
d. Precision (RPD)
e. Accuracy (% Recovery)
f. PQL, MDL or other reporting limit

The variance of the analytical method changes as the analyte concentration increases from the MDL. Precision and accuracy will be evaluated as a function of concentration when comparing the QC data obtained for an analytical batch versus the QC criteria arrived at from the QCTS data base. Concentrations of analyte less than 10 times the method detection limit (MDL) present in non-spiked (lab duplicate) samples will not be considered as out-of-control based on the QCTS data. RPD's exceeding 20 percent for inorganic analyses and 50 percent for organic analyses will be considered as out-of-control for concentrations of analyte greater than 10 times the reporting detection limit.

Figure 5.1, Matrix Accuracy Control Criteria Usage is a flow chart which outlines the control limit criteria to be applied for accuracy measurements.

Figure 5.2, Matrix Precision Control Criteria Usage is a flow chart which outlines the control limit criteria to be applied for precision measurements.

EPA SW-846 methods that do not specify a sample preparation (extraction, digestion, clean-up, etc.) method are listed in Table 5.2, Sample Preparation Method, which includes a reference to the proposed sample preparation method.

FIGURE 5.1
Matrix Accuracy (% Recovery) Control Criteria Usage

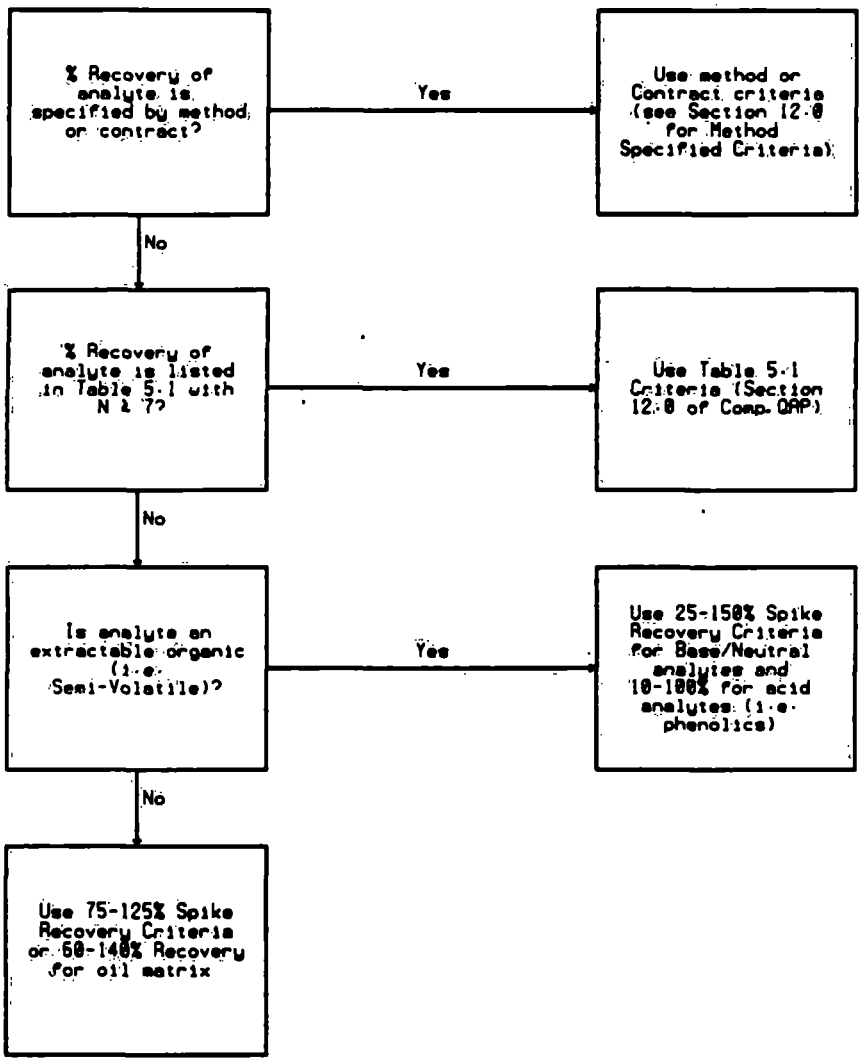
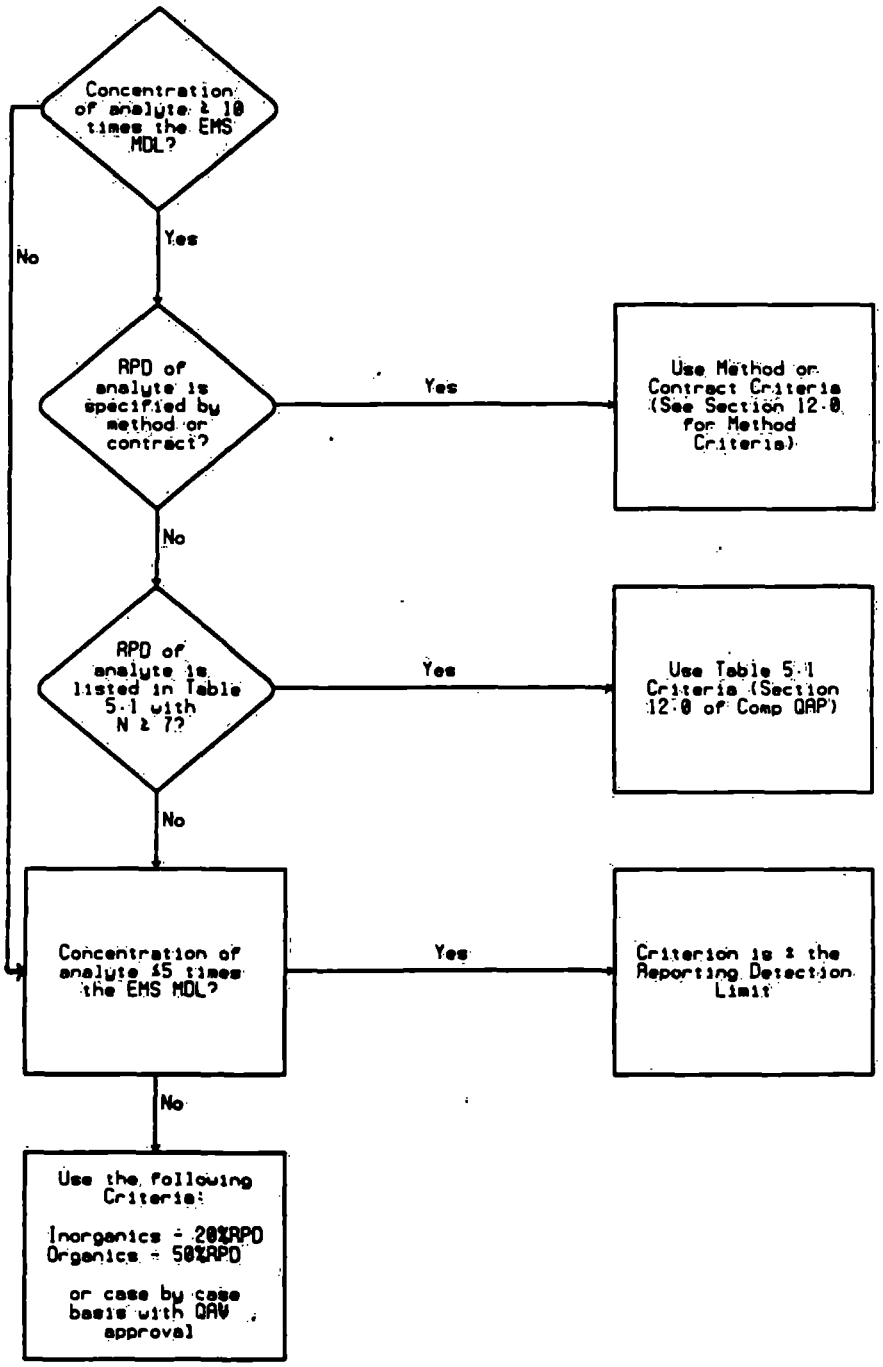


FIGURE 5.2
Matrix Precision (RPD) Control Criteria Usage



EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
ADAC 57-3	S/S/S	CATION EXCHANGE CAPACITY			2	0 - 43		
APHA 209A	Non-Spec Water	SOLIDS			2	0 - 0		
	S/S/S	SOLIDS			15	0 - 4		
APHA 213E	S/S/S	GRAVITY			1	0 - 0		
APHA 312B	Non-Spec Water	HEXAVALENT CHROMIUM	22	74 - 127	25	0 - 10		
	S/S/S	HEXAVALENT CHROMIUM			1	0 - 7		
APHA 314A	Non-Spec Water	HARDNESS			1	0 - 3		
APHA 412K	Non-Spec Water	THIOCYANATE	1	81 - 81	1	0 - 13		
APHA 415A (16E)	S/S/S	IODINE	2	81 - 97	1	0 - 5		
APHA 509A	Non-Spec Water	ALDRIN			2	0 - 32		
		4,4'-DDD			2	0 - 52		
		4,4'-DDT			2	0 - 17		
		HEPTACHLOR			2	0 - 41		
		HEPTACHLOR EPOXIDE			2	0 - 5		
APHA 909C (MOD)	Drinking Water	COLIFORM BACTERIA, FECAL			1	0 - 0		
	Non-Spec Water	COLIFORM BACTERIA, FECAL			3	0 - 0		
ASTM D-129	Non-Spec Water	SULFUR			1	0 - 7		
ASTM D-240	Non-Spec Water	HEAT OF COMBUSTION			1	0 - 13		
	Oil	HEAT OF COMBUSTION			3	0 - 10		
	S/S/S	HEAT OF COMBUSTION			40	0 - 22		
ASTM D-244	Non-Spec Water	GRAVITY			3	0 - 19		
	S/S/S	GRAVITY			8	0 - 0		
ASTM D-482	Oil	RESIDUE, PERCENT ASH			1	0 - 2		
	S/S/S	RESIDUE, PERCENT ASH			40	0 - 21		
ASTM D-70	S/S/S	DENSITY			3	0 - 4		

N = Sample Count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
ASTM D-808	Oil	TOTAL HALOGEN (TX)			1	0 - 5		
	S/S/S	TOTAL HALOGEN (TX)			3	0 - 23		
ASTM D-86	S/S/S	BOILING POINT			6	0 - 7		
ASTM D-92	S/S/S	FLASH POINT			23	0 - 0		
ASTM D-93	Non-Spec Water	FLASH POINT			1	0 - 5		
	S/S/S	FLASH POINT			1	0 - 0		
ASTM D-95	Oil	WATER			1	0 - 0		
	S/S/S	WATER	1	100 - 100	3	0 - 37		
ASTM D-96	S/S/S	BOTTOM SEDIMENT AND WATER			7	0 - 10		
		OIL			5	0 - 18		
		SOLIDS			3	0 - 45		
		WATER			4	0 - 6		
CLP SOW 2/88	Non-Spec Water	BENZENE	4	75 - 123	2	0 - 0		
		CHLOROBENZENE	4	93 - 121	2	0 - 2		
		1,1-DICHLOROETHENE	4	43 - 163	2	0 - 24		
		PCB AROCLOR 1260	14	68 - 118	7	0 - 26		
		TOLUENE	4	82 - 121	2	0 - 7		
		TRICHLOROETHENE	4	94 - 114	2	0 - 4		
	S/S/S	ACENAPHTHENE	2	91 - 99	1	0 - 2		
		4-CHLORO-3-METHYLPHENOL	2	94 - 102	1	0 - 2		
		2-CHLOROPHENOL	2	82 - 90	1	0 - 2		
		1,4-DICHLOROBENZENE (P-DICHLOROBENZENE)	2	85 - 85	1	0 - 0		
		2,4-DINITROTOLUENE	2	90 - 116	1	0 - 6		
		N-NITROSO-DI-N-PROPYLAMINE	2	72 - 98	1	0 - 7		
		4-NITROPHENOL	2	54 - 104	1	0 - 15		
		PENTACHLOROPHENOL	2	53 - 92	1	0 - 12		
		PHENOL	2	76 - 84	1	0 - 3		
		PYRENE	2	51 - 132	1	0 - 21		
		1,2,4-TRICHLOROBENZENE	2	83 - 96	1	0 - 3		
EPA 110.3	Non-Spec Water	COLOR			10	0 - 0		
EPA 120.1	Non-Spec Water	CONDUCTIVITY			13	0 - 0		
EPA 130.2	Non-Spec Water	HARDNESS	2	100 - 100	8	0 - 5		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 150.1	Drinking Water	PH			5	0 - 0		
	Non-Spec Water	PH			304	0 - 2		
	S/S/S	PH			8	0 - 3		
EPA 160.1	Drinking Water	SOLIDS			7	0 - 15		
	Non-Spec Water	SOLIDS	8	87 - 131	84	0 - 13		
	S/S/S	SOLIDS			1	0 - 1		
EPA 160.2	Non-Spec Water	SOLIDS			23	0 - 50		
		SUSPENDED SOLIDS	21	62 - 128	112	0 - 34		
EPA 160.3	Non-Spec Water	SOLIDS			6	0 - 6		
	S/S/S	SOLIDS			86	0 - 6		
EPA 160.4	Non-Spec Water	TOTAL SOLIDS, VOLATILE			1	0 - 0		
		VOLATILE SUSPENDED SOLIDS			11	0 - 19		
	S/S/S	TOTAL SOLIDS, VOLATILE			6	0 - 27		
EPA 180.1	Drinking Water	TURBIDITY			2	0 - 20		
	Non-Spec Water	TURBIDITY			1	0 - 4		
EPA 200.7	Drinking Water	BARIUM	9	80 - 117	7	0 - 4		
		BORON	3	51 - 163	3	0 - 44		
		CALCIUM	1	86 - 86	1	0 - 0		
		CHROMIUM	10	75 - 123				
		COPPER	13	72 - 128	4	0 - 146		
		IRON	6	80 - 110	8	0 - 60		
		MAGNESIUM	2	84 - 113	8	0 - 12		
		MANGANESE	8	75 - 124	3	0 - 4		
		NICKEL	1	90 - 90				
		POTASSIUM	1	88 - 88	1	0 - 5		
		SILVER	9	73 - 127				
		SODIUM	2	83 - 112	2	0 - 32		
		ZINC	8	63 - 131	7	0 - 45		
	Non-Spec Water	ALUMINUM	68	82 - 110	33	0 - 26		
		ANTIMONY	26	67 - 102	12	0 - 10		
		BARIUM	32	87 - 108	15	0 - 5		
		BERYLLIUM	25	69 - 134	8	0 - 1		

N = Sample Count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)
(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 200.7	Non-Spec Water	BORON	2	73 - 128	1	0 - 2		
		CADMIUM	69	60 - 116	16	0 - 10		
		CALCIUM	43	80 - 106	28	0 - 4		
		CHROMIUM	122	76 - 111	40	0 - 44		
		COBALT	21	85 - 106	11	0 - 3		
		COPPER	182	77 - 121	86	0 - 27		
		IRON	47	73 - 111	35	0 - 13		
		LEAD	75	69 - 115	16	0 - 25		
		LITHIUM	2	79 - 129				
		MAGNESIUM	39	87 - 111	25	0 - 4		
		MANGANESE	26	88 - 108	15	0 - 5		
		MOLYBDENUM	3	66 - 124	2	0 - 0		
		NICKEL	73	77 - 108	43	0 - 19		
		POTASSIUM	26	86 - 104	17	0 - 8		
		SILICON			1	0 - 4		
		SILVER	58	80 - 123	13	0 - 9		
		SODIUM	26	89 - 108	17	0 - 19		
		STRONTIUM	2	66 - 121	1	0 - 4		
		THALLIUM	4	50 - 101				
		TITANIUM	2	76 - 123				
		VANADIUM	22	84 - 104	10	0 - 3		
		ZINC	132	70 - 118	107	0 - 56		
		ZIRCONIUM	2	64 - 145				
	S/S/S	ALUMINUM	2	80 - 101	2	0 - 10		
		BARIUM	1	99 - 99	1	0 - 2		
		CADMIUM	4	69 - 110	3	0 - 65		
		CALCIUM	1	94 - 94	1	0 - 1		
		CHROMIUM	4	61 - 126	5	0 - 38		
		COBALT	1	93 - 93	1	0 - 1		
		COPPER	5	87 - 105	6	0 - 13		
		IRON	2	69 - 85	3	0 - 5		
		LEAD	4	62 - 111	3	0 - 37		
		MAGNESIUM	1	99 - 99	1	0 - 1		
		NICKEL	3	81 - 113	5	0 - 37		
		POTASSIUM	3	87 - 94	3	0 - 21		
		SILVER	1	93 - 93	2	0 - 22		
		SODIUM			1	0 - 16		
		ZINC	4	76 - 105	5	0 - 19		
EPA 202.1	Non-Spec Water	ALUMINUM	42	58 - 132	21	0 - 16		
EPA 204.1	Non-Spec Water	ANTIMONY	2	92 - 134	1	0 - 5		
EPA 204.2	Non-Spec Water	ANTIMONY	9	0 - 173	7	0 - 25		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 206.2	Drinking Water	ARSENIC	13	71 - 127	4	0 - 14		
	Non-Spec Water	ARSENIC	105	65 - 133	38	0 - 21		
	S/S/S	ARSENIC	1	95 - 95	1	0 - 200		
EPA 208.1	Drinking Water	BARIUM	3	106 - 113				
	Non-Spec Water	BARIUM	16	66 - 116	9	0 - 18		
EPA 210.1	Non-Spec Water	BERYLLIUM	2	100 - 100	1	0 - 0		
EPA 210.2	Non-Spec Water	BERYLLIUM	45	53 - 161	23	0 - 21		
EPA 212.3	Non-Spec Water	BORON			2	0 - 21		
EPA 213.1	Non-Spec Water	CADMIUM	133	74 - 123	58	0 - 7		
	S/S/S	CADMIUM	2	80 - 114	2	0 - 13		
EPA 213.2	Drinking Water	CADMIUM	20	54 - 138	1	0 - 0		
	Non-Spec Water	CADMIUM	23	54 - 150	7	0 - 10		
EPA 215.1	Drinking Water	CALCIUM			1	0 - 0		
	Non-Spec Water	CALCIUM	3	90 - 100	1	0 - 0		
EPA 218.1	Drinking Water	CHROMIUM	4	78 - 108				
	Non-Spec Water	CHROMIUM	141	74 - 117	69	0 - 12		
	S/S/S	CHROMIUM	1	93 - 93	1	0 - 14		
EPA 218.2	Drinking Water	CHROMIUM	2	90 - 95	2	0 - 1		
	Non-Spec Water	CHROMIUM	8	77 - 123	4	0 - 12		
EPA 219.1	Non-Spec Water	COBALT	2	97 - 110	1	0 - 3		
EPA 220.1	Non-Spec Water	COPPER	139	81 - 117	72	0 - 10		
	S/S/S	COPPER			1	0 - 0		
EPA 220.2	Non-Spec Water	COPPER	59	38 - 176	30	0 - 26		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)
(qaoP.sql)

CMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 236.1	Drinking Water	IRON	3	40 - 141	1	0 - 0		
	Non-Spec Water	IRON	19	37 - 135	13	0 - 20		
EPA 239.1	Non-Spec Water	LEAD	106	74 - 123	49	0 - 19		
	S/S/S	LEAD	2	0 - 342	2	0 - 13		
EPA 239.2	Drinking Water	LEAD	21	67 - 131	4	0 - 94		
	Non-Spec Water	LEAD	217	67 - 134	74	0 - 25		
	S/S/S	LEAD	3	47 - 137	3	0 - 57		
EPA 243.1	Drinking Water	MANGANESE	4	78 - 112				
	Non-Spec Water	MANGANESE	5	77 - 111	5	0 - 234		
	S/S/S	MANGANESE			1	0 - 2		
EPA 245.1	Drinking Water	MERCURY	9	81 - 120				
	Non-Spec Water	MERCURY	110	58 - 129	53	0 - 32		
	S/S/S	MERCURY	2	78 - 120				
EPA 246.2	Non-Spec Water	MOLYBDENUM	2	69 - 129	1	0 - 11		
EPA 249.1	Non-Spec Water	NICKEL	115	71 - 123	58	0 - 9		
	S/S/S	NICKEL	2	2 - 143	2	0 - 20		
EPA 258.1	S/S/S	POTASSIUM			1	0 - 3		
EPA 270.2	Drinking Water	SELENIUM	12	70 - 129	2	0 - 42		
	Non-Spec Water	SELENIUM	45	56 - 142	14	0 - 21		
	S/S/S	SELENIUM	1	122 - 122				
EPA 272.1	Drinking Water	SILVER	1	40 - 40				
	Non-Spec Water	SILVER	92	71 - 125	35	0 - 5		
	S/S/S	SILVER	1	82 - 82				

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 272.2	Drinking Water	SILVER	2	101 - 106	1	0 - 0		
	Non-Spec Water	SILVER	15	89 - 113	8	0 - 24		
EPA 273.1	Drinking Water	SODIUM	2	120 - 120	2	0 - 0		
	Non-Spec Water	SODIUM			3	0 - 6		
EPA 279.2	Non-Spec Water	THALLIUM	37	65 - 125	19	0 - 12		
EPA 282.1	Non-Spec Water	TIN	2	76 - 144	1	0 - 14		
EPA 283.2	Non-Spec Water	TITANIUM	2	103 - 103	1	0 - 0		
	S/S/S	TITANIUM	1	129 - 129				
EPA 286.1	Non-Spec Water	VANADIUM	2	40 - 150	1	0 - 25		
EPA 289.1	Drinking Water	ZINC	1	120 - 120				
	Non-Spec Water	ZINC	144	73 - 121	72	0 - 9		
	S/S/S	ZINC	1	080 - 080	2	0 - 23		
EPA 305.1	Non-Spec Water	ACIDITY			1	0 - 18		
	S/S/S	ACIDITY			6	0 - 14		
EPA 310.1	Drinking Water	ALKALINITY			1	0 - 2		
	Non-Spec Water	ALKALINITY	9	61 - 159	66	0 - 7		
	S/S/S	ALKALINITY			25	0 - 9		
EPA 310.2	Non-Spec Water	ALKALINITY			2	0 - 5		
EPA 325.1	Drinking Water	CHLORIDE	1	90 - 90	3	0 - 0		
	Non-Spec Water	CHLORIDE	56	89 - 120	47	0 - 4		
	S/S/S	CHLORIDE	2	105 - 105	1	0 - 0		
EPA 325.2	Drinking Water	CHLORIDE	1	100 - 100	1	0 - 3		
	Non-Spec Water	CHLORIDE	12	74 - 123	13	0 - 5		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)
(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 325.3	Non-Spec Water	CHLORIDE			1	0 - 2		
EPA 330.5	Non-Spec Water	CHLORINE			7	0 - 3		
EPA 335.1	Non-Spec Water	CYANIDE, AMENABLE			2	0 - 26		
EPA 335.2	Non-Spec Water	CYANIDE	50	64 - 121	51	0 - 22		
	S/S/S	CYANIDE	8	52 - 113	1	0 - 0		
EPA 335.3	Drinking Water	CYANIDE	1	100 - 100				
	Non-Spec Water	CYANIDE	119	67 - 129	18	0 - 47		
	S/S/S	CYANIDE	4	55 - 129				
EPA 340.2	Drinking Water	FLUORIDE	2	67 - 122				
	Non-Spec Water	FLUORIDE	25	59 - 125	23	0 - 39		
	S/S/S	FLUORIDE	1	79 - 79	1	0 - 20		
EPA 350.1	Non-Spec Water	NITROGEN, AMMONIA	8	67 - 132	8	0 - 11		
EPA 350.3	Non-Spec Water	NITROGEN, AMMONIA	74	64 - 124	69	0 - 20		
	S/S/S	NITROGEN, AMMONIA	10	0 - 181	14	0 - 31		
EPA 351.2	Non-Spec Water	NITROGEN, KJELDAHL	7	59 - 147	8	0 - 16		
EPA 351.3	Non-Spec Water	NITROGEN, KJELDAHL	1	100 - 100	1	0 - 0		
	S/S/S	NITROGEN, KJELDAHL	11	66 - 139	14	0 - 11		
EPA 353.1	Drinking Water	NITROGEN, NITRATE	3	82 - 108	2	0 - 26		
	Non-Spec Water	NITROGEN, NITRATE	5	85 - 113	5	0 - 27		
		NITROGEN, NITRATE-NITRITE	4	86 - 140	4	0 - 4		
	S/S/S	NITROGEN, NITRATE	1	90 - 90	1	0 - 0		
EPA 353.2	Drinking Water	NITROGEN, NITRATE	1	120 - 120	3	0 - 15		
	Non-Spec Water	NITROGEN, NITRATE	37	69 - 130	59	0 - 15		
		NITROGEN, NITRATE-NITRITE	18	89 - 128	11	0 - 17		
		NITROGEN, NITRITE			2	0 - 20		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 353.2	S/S/S	NITROGEN, NITRATE			3	0 - 14		
		NITROGEN, NITRITE	4	77 - 135	2	0 - 27		
EPA 353.3	Non-Spec Water	NITROGEN, NITRATE	8	79 - 121	15	0 - 10		
		NITROGEN, NITRATE-NITRITE	9	85 - 113	11	0 - 30		
EPA 354.1	Non-Spec Water	NITROGEN, NITRITE	1	97 - 97				
EPA 365.1	Non-Spec Water	ORTHO-PHOSPHORUS			2	0 - 4		
EPA 365.2	Non-Spec Water	ORTHO-PHOSPHORUS	12	69 - 128	28	0 - 18		
		PHOSPHORUS	74	67 - 129	99	0 - 19		
	S/S/S	ORTHO-PHOSPHORUS	5	87 - 117				
		PHOSPHORUS	3	64 - 138	7	0 - 42		
EPA 365.4	Non-Spec Water	PHOSPHORUS	8	77 - 125	4	0 - 16		
EPA 375.4	Drinking Water	SULFATE	7	83 - 112	7	0 - 12		
	Non-Spec Water	SULFATE	50	79 - 127	55	0 - 10		
	S/S/S	SULFATE	4	96 - 121	3	0 - 3		
EPA 376.1	Non-Spec Water	SULFIDE	1	82 - 82	4	0 - 0		
	S/S/S	SULFIDE	2	99 - 107	1	0 - 2		
EPA 377.1	Non-Spec Water	SULFITE	2	104 - 109	1	0 - 0		
	S/S/S	SULFITE	2	91 - 112	1	0 - 5		
EPA 405.1	Non-Spec Water	BIOCHEMICAL OXYGEN DEMAND			157	0 - 43		
EPA 410.2	Non-Spec Water	CHEMICAL OXYGEN DEMAND			1	0 - 28		
EPA 410.3	Non-Spec Water	CHEMICAL OXYGEN DEMAND	1	104 - 104	1	0 - 32		
EPA 410.4	Drinking Water	CHEMICAL OXYGEN DEMAND	1	96 - 96	1	0 - 14		
	Non-Spec Water	CHEMICAL OXYGEN DEMAND	38	75 - 126	20	0 - 33		
	S/S/S	CHEMICAL OXYGEN DEMAND			6	0 - 13		
EPA 413.1	Non-Spec Water	OIL AND GREASE			19	0 - 13		

N = Sample Count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)
(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 413.1	S/S/S	OIL AND GREASE			1	0 - 24		
EPA 415.1	Drinking Water	TOTAL ORGANIC CARBON (TOC)	2	109 - 109	1	0 - 9		
	Non-Spec Water	TOTAL ORGANIC CARBON (TOC)	10	81 - 116	11	0 - 9		
EPA 418.1 (MOD)	S/S/S	HYDROCARBONS	12	60 - 121	10	0 - 36		
EPA 420.1	Non-Spec Water	PHENOL	8	28 - 159	12	0 - 38		
	S/S/S	PHENOL						
EPA 420.2	Drinking Water	PHENOL	1	95 - 95				
	Non-Spec Water	PHENOL	53	72 - 119	13	0 - 27		
	S/S/S	PHENOL			1	0 - 1		
EPA 425.1	Non-Spec Water	SURFACTANTS, MBAS	3	2 - 176	3	0 - 20		
EPA 502.2	Drinking Water	BENZENE			2	0 - 39		
		BROMODICHLOROMETHANE			1	0 - 1		
		BROMOFORM			2	0 - 32		
		CHLOROFORM			1	0 - 0		
		DIBROMOCHLOROMETHANE			1	0 - 3		
		1,1-DICHLOROETHANE			1	0 - 16		
		DICHLOROMETHANE (METHYLENE CHLORIDE)			1	0 - 2		
		ETHYL BENZENE			2	0 - 20		
		M/P-XYLENE			1	0 - 10		
		O-XYLENE			1	0 - 7		
		TOLUENE			1	0 - 10		
		TOTAL TRIHALOMETHANES			1	0 - 6		
		1,1,1-TRICHLOROETHANE			1	0 - 20		
	Non-Spec Water	BENZENE			1	0 - 13		
		ETHYL BENZENE			1	0 - 10		
		M/P-XYLENE			1	0 - 15		
EPA 504	Drinking Water	1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	2	96 - 101	1	0 - 1		
		1,2-DIBROMOETHANE (EDB)	2	46 - 114	1	0 - 20		
	Non-Spec Water	1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	6	63 - 129	3	0 - 26		
		1,2-DIBROMOETHANE (EDB)	6	69 - 125	3	0 - 30		
EPA 507	Non-Spec Water	AMETRYN	2	120 - 125	1	0 - 1		

N = Sample count
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RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 507	Non-Spec Water	ATRATON	2	0 - 328	1	0 - 128		
		ATRAZINE	2	0 - 199				
		BROMACIL	2	0 - 248	1	0 - 81		
		CHLOROPROPHAM	2	17 - 213	1	0 - 40		
		CYCLOATE	2	93 - 119	1	0 - 6		
		DIPHENAMID	5	42 - 145	2	0 - 1		
		DISULFOTON	2	57 - 133	1	0 - 19		
		EPTC (ERADICANE)	5	46 - 126	2	0 - 24		
		ETHOPROP	6	0 - 304	2	0 - 11		
		HEXAZINONE	2	32 - 160	1	0 - 31		
		MERPHOS	2	31 - 183	1	0 - 34		
		MEVINPHOS	4	0 - 221	1	0 - 20		
		MOLINATE	2	98 - 132	1	0 - 7		
		PROMETON (PRAMITOL)	2	46 - 174	1	0 - 28		
		PROMETRYN (CAPAROL)	5	40 - 135	2	0 - 5		
		PRONAMIDE	2	81 - 131	1	0 - 12		
		PROPAZINE (MILOGARD)	6	0 - 207	2	0 - 4		
		STIROFOS	2	107 - 136	1	0 - 6		
		TERBUTRYN	5	49 - 125	2	0 - 10		
		TRIADEMEFON	6	0 - 248	2	0 - 8		
EPA 508	Non-Spec Water	ETHALFLURALIN	14	23 - 52	7	0 - 26		
		FLUCHLORALIN	14	35 - 53	7	0 - 11		
		PENDIMETHALIN	14	37 - 63	6	0 - 14		
		PROFLURALIN	14	36 - 56	7	0 - 20		
		PROPACHLOR	14	28 - 92	7	0 - 15		
EPA 515.1	Non-Spec Water	2,4-DB	16	13 - 167	7	0 - 95		
		DCPA (DACTHAL)	16	0 - 260	7	0 - 106		
		2,4-DICHLOROPHENOXYACETIC ACID	16	9 - 172	5	0 - 14		
		4-NITROPHENOL	14	0 - 182	6	0 - 143		
		PICLORAM	15	0 - 180	7	0 - 115		
		2,4,5-T	16	31 - 158	6	0 - 27		
		2,4,5-TRICHLOROPHENOXYACETIC ACID (SILVEX)	16	30 - 172	6	0 - 26		
EPA 524.2	Non-Spec Water	BENZENE	16	77 - 114	8	0 - 21		
		BROMOBENZENE	16	75 - 115	8	0 - 30		
		BROMOCHLOROMETHANE	16	67 - 125	8	0 - 18		
		BROMODICHLOROMETHANE	16	76 - 115	8	0 - 14		
		BROMOFORM	16	69 - 126	8	0 - 19		
		BROMOMETHANE	16	72 - 110	6	0 - 8		
		CARBON TETRACHLORIDE	16	55 - 118	7	0 - 6		
		CHLOROBENZENE	16	77 - 117	8	0 - 22		
		CHLOROETHANE	15	63 - 116	8	0 - 48		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)
(qaoP.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 524.2	Non-Spec Water	CHLOROFORM	16	77 - 110	8	0 - 12		
		CHLOROMETHANE	16	64 - 121	7	0 - 20		
		2-CHLOROTOLUENE (O-CHLOROTOLUENE)	16	73 - 113	8	0 - 16		
		4-CHLOROTOLUENE (P-CHLOROTOLUENE)	16	62 - 136	8	0 - 27		
		CIS-1,2-DICHLOROETHENE	16	73 - 116	8	0 - 16		
		DIBROMOMETHANE	16	76 - 124	7	0 - 19		
		1,3-DICHLOROBENZENE (M-DICHLOROBENZENE)	16	75 - 116	8	0 - 16		
		1,2-DICHLOROBENZENE (O-DICHLOROBENZENE)	16	76 - 120	8	0 - 22		
		1,4-DICHLOROBENZENE (P-DICHLOROBENZENE)	16	66 - 126	8	0 - 21		
		DICHLORODIFLUOROMETHANE	15	60 - 99	7	0 - 9		
		1,1-DICHLOROETHANE	16	72 - 114	6	0 - 6		
		1,2-DICHLOROETHANE	16	75 - 122	8	0 - 23		
		1,1-DICHLOROETHENE	16	58 - 117	8	0 - 28		
		DICHLOROMETHANE (METHYLENE CHLORIDE)	16	51 - 158	8	0 - 67		
		1,2-DICHLOROPROPANE	16	79 - 116	8	0 - 19		
		2,2-DICHLOROPROPANE	16	55 - 109	8	0 - 17		
		1,3-DICHLOROPROPANE	16	82 - 114	8	0 - 12		
		1,1-DICHLOROPROPENE	16	65 - 119	8	0 - 14		
		ETHYL BENZENE	16	71 - 115	8	0 - 28		
		FLUOROTRICHLOROMETHANE	16	0 - 188	8	0 - 102		
		HEXACHLOROBUTADIENE	16	45 - 141	8	0 - 39		
		ISOPROPYLBENZENE (CUMENE)	16	62 - 123	6	0 - 4		
		4-ISOPROPYLTOLUENE (P-ISOPROPYLTOLUENE)	16	62 - 123	8	0 - 19		
		N-BUTYLBENZENE	16	66 - 115	8	0 - 19		
		N-PROPYLBENZENE	16	66 - 120	7	0 - 19		
		NAPHTHALENE	16	71 - 140	7	0 - 16		
		O-XYLENE	16	78 - 111	7	0 - 8		
		SEC-BUTYLBENZENE	16	65 - 121	8	0 - 20		
		STYRENE	14	80 - 107	7	0 - 8		
		TERT-BUTYLBENZENE	16	43 - 133	8	0 - 7		
		1,1,1,2-TETRACHLOROETHANE	16	73 - 117	7	0 - 7		
		1,1,2,2-TETRACHLOROETHANE	16	81 - 124	8	0 - 22		
		TETRACHLOROETHENE	16	59 - 124	8	0 - 20		
		TOLUENE	16	78 - 110	8	0 - 15		
		TRANS-1,2-DICHLOROETHENE	16	66 - 116	8	0 - 20		
		1,2,3-TRICHLOROBENZENE	16	68 - 138	7	0 - 31		
		1,2,4-TRICHLOROBENZENE	16	69 - 133	8	0 - 17		
		1,1,1-TRICHLOROETHANE	16	66 - 117	8	0 - 18		
		1,1,2-TRICHLOROETHANE	16	79 - 119	8	0 - 21		
		TRICHLOROETHENE	16	72 - 111	8	0 - 21		
		1,2,3-TRICHLOROPROPANE	16	72 - 135	8	0 - 33		
		1,2,4-TRIMETHYLBENZENE	16	53 - 133	7	0 - 20		
		1,3,5-TRIMETHYLBENZENE	16	41 - 132	8	0 - 12		
		VINYL CHLORIDE	16	68 - 123	8	0 - 14		
EPA 525	Drinking Water	ACENAPHTHYLENE	1	36 - 36				

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 525	Drinking Water	ALACHLOR	1	86 - 86				
		ALDRIN	1	76 - 76				
		ALPHA-CHLORDANE	1	78 - 78				
		ANTHRACENE	1	38 - 38				
		ATRAZINE	1	82 - 82				
		BENZ(A)ANTHRACENE	1	80 - 80				
		BENZO(A)PYRENE	1	0 - 0				
		BENZO(B)FLUORANTHENE	1	220 - 220				
		BENZO(G,H,I)PERYLENE	1	260 - 260				
		BENZO(K)FLUORANTHENE	1	220 - 220				
		(BENZYLBUTYLPHTHALATE) BUTYLBENZYLPHTHALATE	1	88 - 88				
		BIS(2-ETHYLHEXYL)PHTHALATE	1	98 - 98				
		2-CHLOROBIPHENYL	1	88 - 88				
		CHRYSENE	1	98 - 98				
		DI(2-ETHYLHEXYL)ADIPATE	1	92 - 92				
		DI-N-BUTYLPHTHALATE	1	88 - 88				
		DIBENZ(A,H)ANTHRACENE	1	300 - 300				
		2,3-DICHLOROBIPHENYL	1	84 - 84				
		DIETHYLPHTHALATE	1	86 - 86				
		DIMETHYLPHTHALATE	1	88 - 88				
		FLUORENE	1	90 - 90				
		GAMMA-CHLORDANE	1	80 - 80				
		HEPTACHLOR	1	108 - 108				
		HEPTACHLOR EPOXIDE	1	80 - 80				
		2,2',3,3',4,4',6-HEPTACHLOROBIPHENYL	1	74 - 74				
		HEXACHLOROBENZENE	1	80 - 80				
		2,2',4,4',5,6'-HEXACHLOROBIPHENYL	1	80 - 80				
		HEXACHLOROCYCLOPENTADIENE	1	68 - 68				
		INDENO(1,2,3-CD)PYRENE	1	380 - 380				
		2,2',3,3',4,5',6,6'-OCTACHLOROBIPHENYL	1	72 - 72				
		2,2',3',4,6-PENTACHLOROBIPHENYL	1	78 - 78				
		PENTACHLOROPHENOL	1	108 - 108				
		PHENANTHRENE	1	84 - 84				
		PYRENE	1	78 - 78				
		SIMAZINE (PRINCEP)	1	84 - 84				
		2,2',4,4'-TETRACHLOROBIPHENYL	1	82 - 82				
		TRANS-NONACHLOR	1	82 - 82				
		2,4,5-TRICHLOROBIPHENYL	1	84 - 84				
	Non-Spec Water	ACENAPHTHYLENE	21	17 - 126	8	0 - 13		
		ALACHLOR	11	51 - 126	5	0 - 28		
		ALDRIN	9	57 - 98	4	0 - 29		
		ALPHA-CHLORDANE	9	43 - 113	4	0 - 38		
		ANTHRACENE	21	45 - 111	10	0 - 40		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 525	Non-Spec Water	ATRAZINE	11	43 - 112	5	0 - 15		
		BENZ(A)ANTHRACENE	21	53 - 121	9	0 - 12		
		BENZO(A)PYRENE	21	0 - 149	9	0 - 10		
		BENZO(B)FLUORANTHENE	21	27 - 157	9	0 - 21		
		BENZO(G,H,I)PERYLENE	21	0 - 162	10	0 - 41		
		BENZO(K)FLUORANTHENE	21	32 - 135	10	0 - 55		
		(BENZYLBUTYLPHTHALATE) BUTYLBENZYLPHTHALATE	22	39 - 165	10	0 - 24		
		BIS(2-ETHYLHEXYL)PHTHALATE	22	13 - 187	9	0 - 15		
		2-CHLOROBIPHENYL	23	40 - 105	9	0 - 10		
		CHRYSENE	21	45 - 127	8	0 - 9		
		DI(2-ETHYLHEXYL)ADIPATE	22	1 - 208	11	0 - 47		
		DI-N-BUTYLPHTHALATE	23	42 - 156	11	0 - 43		
		DIBENZ(A,H)ANTHRACENE	21	19 - 155	10	0 - 43		
		2,3-DICHLOROBIPHENYL	23	42 - 114	10	0 - 17		
		DIETHYLPHTHALATE	23	42 - 138	8	0 - 8		
		DIMETHYLPHTHALATE	22	41 - 124	10	0 - 39		
		ENDRIN	9	29 - 184	4	0 - 28		
		FLUORENE	21	47 - 113	9	0 - 14		
		GAMMA-BHC (LINDANE)	9	51 - 119	4	0 - 26		
		GAMMA-CHLORDANE	9	38 - 117	4	0 - 19		
		HEPTACHLOR	9	17 - 167	4	0 - 22		
		HEPTACHLOR EPOXIDE	9	49 - 134	4	0 - 42		
		2,2',3,3',4,4',6-HEPTACHLOROBIPHENYL	23	27 - 123	10	0 - 29		
		HEXACHLOROBENZENE	23	39 - 113	11	0 - 49		
		2,2',4,4',5,6'-HEXACHLOROBIPHENYL	23	37 - 113	10	0 - 24		
		HEXACHLOROCYCLOPENTADIENE	23	0 - 125	11	0 - 52		
		INDENO(1,2,3-CD)PYRENE	21	0 - 186	10	0 - 58		
		METHOXYCHLOR	9	24 - 154	4	0 - 28		
		2,2',3,3',4,5',6,6'-OCTACHLOROBIPHENYL	23	31 - 115	10	0 - 25		
		2,2',3',4,6-PENTACHLOROBIPHENYL	23	45 - 111	9	0 - 9		
		PENTACHLOROPHENOL	11	0 - 121	5	0 - 47		
		PHENANTHRENE	21	54 - 114	9	0 - 18		
		PYRENE	21	20 - 140	9	0 - 19		
		SIMAZINE (PRINCEP)	10	52 - 95	5	0 - 30		
		2,2',4,4'-TETRACHLOROBIPHENYL	23	42 - 115	9	0 - 11		
		TRANS-NONACHLOR	23	41 - 116	10	0 - 18		
		2,4,5-TRICHLOROBIPHENYL	17	43 - 107	6	0 - 7		
EPA 531.1	Non-Spec Water	ALDICARB	16	36 - 111	7	0 - 18		
		ALDICARB SULFONE	16	52 - 120	8	0 - 15		
		ALDICARB SULFOXIDE	16	51 - 129	7	0 - 13		
		CARBARYL	16	59 - 113	8	0 - 12		
		CARBOFURAN	16	49 - 126	8	0 - 18		
		3-HYDROXYCARBOFURAN	16	45 - 132	7	0 - 18		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sol)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 531.1	Non-Spec Water	METHIOCARB	14	56 - 88	8	0 - 23		
		METHOMYL	16	45 - 125	8	0 - 10		
		OXAMYL	16	41 - 134	8	0 - 17		
		PROPOXUR (BAYCON)	16	49 - 126	8	0 - 28		
EPA 548.1	Non-Spec Water	ENDOTHALL	2	79 - 129	1	0 - 12		
EPA 601/602 MOD	Drinking Water	BENZENE	12	35 - 143	5	0 - 74		
		DI-ISOPROPYL ETHER (IPE)	2	34 - 141				
		1,2-DIBROMOETHANE (EDB)	8	70 - 132	3	0 - 50		
		1,2-DICHLOROETHANE	15	18 - 182	6	0 - 87		
		ETHYL BENZENE	12	56 - 124	5	0 - 37		
		M/P-XYLENE	7	74 - 112	3	0 - 31		
		METHYL-T-BUTYL ETHER (MTBE)	7	59 - 124	3	0 - 78		
		O-XYLENE	7	72 - 113	3	0 - 35		
		TOLUENE	12	53 - 135	5	0 - 62		
	Non-Spec Water	BENZENE	1	97 - 97				
		DI-ISOPROPYL ETHER (IPE)						
		1,2-DIBROMOETHANE (EDB)	1	139 - 139				
		1,2-DICHLOROETHANE	1	96 - 96				
		ETHYL BENZENE	1	99 - 99				
		M/P-XYLENE	1	99 - 99				
		METHYL-T-BUTYL ETHER (MTBE)	1	65 - 65				
		O-XYLENE	1	100 - 100				
		TOLUENE	1	98 - 98				
EPA 602	Drinking Water	BENZENE	7	31 - 146	3	0 - 58		
		ETHYL BENZENE	7	43 - 144	3	0 - 18		
		METHYL-T-BUTYL ETHER (MTBE)	5	0 - 229	2	0 - 62		
		TOLUENE	7	44 - 142	3	0 - 22		
	Non-Spec Water	BENZENE	1	97 - 97				
		DI-ISOPROPYL ETHER (IPE)	1	99 - 99				
		ETHYL BENZENE	1	115 - 115				
		METHYL-T-BUTYL ETHER (MTBE)	1	98 - 98				
		TOLUENE	1	113 - 113				
		XYLENES (O/M/P-XYLENE)	1	116 - 116				
EPA 608	Drinking Water	ENDRIN	2	110 - 110	1	0 - 0		
		GAMMA-BHC (LINDANE)	2	60 - 76	1	0 - 6		
	Non-Spec Water	ALDRIN	4	55 - 112	2	0 - 34		
		CHLORDANE	1	78 - 78				
		4,4'-DDT	18	76 - 137	8	0 - 15		
		DIELDRIN	18	72 - 137	9	0 - 28		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 608	Non-Spec Water	ENDRIN	4	77 - 176	3	0 - 25		
		GAMMA-BHC (LINDANE)	4	69 - 123	3	0 - 30		
		HEPTACHLOR	4	79 - 122	3	0 - 9		
		HEPTACHLOR EPOXIDE			1	0 - 3		
		METHOXYCHLOR			1	0 - 6		
		PCB AROCLOR 1242	3	20 - 166	1	0 - 0		
		PCB AROCLOR 1248	3	73 - 92	1	0 - 6		
		PCB AROCLOR 1260	48	30 - 128	10	0 - 20		
		TOXAPHENE	1	124 - 124	1	0 - 2		
	S/S/S	PCB AROCLOR 1260	5	50 - 174	2	0 - 6		
EPA 624	Non-Spec Water	ACROLEIN	13	0 - 208	5	0 - 58		
		ACRYLONITRILE	11	42 - 169	5	0 - 71		
		BENZENE	16	75 - 133	8	0 - 13		
		BROMODICHLOROMETHANE	19	83 - 146	5	0 - 16		
		4-BROMOFLUOROBENZENE	8	87 - 111	3	0 - 8		
		BROMOFORM	19	72 - 138	5	0 - 33		
		BROMOMETHANE	18	50 - 148	5	0 - 27		
		CARBON TETRACHLORIDE	19	80 - 143	5	0 - 13		
		CHLOROBENZENE	16	88 - 116	8	0 - 9		
		CHLOROETHANE	19	64 - 143	5	0 - 25		
		2-CHLOROETHYLVINYLETHER	15	0 - 193	2	0 - 31		
		CHLOROFORM	17	102 - 123	6	0 - 14		
		CHLOROMETHANE	18	22 - 180	5	0 - 41		
		DIBROMOCHLOROMETHANE	19	79 - 140	5	0 - 27		
		1,3-DICHLOROBENZENE (M-DICHLOROBENZENE)	3	69 - 138				
		1,2-DICHLOROBENZENE (O-DICHLOROBENZENE)	3	69 - 138				
		1,4-DICHLOROBENZENE (P-DICHLOROBENZENE)	3	70 - 133				
		1,1-DICHLOROETHANE	18	83 - 127	5	0 - 15		
		1,2-DICHLOROETHANE	19	81 - 151	5	0 - 17		
		DICHLOROETHANE-D4	8	82 - 110	3	0 - 8		
		1,1-DICHLOROETHENE	16	65 - 140	8	0 - 18		
		1,2-DICHLOROETHENE (CIS AND TRANS)	17	81 - 122	4	0 - 18		
		DICHLOROMETHANE (METHYLENE CHLORIDE)	19	5 - 193	5	0 - 9		
		1,2-DICHLOROPROPANE	19	69 - 146	5	0 - 20		
		ETHYL BENZENE	20	65 - 133	5	0 - 22		
		FLUOROTRICHLOROMETHANE	19	71 - 156	5	0 - 20		
		1,1,2,2-TETRACHLOROETHANE	19	62 - 158	5	0 - 29		
		TETRACHLOROETHENE	19	77 - 139	5	0 - 15		
		TOLUENE	14	86 - 121	7	0 - 9		
		TOLUENE-D8	8	87 - 110	3	0 - 2		
		TRANS-1,3-DICHLOROPROPENE	19	66 - 136	5	0 - 31		
		1,1,1-TRICHLOROETHANE	19	75 - 150	6	0 - 12		
		1,1,2-TRICHLOROETHANE	19	71 - 150	5	0 - 13		
		TRICHLOROETHENE	16	63 - 134	8	0 - 20		

N = Sample count
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EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 624	Non-Spec Water	VINYL CHLORIDE	20	59 - 142	5	0 - 28		
EPA 625	Non-Spec Water	ACENAPHTHENE	22	49 - 117	10	0 - 17		
		ACENAPHTHYLENE	11	73 - 108	5	0 - 18		
		ANTHRACENE	11	78 - 110	5	0 - 6		
		BENZ(A)ANTHRACENE	11	86 - 124	5	0 - 15		
		BENZIDINE						
		BENZO(A)PYRENE	11	69 - 137	5	0 - 23		
		BENZO(B)FLUORANTHENE	11	50 - 169	5	0 - 29		
		BENZO(G,H,I)PERYLENE	11	15 - 194	5	0 - 58		
		BENZO(K)FLUORANTHENE	11	36 - 165	5	0 - 47		
		(BENZYLBUTYLPHTHALATE) BUTYLBENZYLPHTHALATE	11	42 - 171	5	0 - 16		
		BIS(2-CHLOROETHOXY)METHANE	11	30 - 142	5	0 - 18		
		BIS(2-CHLOROETHYL)ETHER	11	57 - 123	5	0 - 26		
		BIS(2-CHLOROISOPROPYL)ETHER	11	49 - 142	4	0 - 20		
		BIS(2-ETHYLHEXYL)PHTHALATE	11	0 - 232	5	0 - 35		
		4-BROMOPHENYL-PHENYLETHER	11	77 - 112	5	0 - 26		
		4-CHLORO-3-METHYLPHENOL	22	29 - 138	10	0 - 22		
		2-CHLORONAPHTHALENE	10	87 - 103	5	0 - 16		
		2-CHLOROPHENOL	22	26 - 130	10	0 - 45		
		4-CHLOROPHENYL-PHENYLETHER	11	83 - 109	5	0 - 17		
		CHRYSENE	11	70 - 122	5	0 - 31		
		DI-N-BUTYLPHTHALATE	12	48 - 136	5	0 - 21		
		DI-N-OCTYLPHTHALATE	11	0 - 239	5	0 - 35		
		DIBENZ(A,H)ANTHRACENE	11	17 - 195	5	0 - 63		
		1,3-DICHLOROBENZENE (M-DICHLOROBENZENE)	11	36 - 119	5	0 - 22		
		1,2-DICHLOROBENZENE (O-DICHLOROBENZENE)	11	45 - 121	5	0 - 19		
		1,4-DICHLOROBENZENE (P-DICHLOROBENZENE)	18	19 - 119	9	0 - 29		
		3,3'-DICHLOROBENZIDINE	10	13 - 131	5	0 - 45		
		2,4-DICHLOROPHENOL	11	65 - 111	5	0 - 17		
		DIETHYLPHTHALATE	11	79 - 122	5	0 - 22		
		2,4-DIMETHYLPHENOL	11	33 - 92	5	0 - 39		
		DIMETHYLPHTHALATE	11	53 - 151	5	0 - 10		
		4,6-DINITRO-O-CRESOL	11	0 - 160	5	0 - 108		
		2,4-DINITROPHENOL	11	0 - 170	5	0 - 330		
		2,4-DINITROTOLUENE	22	0 - 175	10	0 - 33		
		2,6-DINITROTOLUENE	11	82 - 123	5	0 - 23		
		FLUORANTHENE	11	52 - 124	5	0 - 19		
		FLUORENE	11	76 - 114	5	0 - 15		
		2-FLUOROBIPHENYL	1	89 - 89				
		2-FLUOROPHENOL	1	71 - 71				
		HEXACHLOROBENZENE	11	52 - 143	5	0 - 41		
		HEXACHLOROBUTADIENE	11	36 - 125	5	0 - 47		
		HEXACHLOROCYCLOPENTADIENE	11	18 - 142	5	0 - 37		

N = Sample count
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RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 625	Non-Spec Water	HEXACHLOROETHANE	11	11 - 153	5	0 - 37		
		INDENO(1,2,3-CD)PYRENE	11	28 - 173	5	0 - 41		
		ISOPHORONE	11	69 - 121	5	0 - 16		
		N-NITROSO-DIPROPYLAMINE	16	30 - 151	6	0 - 9		
		N-NITROSODIMETHYLAMINE	1	20 - 20				
		N-NITROSODIPHENYLAMINE	11	62 - 121	5	0 - 29		
		NAPHTHALENE	11	61 - 115	5	0 - 7		
		NITROBENZENE	11	59 - 151	5	0 - 20		
		NITROBENZENE-D5	1	68 - 68				
		2-NITROPHENOL	11	80 - 140	5	0 - 18		
		4-NITROPHENOL	22	0 - 110	10	0 - 109		
		PENTACHLOROPHENOL	20	18 - 131	9	0 - 13		
		PHENANTHRENE	10	83 - 109	5	0 - 19		
		PHENOL	20	0 - 187	7	0 - 21		
		PHENOL-D5	1	72 - 72				
		PYRENE	20	29 - 156	10	0 - 18		
		TERPHENYL-D14	1	90 - 90				
		2,4,6-TRIBROMOPHENOL	1	98 - 98				
		1,2,4-TRICHLOROBENZENE	22	44 - 115	9	0 - 13		
		2,4,6-TRICHLOROPHENOL	11	57 - 114	5	0 - 27		
	S/S/S	ACENAPHTHENE	4	57 - 107	2	0 - 26		
		ACENAPHTHYLENE	2	46 - 114	1	0 - 20		
		ANTHRACENE	2	69 - 90	1	0 - 18		
		BENZ(A)ANTHRACENE	2	38 - 140	1	0 - 27		
		BENZO(A)PYRENE	2	46 - 135	1	0 - 23		
		BENZO(B)FLUORANTHENE	2	35 - 171	1	0 - 16		
		BENZO(G,H,I)PERYLENE	2	4 - 101	1	0 - 40		
		BENZO(K)FLUORANTHENE	2	82 - 108	1	0 - 6		
		(BENZYLBUTYLPHTHALATE) BUTYLBENZYLPHTHALATE	2	69 - 77	1	0 - 3		
		BIS(2-CHLOROETHOXY)METHANE	2	37 - 84	1	0 - 18		
		BIS(2-CHLOROETHYL)ETHER	2	45 - 108	1	0 - 20		
		BIS(2-CHLOROISOPROPYL)ETHER	2	54 - 109	1	0 - 16		
		BIS(2-ETHYLHEXYL)PHTHALATE	2	61 - 82	1	0 - 7		
		4-BROMOPHENYL-PHENYLETHER	2	40 - 124	1	0 - 24		
		4-CHLORO-3-METHYLPHENOL	2	63 - 92	1	0 - 9		
		2-CHLORONAPHTHALENE	2	38 - 145	1	0 - 27		
		2-CHLOROPHENOL	2	50 - 113	1	0 - 18		
		4-CHLOROPHENYL-PHENYLETHER	2	78 - 107	1	0 - 8		
		CHRYSENE	2	51 - 114	1	0 - 18		
		DI-N-BUTYLPHTHALATE	2	63 - 79	1	0 - 6		
		DI-N-OCTYLPHTHALATE	2	22 - 129	1	0 - 33		
		DIBENZ(A,H)ANTHRACENE	2	6 - 108	1	0 - 42		
		1,3-DICHLOROBENZENE (M-DICHLOROBENZENE)	2	47 - 115	1	0 - 20		

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EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
EPA 625	S/S/S	1,2-DICHLOROBENZENE (O-DICHLOROBENZENE)	2	47 - 115	1	0 - 20		
		1,4-DICHLOROBENZENE (P-DICHLOROBENZENE)	4	51 - 108	2	0 - 34		
		3,3'-DICHLOROBENZIDINE	2	39 - 55	1	0 - 9		
		2,4-DICHLOROPHENOL	2	51 - 98	1	0 - 15		
		DIETHYLPHTHALATE	2	78 - 94	1	0 - 5		
		2,4-DIMETHYLPHENOL	2	46 - 96	1	0 - 11		
		DIMETHYLPHTHALATE	2	82 - 108	1	0 - 6		
		4,6-DINITRO-O-CRESOL	2	0 - 71	1	0 - 92		
		2,4-DINITROPHENOL	1	25 - 25				
		2,4-DINITROTOLUENE	4	27 - 141	2	0 - 43		
		2,6-DINITROTOLUENE	2	85 - 93	1	0 - 2		
		FLUORANTHENE	2	32 - 116	1	0 - 27		
		FLUORENE	2	88 - 104	1	0 - 14		
		HEXACHLOROBENZENE	2	49 - 122	1	0 - 20		
		HEXACHLOROBUTADIENE	2	50 - 113	1	0 - 18		
		HEXACHLOROCYCLOPENTADIENE	2	5 - 120	1	0 - 40		
		HEXACHLOROETHANE	2	52 - 102	1	0 - 16		
		INDENO(1,2,3-CD)PYRENE	2	2 - 117	1	0 - 45		
		ISOPHORONE	2	58 - 87	1	0 - 10		
		N-NITROSO-DIPROPYLAMINE	2	52 - 91	1	0 - 13		
		N-NITROSODIPHENYLAMINE	2	50 - 105	1	0 - 17		
		NAPHTHALENE	2	47 - 115	1	0 - 20		
		NITROBENZENE	2	54 - 101	1	0 - 14		
		2-NITROPHENOL	2	65 - 128	1	0 - 9		
		4-NITROPHENOL	2	0 - 179	1	0 - 76		
		PENTACHLOROPHENOL	2	1 - 85	1	0 - 47		
		PHENANTHRENE	2	45 - 126	1	0 - 14		
		PHENOL	2	51 - 98	1	0 - 15		
		PYRENE	4	51 - 116	2	0 - 48		
		1,2,4-TRICHLOROBENZENE	4	49 - 105	2	0 - 31		
		2,4,6-TRICHLOROPHENOL	2	55 - 94	1	0 - 12		
ILM01	Non-Spec Water	ALUMINUM	40	88 - 107	19	0 - 5		
		ANTIMONY	37	75 - 103	16	0 - 7		
		ARSENIC	28	74 - 116	13	0 - 11		
		BARIUM	42	87 - 110	19	0 - 4		
		BERYLLIUM	39	81 - 129	17	0 - 5		
		CADMIUM	42	71 - 120	20	0 - 9		
		CALCIUM	38	81 - 104	17	0 - 4		
		CHROMIUM	42	82 - 109	20	0 - 4		
		COBALT	40	84 - 110	19	0 - 3		
		COPPER	39	86 - 120	18	0 - 5		
		IRON	38	75 - 116	16	0 - 5		
		LEAD	62	82 - 111	27	0 - 7		
		MAGNESIUM	38	82 - 113	17	0 - 4		
		MANGANESE	40	87 - 112	18	0 - 3		

N : Sample count
REC = Percent Recovery (observed/actual*100)
RPD : Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
ILM01	Non-Spec Water	MERCURY	28	76 - 111	14	0 - 7	———	———
		NICKEL	41	82 - 110	19	0 - 3	———	———
		POTASSIUM	38	87 - 107	18	0 - 5	———	———
		SELENIUM	26	75 - 117	13	0 - 15	———	———
		SILVER	42	85 - 120	20	0 - 11	———	———
		SODIUM	38	84 - 109	18	0 - 5	———	———
		THALLIUM	65	70 - 111	30	0 - 11	———	———
		VANADIUM	40	82 - 108	19	0 - 3	———	———
		ZINC	37	77 - 116	17	0 - 7	———	———
	Oil	ALUMINUM	2	71 - 79	1	0 - 1	———	———
		ANTIMONY	2	55 - 63	1	0 - 2	———	———
		ARSENIC	2	83 - 104	1	0 - 5	———	———
		BARIUM	4	85 - 102	2	0 - 4	———	———
		BERYLLIUM	2	81 - 115	1	0 - 7	———	———
		CADMIUM	4	20 - 144	2	0 - 3	———	———
		CALCIUM	2	69 - 77	1	0 - 2	———	———
		CHROMIUM	4	47 - 133	2	0 - 11	———	———
		COBALT	2	74 - 74	1	0 - 0	———	———
		COPPER	2	81 - 89	1	0 - 2	———	———
		IRON	2	68 - 110	1	0 - 11	———	———
		LEAD	6	26 - 142	3	0 - 4	———	———
		MAGNESIUM	2	80 - 80	1	0 - 1	———	———
		MANGANESE	2	77 - 85	1	0 - 2	———	———
		NICKEL	2	66 - 66	1	0 - 1	———	———
		POTASSIUM	2	77 - 85	1	0 - 3	———	———
		SELENIUM	2	82 - 103	1	0 - 5	———	———
		SILVER	6	59 - 90	3	0 - 21	———	———
		SODIUM	2	83 - 91	1	0 - 2	———	———
		THALLIUM	2	75 - 75	1	0 - 0	———	———
		VANADIUM	2	75 - 83	1	0 - 2	———	———
		ZINC	2	64 - 64	1	0 - 0	———	———
	S/S/S	ANTIMONY	12	0 - 105	6	0 - 31	———	———
		ARSENIC	40	45 - 137	19	0 - 28	———	———
		BARIUM	54	76 - 118	25	0 - 12	———	———
		BERYLLIUM	51	64 - 128	23	0 - 11	———	———
		CADMIUM	45	64 - 127	22	0 - 16	———	———
		CALCIUM	34	61 - 125	15	0 - 38	———	———
		CHROMIUM	49	67 - 128	24	0 - 25	———	———
		COBALT	51	69 - 119	25	0 - 11	———	———
		COPPER	42	71 - 120	19	0 - 15	———	———
		LEAD	42	66 - 112	20	0 - 19	———	———
		MAGNESIUM	47	75 - 122	23	0 - 19	———	———
		MANGANESE	13	70 - 138	4	0 - 28	———	———
		MERCURY	49	70 - 123	23	0 - 11	———	———

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)
(qao2.sql)

KMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
ILM01	S/S/S	NICKEL	49	70 - 118	25	0 - 15		
		POTASSIUM	49	75 - 113	22	0 - 8		
		SELENIUM	38	61 - 120	19	0 - 24		
		SILVER	48	75 - 120	24	0 - 13		
		SODIUM	52	72 - 120	24	0 - 6		
		THALLIUM	83	60 - 126	36	0 - 11		
		VANADIUM	53	70 - 122	26	0 - 15		
		ZINC	36	70 - 126	18	0 - 24		
NIOSH P&CAM 125	Non-Spec Water	FORMALDEHYDE	2	73 - 107				
	S/S/S	FORMALDEHYDE			2	0 - 13		
SAS	Non-Spec Water	ACIDITY TO PH 11			1	0 - 19		
		ACRYLAMIDE	2	150 - 155	1	0 - 1		
		ACRYLIC ACID	25	86 - 124	13	0 - 5		
		BENZOIC ACID	2	110 - 110	1	0 - 0		
		BIS-ACRYLAMIDE	2	100 - 113	1	0 - 3		
		DIQUAT	4	59 - 114	2	0 - 57		
		HYDROQUINONE	2	85 - 89	1	0 - 0		
		4-METHYLPHENOL (P-CRESOL)	2	95 - 95	1	0 - 0		
		NITRATE	2	99 - 104	1	0 - 0		
		PARAQUAT	3	31 - 92	2	0 - 71		
		PHENOL	2	95 - 95	1	0 - 0		
		UREA	2	12 - 177	1	0 - 52		
	OIL	LEAD	2	92 - 113	1	0 - 3		
	S/S/S	ACIDITY TO PH 11			40	0 - 16		
		ETHYLENE GLYCOL	2	20 - 75	1	0 - 85		
		HYDROFLUORIC ACID			3	0 - 34		
		ISOFENPHOS	2	99 - 112	1	0 - 2		
		4-METHYLPHENOL (P-CRESOL)	2	68 - 136	1	0 - 16		
		MOISTURE CONTENT			3	0 - 10		
		NITRIC ACID			4	0 - 17		
		PH			1	0 - 0		
		PHENOL	2	97 - 97	1	0 - 0		
		SOLIDS			17	0 - 19		
		TETRAMETHYLTHIURAM DISULFIDE	2	79 - 129	1	0 - 12		
SM 320A 14TH ED	Drinking Water	CHLORIDE	1	114 - 114	1	0 - 5		
	Non-Spec Water	CHLORIDE	1	118 - 118	1	0 - 4		
SM 405	S/S/S	BROMIDE	2	92 - 118	1	0 - 10		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)
(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SM 407A	Drinking Water	CHLORIDE	1	100 - 100				
	Non-Spec Water	CHLORIDE	11	83 - 124	14	0 - 6		
	S/S/S	CHLORIDE	4	92 - 120	15	0 - 11		
SM 503B	S/S/S	OIL AND GREASE	2	56 - 124	1	0 - 18		
SM 503E	S/S/S	PETROLEUM HYDROCARBONS	49	76 - 108	29	0 - 22		
SW846-1010	S/S/S	IGNITABILITY			19	0 - 8		
SW846-6010	Non-Spec Water	ALUMINUM	15	72 - 124	10	0 - 35		
		ANTIMONY	30	65 - 100	7	0 - 6		
		BARIUM	149	82 - 111	85	0 - 8		
		BERYLLIUM	28	53 - 154	9	0 - 222		
		BORON	70	81 - 127	14	0 - 50		
		CADMIUM	137	59 - 124	52	0 - 14		
		CALCIUM	37	79 - 104	29	0 - 4		
		CHROMIUM	143	77 - 111	52	0 - 19		
		COBALT	25	77 - 107	7	0 - 3		
		COPPER	58	84 - 112	16	0 - 290		
		IRON	111	72 - 114	69	0 - 30		
		LEAD	17	75 - 111	3	0 - 24		
		LITHIUM	40	89 - 110	19	0 - 6		
		MAGNESIUM	35	85 - 109	25	0 - 3		
		MANGANESE	112	82 - 114	57	0 - 4		
		MOLYBDENUM	40	85 - 107	19	0 - 4		
		NICKEL	126	79 - 111	57	0 - 27		
		POTASSIUM	25	85 - 109	16	0 - 6		
		SILICON			4	0 - 5		
		SILVER	147	80 - 121	47	0 - 11		
		SODIUM	124	81 - 113	73	0 - 5		
		STRONTIUM	40	78 - 109	18	0 - 4		
		THALLIUM	1	89 - 89				
		TIN	34	80 - 105	16	0 - 4		
		TITANIUM	38	86 - 111	18	0 - 4		
		VANADIUM	28	78 - 103	10	0 - 40		
		ZINC	53	81 - 106	35	0 - 107		
	Oil	ALUMINUM	4	37 - 132	6	0 - 12		
		BARIUM	16	77 - 110	11	0 - 13		
		BERYLLIUM	4	40 - 151				
		CADMIUM	13	52 - 108	8	0 - 26		
		CALCIUM	3	42 - 112	7	0 - 19		
		CHROMIUM	21	37 - 142	18	0 - 16		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-6010	Oil	COPPER	2	42 - 136	5	0 - 18		
		IRON	1	68 - 68	5	0 - 11		
		LEAD	13	43 - 107	15	0 - 20		
		LITHIUM	2	89 - 97	1	0 - 1		
		MAGNESIUM	4	49 - 111	5	0 - 30		
		MOLYBDENUM	2	71 - 79	1	0 - 2		
		NICKEL	4	58 - 100	2	0 - 4		
		SILICON			5	0 - 16		
		SILVER	10	63 - 120	3	0 - 23		
		SODIUM	4	54 - 113	6	0 - 61		
		STRONTIUM	2	80 - 96	1	0 - 3		
		TIN	1	68 - 68	6	0 - 27		
		TITANIUM	5	71 - 92	5	0 - 10		
		ZINC	1	124 - 124	7	0 - 13		
	S/S/S	ALUMINUM	5	95 - 102	14	0 - 15		
		ANTIMONY	5	45 - 87	1	0 - 0		
		BARIUM	74	72 - 121	54	0 - 24		
		BERYLLIUM	27	52 - 130	9	0 - 1		
		BORON	4	82 - 125	8	0 - 150		
		CADMIUM	64	47 - 127	24	0 - 40		
		CALCIUM	12	67 - 116	21	0 - 18		
		CHROMIUM	82	56 - 132	82	0 - 36		
		COBALT	11	71 - 105	7	0 - 5		
		COPPER	52	72 - 121	59	0 - 22		
		IRON	6	60 - 126	18	0 - 149		
		LEAD	82	52 - 120	63	0 - 39		
		LITHIUM	53	82 - 112	24	0 - 7		
		MAGNESIUM	21	71 - 125	22	0 - 26		
		MANGANESE	8	57 - 135	12	0 - 9		
		MOLYBDENUM	57	76 - 104	25	0 - 4		
		NICKEL	53	65 - 121	52	0 - 29		
		POTASSIUM	12	74 - 116	5	0 - 6		
		SILICON			2	0 - 1		
		SILVER	64	64 - 123	15	0 - 21		
		SODIUM	20	80 - 110	15	0 - 9		
		STRONTIUM	53	75 - 112	27	0 - 10		
		THALLIUM	13	67 - 94				
		TIN	44	67 - 117	20	0 - 9		
		TITANIUM	29	0 - 199	13	0 - 39		
		VANADIUM	14	66 - 126	11	0 - 11		
		ZINC	32	61 - 122	60	0 - 149		
SW846-7020	Non-Spec Water	ALUMINUM	13	0 - 258	7	0 - 6		
	S/S/S	ALUMINUM	4	50 - 174	6	0 - 27		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-7040	S/S/S	ANTIMONY	4	48 - 136				
SW846-7041	Non-Spec Water	ANTIMONY	5	56 - 125	2	0 - 49		
	Oil	ANTIMONY	4	55 - 114				
	S/S/S	ANTIMONY	5	71 - 97	1	0 - 1		
SW846-7060	Non-Spec Water	ARSENIC	171	70 - 123	72	0 - 16		
	Oil	ARSENIC	21	33 - 129	4	0 - 26		
	S/S/S	ARSENIC	158	47 - 139	94	0 - 23		
SW846-7080	Non-Spec Water	BARIUM	29	71 - 131	13	0 - 28		
	Oil	BARIUM	2	68 - 118	1	0 - 8		
	S/S/S	BARIUM	60	55 - 150	85	0 - 18		
SW846-7090	S/S/S	BERYLLIUM	5	88 - 132				
SW846-7091	Non-Spec Water	BERYLLIUM	4	83 - 95	2	0 - 9		
	S/S/S	BERYLLIUM	4	44 - 162	3	0 - 20		
SW846-7130	Non-Spec Water	CADMIUM	10	69 - 123	4	0 - 21		
	Oil	CADMIUM	7	61 - 121	3	0 - 16		
	S/S/S	CADMIUM	118	69 - 124	69	0 - 20		
SW846-7131	Non-Spec Water	CADMIUM	87	56 - 135	17	0 - 20		
	Oil	CADMIUM	8	56 - 134				
	S/S/S	CADMIUM	5	45 - 136	7	0 - 11		
SW846-7140	Non-Spec Water	CALCIUM	2	99 - 99	5	0 - 17		
SW846-7190	Non-Spec Water	CHROMIUM	19	72 - 113	12	0 - 10		
	Oil	CHROMIUM	6	52 - 143	2	0 - 10		
	S/S/S	CHROMIUM	178	45 - 140	125	0 - 25		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)
(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-7191	Non-Spec Water	CHROMIUM	12	73 - 117	3	0 - 17		
SW846-7196	Non-Spec Water	HEXAVALENT CHROMIUM	7	76 - 124	3	0 - 12		
	S/S/S	HEXAVALENT CHROMIUM			1	0 - 18		
SW846-7200	S/S/S	COBALT	6	66 - 130	2	0 - 92		
SW846-7210	Non-Spec Water	COPPER	22	80 - 124	9	0 - 6		
	S/S/S	COPPER	53	54 - 136	36	0 - 21		
SW846-7380	Non-Spec Water	IRON	18	70 - 122	8	0 - 5		
	S/S/S	IRON	6	37 - 179	9	0 - 18		
SW846-7420	Non-Spec Water	LEAD	13	89 - 113	7	0 - 7		
	Oil	LEAD	6	65 - 103	6	0 - 12		
	S/S/S	LEAD	181	65 - 134	117	0 - 21		
SW846-7421	Non-Spec Water	LEAD	298	72 - 125	107	0 - 16		
	Oil	LEAD	8	51 - 145				
	S/S/S	LEAD	6	62 - 124	26	0 - 19		
SW846-7450	Non-Spec Water	MAGNESIUM	2	80 - 80	5	0 - 13		
	S/S/S	MAGNESIUM	1	88 - 88	1	0 - 12		
SW846-7460	Non-Spec Water	MANGANESE	4	57 - 123	2	0 - 5		
	S/S/S	MANGANESE	4	59 - 152	5	0 - 10		
SW846-7470	Non-Spec Water	MERCURY	167	65 - 125	55	0 - 13		
	S/S/S	MERCURY	51	65 - 128	10	0 - 10		
SW846-7471	Oil	MERCURY	7	69 - 120	2	0 - 0		
	S/S/S	MERCURY	112	60 - 129	33	0 - 26		
SW846-7480	S/S/S	MOLYBDENUM	2	74 - 150				

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-7520	Non-Spec Water	NICKEL	14	58 - 128	7	0 - 20		
	S/S/S	NICKEL	34	61 - 132	50	0 - 17		
SW846-7610	Non-Spec Water	POTASSIUM	4	89 - 92	3	0 - 27		
	S/S/S	POTASSIUM			2	0 - 3		
SW846-7740	Non-Spec Water	SELENIUM	141	64 - 134	46	0 - 19		
	Oil	SELENIUM	9	41 - 117	4	0 - 6		
	S/S/S	SELENIUM	100	39 - 146	27	0 - 28		
SW846-7760	Non-Spec Water	SILVER	3	72 - 141	1	0 - 0		
	Oil	SILVER	2	96 - 96	1	0 - 0		
	S/S/S	SILVER	51	51 - 135	13	0 - 9		
SW846-7761	Non-Spec Water	SILVER	4	104 - 118	1	0 - 3		
SW846-7770	Non-Spec Water	SODIUM	5	74 - 148	4	0 - 6		
	S/S/S	SODIUM	2	105 - 105	3	0 - 22		
SW846-7780	Non-Spec Water	STRONTIUM	17	42 - 150	9	0 - 12		
	S/S/S	STRONTIUM	8	68 - 140	4	0 - 22		
SW846-7840	S/S/S	THALLIUM	2	74 - 121				
SW846-7841	Non-Spec Water	THALLIUM	42	57 - 126	11	0 - 9		
	Oil	THALLIUM	4	55 - 115				
	S/S/S	THALLIUM	20	32 - 145	7	0 - 24		
SW846-7870	Non-Spec Water	TIN						
	Oil	TIN	1	89 - 82				
SW846-7910	Non-Spec Water	VANADIUM			1	0 - 3		
	S/S/S	VANADIUM	4	28 - 165	1	0 - 0		

N : Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-7950	Non-Spec Water	ZINC	21	77 - 118	10	0 - 11		
	S/S/S	ZINC	43	61 - 136	35	0 - 26		
SW846-8000	Non-Spec Water	CYCLOHEXANONE	2	73 - 123	1	0 - 12		
		DIESEL FUEL	2	71 - 134	1	0 - 15		
		1,4-DIOXANE	2	65 - 78	1	0 - 5		
		ETHYLENE GLYCOL	2	0 - 150	1	0 - 5		
		ETHYLENE OXIDE	2	60 - 110	1	0 - 14		
		GASOLINE	8	47 - 133	4	0 - 10		
		ISOBUTANOL	2	110 - 118	1	0 - 2		
		ISOPROPYL ALCOHOL (2-PROPANOL)	2	99 - 115	1	0 - 4		
		METHANOL	2	105 - 186	1	0 - 13		
		MINERAL SPIRITS	1	62 - 62				
		N,N-DIMETHYLFORMAMIDE (DMF)	2	94 - 120	1	0 - 6		
		UNKNOWN HYDROCARBON			1	0 - 0		
	Oil	BENZENE	2	89 - 94	1	0 - 2		
		CHLOROBENZENE	2	88 - 96	1	0 - 2		
		2-METHYLPHENOL (O-CRESOL)	2	93 - 93	1	0 - 0		
		XYLENES (O/M/P-XYLENE)	2	90 - 95	1	0 - 2		
	S/S/S	ACETONE	16	62 - 123	8	0 - 24		
		BENZENE	2	76 - 110	1	0 - 9		
		CHLOROBENZENE	2	57 - 130	1	0 - 18		
		DICHLOROMETHANE (METHYLENE CHLORIDE)	2	69 - 124	1	0 - 13		
		DIESEL FUEL	2	11 - 147	1	0 - 34		
		ETHANOL	7	51 - 142	3	0 - 25		
		ETHYL ACETATE	8	35 - 119	4	0 - 17		
		GASOLINE	2	70 - 78	1	0 - 3		
		ISOAMYL ALCOHOL, PRIMARY	2	87 - 92	1	0 - 1		
		METHANOL	6	41 - 127	3	0 - 30		
		2-METHYL-1-BUTANOL	2	87 - 92	1	0 - 1		
		2-METHYLPHENOL (O-CRESOL)	2	40 - 163	1	0 - 29		
		3-METHYLPHENOL/4-METHYLPHENOL (M/P-CRESOL)	4	62 - 150	2	0 - 82		
		MINERAL SPIRITS	1	94 - 94				
		N,N-DIMETHYLFORMAMIDE (DMF)	10	73 - 132	5	0 - 18		
		N-AMYL ALCOHOL, PRIMARY	2	68 - 89	1	0 - 6		
		N-BUTYL ACETATE	2	85 - 90	1	0 - 1		
		N-HEXANE	2	94 - 95	1	0 - 11		
		2-NITROPROPANE	2	68 - 115	1	0 - 12		
		OTHER HYDROCARBONS	4	86 - 109	2	0 - 14		
		PYRIDINE	2	44 - 146	1	0 - 25		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-8000	S/S/S	TOLUENE	4	68 - 112	2	0 - 39		
		1,1,2-TRICHLOROETHANE	2	62 - 125	1	0 - 16		
		TRICHLOROETHENE	2	90 - 103	1	0 - 3		
		TRICHLOROETHYLENE	1	110 - 110				
		TRIETHYLAMINE	1	20 - 20				
		XYLENES (O/M/P-XYLENE)	2	59 - 59	1	0 - 0		
SW846-8010	Non-Spec Water	1,1-DICHLOROETHANE			1	0 - 7		
		1,2-DICHLOROETHANE			1	0 - 27		
		1,1-DICHLOROETHENE			1	0 - 22		
		DICHLOROMETHANE (METHYLENE CHLORIDE)			1	0 - 6		
		TRANS-1,2-DICHLOROETHENE			1	0 - 10		
		1,1,1-TRICHLOROETHANE			2	0 - 66		
		TRICHLOROETHENE			2	0 - 25		
	S/S/S	1,4-DICHLOROBENZENE (P-DICHLOROBENZENE)			1	0 - 10		
		1,1-DICHLOROETHENE	14	46 - 133	7	0 - 17		
		1,1,1-TRICHLOROETHANE	14	52 - 135	7	0 - 18		
SW846-8015	Non-Spec Water	CYCLOHEXANONE	2	100 - 108	1	0 - 2		
		ETHANOL	2	81 - 86	1	0 - 1		
		GASOLINE	2	56 - 95				
		ISOBUTANOL	6	87 - 113	3	0 - 16		
		METHANOL	2	112 - 125	1	0 - 3		
		N-BUTYL ALCOHOL	2	97 - 105	1	0 - 2		
	Oil	CYCLOHEXANONE	2	84 - 113	1	0 - 7		
		ETHANOL	2	72 - 127	1	0 - 13		
		ISOBUTANOL	2	81 - 128	1	0 - 11		
		METHANOL	2	111 - 116	1	0 - 1		
		N-BUTYL ALCOHOL	2	86 - 112	1	0 - 6		
	S/S/S	CYCLOHEXANONE	7	44 - 143	3	0 - 16		
		GASOLINE	2	92 - 92				
		ISOBUTANOL	9	53 - 131	4	0 - 17		
		ISOPROPYL ALCOHOL (2-PROPANOL)	1	97 - 97				
		METHANOL	10	47 - 157	5	0 - 31		
		N-BUTYL ALCOHOL	9	60 - 147	4	0 - 10		
		TERTIARY BUTYL ALCOHOL	2	40 - 56	1	0 - 8		
SW846-8015 MOD	Non-Spec Water	2-BUTOXYETHANOL			1	0 - 3		
		GASOLINE	10	80 - 127	5	0 - 11		
		HEXANE	2	101 - 101	1	0 - 0		
		ISOBUTANOL	2	102 - 110	1	0 - 2		
		ISOPROPYL ALCOHOL (2-PROPANOL)			1	0 - 0		
		METHANOL	2	85 - 98	1	0 - 3		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-8015 MOD	Non-Spec Water	PYRIDINE	2	57 - 65	1	0 - 3		
		TERPINEOL(ALPHA)			1	0 - 5		
	S/S/S	ACETONE	2	85 - 101	1	0 - 4		
		DIESEL FUEL	6	79 - 137	4	0 - 26		
		2-ETHOXYETHANOL	2	106 - 111	1	0 - 1		
		GASOLINE	26	72 - 129	13	0 - 33		
		HEXANE	6	60 - 122	3	0 - 3		
		ISOBUTANOL	2	95 - 100	1	0 - 1		
		METHANOL	4	73 - 110	2	0 - 23		
		2-NITROPROPANE	2	93 - 109	1	0 - 4		
		PYRIDINE	8	61 - 130	4	0 - 7		
SW846-8020	Non-Spec Water	BENZENE	3	5 - 108	2	0 - 35		
		ETHYL BENZENE	3	54 - 117	2	0 - 37		
		M/P-XYLENE	3	61 - 118	2	0 - 4		
		METHYL-T-BUTYL ETHER (MTBE)	3	19 - 105				
		O-XYLENE	3	74 - 113	2	0 - 26		
		TOLUENE	3	12 - 140	2	0 - 21		
	S/S/S	BENZENE	68	63 - 125	34	0 - 15		
		ETHYL BENZENE	74	59 - 127	36	0 - 19		
		M/P-XYLENE	59	55 - 129	30	0 - 19		
		METHYL-T-BUTYL ETHER (MTBE)	1	138 - 138	1	0 - 11		
		NAPHTHALENE	2	70 - 117	1	0 - 12		
		O-XYLENE	59	54 - 137	28	0 - 21		
		TOLUENE	74	51 - 136	37	0 - 26		
SW846-8021	Non-Spec Water	BENZENE	1	92 - 92				
		1,1-DICHLOROETHANE	1	114 - 114				
		DICHLOROMETHANE (METHYLENE CHLORIDE)	1	85 - 85				
		ETHYL BENZENE	1	89 - 89				
		TOLUENE	1	90 - 90				
	S/S/S	BENZENE	22	64 - 122	11	0 - 14		
		CARBON TETRACHLORIDE	2	79 - 87	1	0 - 2		
		1,4-DICHLOROBENZENE (P-DICHLOROBENZENE)	2	82 - 124	1	0 - 10		
		1,1-DICHLOROETHANE	4	37 - 162	2	0 - 13		
		1,2-DICHLOROETHANE	2	101 - 117	1	0 - 4		
		1,1-DICHLOROETHENE	16	59 - 120	8	0 - 20		
		ETHYL BENZENE	20	55 - 129	10	0 - 13		
		M/P-XYLENE	2	74 - 90	1	0 - 5		
		O-XYLENE	2	83 - 83	1	0 - 0		
		TOLUENE	18	60 - 126	8	0 - 8		
		1,1,1-TRICHLOROETHANE	20	60 - 136	10	0 - 17		
		TRICHLOROETHENE	2	116 - 121	1	0 - 1		

N = Sample count
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RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)
(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-8021	S/S/S	VINYL CHLORIDE	2	143 - 203	1	0 - 8		
SW846-8040	S/S/S	4-CHLORO-3-METHYLPHENOL	2	40 - 100	1	0 - 20		
		2,4-DICHLOROPHENOL	2	58 - 79	1	0 - 7		
		4,6-DINITRO-2-METHYLPHENOL	2	32 - 45	1	0 - 8		
		2-NITROPHENOL	2	70 - 75	1	0 - 1		
		PENTACHLOROPHENOL	2	36 - 57	1	0 - 11		
		PHENOL	4	90 - 106	2	0 - 11		
		2,4,6-TRICHLOROPHENOL	2	88 - 93	1	0 - 1		
SW846-8080	Drinking Water	ENDRIN	4	64 - 125	2	0 - 17		
		GAMMA-BHC (LINDANE)	4	76 - 85	2	0 - 10		
	Non-Spec Water	ALDRIN	59	24 - 121	29	0 - 34		
		4,4'-DDT	57	48 - 135	29	0 - 36		
		DIELDRIN	59	60 - 120	28	0 - 18		
		ENDRIN	56	59 - 148	27	0 - 30		
		GAMMA-BHC (LINDANE)	59	50 - 114	30	0 - 22		
		HEPTACHLOR	61	39 - 137	29	0 - 34		
		PCB AROCLOR 1232			1	0 - 13		
		PCB AROCLOR 1254			1	0 - 21		
		PCB AROCLOR 1260	82	59 - 126	38	0 - 20		
	Oil	ALDRIN	2	66 - 79	1	0 - 13		
		4,4'-DDT	2	116 - 132	1	0 - 4		
		DIELDRIN	2	110 - 115	1	0 - 6		
		ENDRIN	2	133 - 138	1	0 - 0		
		GAMMA-BHC (LINDANE)	2	92 - 113	1	0 - 4		
		HEPTACHLOR	2	102 - 107	1	0 - 9		
		PCB AROCLOR 1016						
		PCB AROCLOR 1221						
		PCB AROCLOR 1232						
		PCB AROCLOR 1242			1	0 - 35		
		PCB AROCLOR 1248	24	61 - 119	13	0 - 29		
		PCB AROCLOR 1254	2	50 - 66	1	0 - 3		
		PCB AROCLOR 1260	154	54 - 129	74	0 - 26		
		PCB AROCLOR 1262						
	S/S/S	ALDRIN	6	4 - 103	3	0 - 13		
		2-CHLOROBIPHENYL	24	0 - 197	8	0 - 64		
		3-CHLOROBIPHENYL	24	29 - 164	8	0 - 61		
		4-CHLOROBIPHENYL	26	0 - 232	9	0 - 69		
		4,4'-DDT	8	0 - 164	4	0 - 36		
		DIELDRIN	6	22 - 172	3	0 - 50		
		ENDRIN	15	0 - 362	4	0 - 159		
		GAMMA-BHC (LINDANE)	14	21 - 157	4	0 - 88		

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EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-8080	S/S/S	HEPTACHLOR	15	29 - 151	4	0 - 23		
		HEPTACHLOR EPOXIDE	9	0 - 189	2	0 - 22		
		METHOXYCHLOR	9	18 - 135	2	0 - 30		
		PCB AROCLOR 1232	1	59 - 59				
		PCB AROCLOR 1242	7	46 - 106	5	0 - 83		
		PCB AROCLOR 1248	77	35 - 150	12	0 - 15		
		PCB AROCLOR 1254	18	51 - 154	9	0 - 37		
		PCB AROCLOR 1260	366	41 - 140	124	0 - 23		
		TOXAPHENE	8	67 - 124	2	0 - 17		
SW846-8100	S/S/S	ACENAPHTHENE	7	22 - 151	3	0 - 32		
		ACENAPHTHYLENE	9	25 - 147	4	0 - 30		
		ANTHRACENE	7	0 - 200	3	0 - 23		
		BENZO(A)PYRENE	9	31 - 182	4	0 - 51		
		BENZO(B)FLUORANTHENE	5	21 - 200	2	0 - 51		
		BENZO(G,H,I)PERYLENE	11	44 - 166	5	0 - 47		
		BENZO(K)FLUORANTHENE	5	19 - 175	2	0 - 13		
		CHRYSENE	7	46 - 167	3	0 - 26		
		DIBENZ(A,H)ANTHRACENE	5	1 - 200	2	0 - 25		
		FLUORANTHENE	11	0 - 180	5	0 - 66		
		FLUORENE	11	21 - 164	5	0 - 26		
		INDENO(1,2,3-CD)PYRENE	5	0 - 231	2	0 - 152		
		NAPHTHALENE	11	32 - 136	5	0 - 33		
		PHENANTHRENE	7	0 - 209	3	0 - 30		
		PYRENE	5	74 - 152	2	0 - 16		
SW846-8141	Non-Spec Water	DISULFOTON	2	100 - 113	1	0 - 3		
		FANPHUR	2	103 - 108	1	0 - 1		
		METHYL PARATHION	6	23 - 169	3	0 - 16		
		PARATHION	6	25 - 143	3	0 - 16		
		PHORATE	2	90 - 116	1	0 - 5		
	S/S/S	MALATHION	2	52 - 149	3	0 - 32		
SW846-8150	Drinking Water	2,4-DICHLOROPHENOXYACETIC ACID	5	41 - 189	2	0 - 48		
		SILVEX	5	68 - 137	2	0 - 13		
		2,4,5-TRICHLOROPHENOXYACETIC ACID (SILVEX)	2	87 - 121	1	0 - 8		
	Non-Spec Water	2,4-DICHLOROPHENOXYACETIC ACID	11	0 - 183	4	0 - 25		
		SILVEX	11	13 - 174	4	0 - 30		
		2,4,5-TRICHLOROPHENOXYACETIC ACID (SILVEX)	6	41 - 129	3	0 - 41		

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(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-8150	S/S/S	2,4-DICHLOROPHENOXYACETIC ACID	23	0 - 194	5	0 - 43		
		SILVEX	21	22 - 160	4	0 - 27		
		2,4,5-TRICHLOROPHENOXYACETIC ACID (SILVEX)	2	54 - 88	1	0 - 11		
SW846-8240	Non-Spec Water	BENZENE	27	85 - 124	14	0 - 16		
		BROMODICHLOROMETHANE						
		4-BROMOFLUOROBENZENE	2	88 - 96	1	0 - 2		
		BROMOFORM						
		BROMOMETHANE						
		CARBON TETRACHLORIDE						
		CHLOROBENZENE	19	86 - 117	10	0 - 11		
		CHLOROETHANE						
		2-CHLOROETHYLVINYLETHER						
		CHLOROFORM						
		CHLOROMETHANE						
		CIS-1,3-DICHLOROPROPENE						
		DIBROMOCHLOROMETHANE						
		1,1-DICHLOROETHANE						
		1,2-DICHLOROETHANE						
		DICHLOROETHANE-D4	2	93 - 101	1	0 - 2		
		1,1-DICHLOROETHENE	17	59 - 137	9	0 - 36		
		1,2-DICHLOROETHENE (CIS AND TRANS)						
		DICHLOROMETHANE (METHYLENE CHLORIDE)						
		1,2-DICHLOROPROPANE						
		ETHYL BENZENE						
		FLUOROTRICHLOROMETHANE						
		METHYL-T-BUTYL ETHER (MTBE)						
		1,1,2,2-TETRACHLOROETHANE						
		TETRACHLOROETHENE						
		TOLUENE	25	84 - 121	13	0 - 13		
		TOLUENE-D8	2	90 - 95	1	0 - 2		
		TRANS-1,3-DICHLOROPROPENE						
		1,1,1-TRICHLOROETHANE						
		1,1,2-TRICHLOROETHANE						
		TRICHLOROETHENE	16	72 - 124	9	0 - 13		
		VINYL CHLORIDE						
	Oil	BENZENE	4	92 - 109	2	0 - 11		
		CHLOROBENZENE	4	63 - 153	2	0 - 13		
		1,1-DICHLOROETHENE	4	70 - 96	2	0 - 7		
		TOLUENE	4	0 - 205	2	0 - 64		
		TRICHLOROETHENE	4	60 - 102	2	0 - 25		
	S/S/S	ACETONE	1	89 - 89				

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EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-8240	S/S/S	BENZENE	25	79 - 122	12	0 - 19		
		4-BROMOFLUOROBENZENE	14	70 - 119	3	0 - 17		
		CARBON TETRACHLORIDE	15	71 - 129				
		CHLOROBENZENE	18	69 - 119	9	0 - 14		
		CHLOROFORM	17	83 - 122	1	0 - 4		
		1,2-DICHLOROETHANE	17	79 - 126	1	0 - 2		
		DICHLOROETHANE-D4	14	76 - 123	3	0 - 25		
		1,1-DICHLOROETHENE	16	39 - 159	8	0 - 22		
		1,1-DICHLOROETHYLENE	15	81 - 126				
		METHYL ETHYL KETONE	17	0 - 209	1	0 - 19		
		STYRENE			1	0 - 2		
		TETRACHLOROETHYLENE	15	63 - 118				
		TOLUENE	25	60 - 139	12	0 - 18		
		TOLUENE-D8	14	80 - 127	3	0 - 6		
		TRICHLOROETHENE	16	66 - 110	8	0 - 16		
		TRICHLOROETHYLENE	15	71 - 122				
		VINYL CHLORIDE	15	69 - 122				
SW846-8270	Non-Spec Water	ACENAPHTHENE	56	40 - 129	28	0 - 21		
		ACENAPHTHYLENE						
		ANTHRACENE						
		BENZ(A)ANTHRACENE						
		BENZO(A)PYRENE						
		BENZO(B)FLUORANTHENE						
		BENZO(G,H,I)PERYLENE						
		BENZO(K)FLUORANTHENE						
		(BENZYLBUTYLPHTHALATE) BUTYLBENZYLPHTHALATE						
		BIS(2-CHLOROETHOXY)METHANE						
		BIS(2-CHLOROETHYL)ETHER						
		BIS(2-CHLOROISOPROPYL)ETHER						
		BIS(2-ETHYLHEXYL)PHTHALATE						
		4-BROMOPHENYL-PHENYLETHER						
		4-CHLORO-3-METHYLPHENOL	51	30 - 145	27	0 - 26		
		2-CHLORONAPHTHALENE						
		2-CHLOROPHENOL	53	35 - 130	27	0 - 22		
		4-CHLOROPHENYL-PHENYLETHER						
		CHRYSENE						
		DI-N-BUTYLPHTHALATE						
		DI-N-OCTYLPHTHALATE						
		DIBENZ(A,H)ANTHRACENE						
		1,3-DICHLOROBENZENE (M-DICHLOROBENZENE)						
		1,2-DICHLOROBENZENE (O-DICHLOROBENZENE)						
		1,4-DICHLOROBENZENE (P-DICHLOROBENZENE)	53	29 - 109	26	0 - 39		
		3,3'-DICHLOROBENZIDINE						

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)
(qao2.rql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-8270	Non-Spec Water	2,4-DICHLOROPHENOL						
		DIETHYLPHTHALATE						
		2,4-DIMETHYLPHENOL						
		DIMETHYLPHTHALATE						
		4,6-DINITRO-O-CRESOL						
		2,4-DINITROPHENOL						
		2,4-DINITROTOLUENE	54	38 - 148	28	0 - 22		
		2,6-DINITROTOLUENE						
		FLUORANTHENE						
		FLUORENE						
		HEXACHLOROBENZENE						
		HEXACHLOROBUTADIENE						
		HEXACHLOROCYCLOPENTADIENE						
		HEXACHLOROETHANE						
		INDENO(1,2,3-CD)PYRENE						
		ISOPHORONE						
		N-NITROSO-DI-N-PROPYLAMINE	52	32 - 149	26	0 - 28		
		N-NITROSODIMETHYLAMINE						
		N-NITROSODIPHENYLAMINE						
		NAPHTHALENE						
		NITROBENZENE						
		2-NITROPHENOL						
		4-NITROPHENOL	57	0 - 70	29	0 - 56		
		PENTACHLOROPHENOL	55	0 - 187	28	0 - 43		
		PHENANTHRENE						
		PHENOL	21	0 - 81	11	0 - 61		
		PYRENE	58	43 - 134	27	0 - 12		
		1,2,4-TRICHLOROBENZENE	53	29 - 110	26	0 - 32		
		2,4,6-TRICHLOROPHENOL						
	Oil	ACENAPHTHENE	3	12 - 73	1	0 - 7		
		4-CHLORO-3-METHYLPHENOL	3	0 - 88	1	0 - 15		
		2-CHLOROPHENOL	3	14 - 65	1	0 - 17		
		1,4-DICHLOROBENZENE (P-DICHLOROBENZENE)	3	18 - 69	1	0 - 7		
		2,4-DINITROTOLUENE	3	0 - 83	1	0 - 7		
		N-NITROSO-DI-N-PROPYLAMINE	3	16 - 77	1	0 - 8		
		4-NITROPHENOL	3	0 - 95	1	0 - 21		
		PENTACHLOROPHENOL	3	0 - 153	1	0 - 24		
		PHENOL	3	23 - 53	1	0 - 13		
		PYRENE	3	17 - 41	1	0 - 11		
		1,2,4-TRICHLOROBENZENE	3	7 - 83	1	0 - 10		
	S/S/S	ACENAPHTHENE	36	35 - 132	18	0 - 22		
		ACENAPHTHYLENE	2	69 - 111	1	0 - 11		
		ANTHRACENE	2	69 - 116	1	0 - 12		
		BENZ(A)ANTHRACENE	2	50 - 144	1	0 - 12		

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EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-8270	S/S/S	BENZO(A)PYRENE	2	93 - 114	1	0 - 5		
		BENZO(B)FLUORANTHENE	2	115 - 120	1	0 - 1		
		BENZO(G,H,I)PERYLENE	2	48 - 197	1	0 - 29		
		BENZO(K)FLUORANTHENE	2	79 - 105	1	0 - 7		
		(BENZYLBUTYLPHTHALATE) BUTYLBENZYLPHTHALATE	2	73 - 112	1	0 - 10		
		BIS(2-CHLOROETHOXY)METHANE	2	89 - 97	1	0 - 2		
		BIS(2-CHLOROETHYL)ETHER	2	0 - 236	1	0 - 49		
		BIS(2-CHLOROISOPROPYL)ETHER	2	63 - 123	1	0 - 15		
		BIS(2-ETHYLHEXYL)PHTHALATE	2	48 - 137	1	0 - 23		
		4-BROMOPHENYL-PHENYLETHER	2	87 - 100	1	0 - 3		
		4-CHLORO-3-METHYLPHENOL	34	13 - 135	16	0 - 41		
		2-CHLORONAPHTHALENE	2	84 - 113	1	0 - 7		
		2-CHLOROPHENOL	36	21 - 142	18	0 - 29		
		4-CHLOROPHENYL-PHENYLETHER	2	68 - 107	1	0 - 10		
		CHRYSENE	2	44 - 133	1	0 - 2		
		DI-N-BUTYLPHTHALATE	2	57 - 125	1	0 - 18		
		DI-N-OCTYLPHTHALATE	2	78 - 104	1	0 - 7		
		DIBENZ(A,H)ANTHRACENE	2	69 - 166	1	0 - 20		
		1,3-DICHLOROBENZENE (M-DICHLOROBENZENE)	2	70 - 112	1	0 - 11		
		1,2-DICHLOROBENZENE (O-DICHLOROBENZENE)	2	68 - 118	1	0 - 13		
		1,4-DICHLOROBENZENE (P-DICHLOROBENZENE)	40	35 - 123	20	0 - 21		
		3,3'-DICHLOROBENZIDINE	2	62 - 67	1	0 - 2		
		2,4-DICHLOROPHENOL	2	43 - 140	1	0 - 25		
		DIETHYLPHTHALATE	2	39 - 133	1	0 - 21		
		2,4-DIMETHYLPHENOL	2	44 - 125	1	0 - 22		
		DIMETHYLPHTHALATE	2	85 - 98	1	0 - 3		
		4,6-DINITRO-O-CRESOL	2	21 - 183	1	0 - 35		
		2,4-DINITROPHENOL	2	0 - 302	1	0 - 98		
		2,4-DINITROTOLUENE	36	15 - 143	16	0 - 23		
		2,6-DINITROTOLUENE	1	84 - 84	1	0 - 7		
		FLUORANTHENE	2	7 - 172	1	0 - 44		
		FLUORENE	2	42 - 126	1	0 - 24		
		HEXACHLOROBENZENE	2	86 - 102	1	0 - 4		
		HEXACHLOROBUTADIENE	2	93 - 98	1	0 - 1		
		HEXACHLOROCYCLOPENTADIENE	2	35 - 142	1	0 - 28		
		HEXACHLOROETHANE	2	75 - 109	1	0 - 9		
		INDENO(1,2,3-CD)PYRENE	2	59 - 182	1	0 - 16		
		ISOPHORONE	2	70 - 104	1	0 - 9		
		N-NITROSO-DI-N-PROPYLAMINE	30	31 - 129	14	0 - 26		
		N-NITROSODIPHENYLAMINE	2	68 - 128	1	0 - 14		
		NAPHTHALENE	2	73 - 112	1	0 - 10		
		NITROBENZENE	2	85 - 98	1	0 - 3		
		2-NITROPHENOL	2	72 - 119	1	0 - 12		
		4-NITROPHENOL	36	0 - 167	18	0 - 52		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-8270	S/S/S	PENTACHLOROPHENOL	36	0 - 161	18	0 - 64		
		PHENANTHRENE	2	58 - 134	1	0 - 19		
		PHENOL	34	0 - 143	17	0 - 45		
		PYRENE	37	26 - 124	18	0 - 44		
		1,2,4-TRICHLOROBENZENE	34	33 - 143	17	0 - 26		
		2,4,6-TRICHLOROPHENOL	2	71 - 113	1	0 - 11		
SW846-8310	Non-Spec Water	ACENAPHTHENE	4	22 - 105	2	0 - 25		
		ACENAPHTHYLENE	4	55 - 84	2	0 - 25		
		ANTHRACENE	2	68 - 81	1	0 - 4		
		BENZO(A)PYRENE	2	76 - 84	1	0 - 3		
		BENZO(B)FLUORANTHENE	4	74 - 96	2	0 - 13		
		BENZO(G,H,I)PERYLENE	4	28 - 125	2	0 - 22		
		BENZO(K)FLUORANTHENE	4	73 - 99	2	0 - 6		
		CHRYSENE	4	71 - 92	2	0 - 5		
		DIBENZ(A,H)ANTHRACENE	4	47 - 180	2	0 - 29		
		FLUORANTHENE	4	63 - 105	2	0 - 14		
		FLUORENE	4	69 - 96	2	0 - 5		
		INDENO(1,2,3-CD)PYRENE	4	65 - 100	2	0 - 13		
		NAPHTHALENE	2	23 - 86	1	0 - 28		
		PHENANTHRENE	4	66 - 106	2	0 - 11		
		PYRENE	4	46 - 119	2	0 - 20		
	S/S/S	ACENAPHTHENE	10	20 - 202	5	0 - 31		
		ACENAPHTHYLENE	8	38 - 194	4	0 - 22		
		ANTHRACENE	12	25 - 136	6	0 - 43		
		BENZO(A)PYRENE	10	0 - 182	5	0 - 72		
		BENZO(B)FLUORANTHENE	10	56 - 139	5	0 - 40		
		BENZO(G,H,I)PERYLENE	10	0 - 233	5	0 - 27		
		BENZO(K)FLUORANTHENE	10	41 - 151	5	0 - 20		
		CHRYSENE	10	53 - 158	4	0 - 11		
		DIBENZ(A,H)ANTHRACENE	5	87 - 122	4	0 - 77		
		FLUORANTHENE	10	47 - 157	5	0 - 27		
		FLUORENE	8	30 - 171	4	0 - 44		
		INDENO(1,2,3-CD)PYRENE	8	28 - 165	4	0 - 13		
		NAPHTHALENE	8	57 - 198	4	0 - 20		
		PHENANTHRENE	12	53 - 165	6	0 - 28		
		PYRENE	10	15 - 169	5	0 - 34		
SW846-9010	Non-Spec Water	CYANIDE	7	55 - 130	1	0 - 16		
	S/S/S	CYANIDE	14	31 - 134	5	0 - 18		
SW846-9012	Non-Spec Water	CYANIDE	60	69 - 115	28	0 - 26		
	S/S/S	CYANIDE	21	60 - 125	10	0 - 47		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-9012	S/S/S	CYANIDE, AMENABLE	1	100 - 100				
SW846-9020	Drinking Water	TOTAL ORGANIC HALOGEN (TOX)			2	0 - 26		
	Non-Spec Water	TOTAL ORGANIC HALOGEN (TOX)	72	68 - 129	136	0 - 34		
	Oil	TOTAL ORGANIC HALOGEN (TOX)			6	0 - 33		
	S/S/S	TOTAL ORGANIC HALOGEN (TOX)	26	79 - 124	15	0 - 29		
SW846-9030	Non-Spec Water	SULFIDE	6	91 - 107				
	Oil	SULFIDE	2	93 - 93	1	0 - 0		
	S/S/S	SULFIDE	6	90 - 109	4	0 - 21		
SW846-9038	Non-Spec Water	SULFATE	79	81 - 123	47	0 - 12		
	S/S/S	SULFATE	6	88 - 124	5	0 - 11		
SW846-9040	Non-Spec Water	PH			86	0 - 3		
	S/S/S	PH			40	0 - 0		
SW846-9041	Non-Spec Water	PH			10	0 - 0		
	S/S/S	PH			56	0 - 0		
SW846-9045	Oil	PH			1	0 - 0		
	S/S/S	PH			182	0 - 2		
SW846-9050	Drinking Water	CONDUCTIVITY			1	0 - 0		
	Non-Spec Water	CONDUCTIVITY			56	0 - 0		
SW846-9060	Drinking Water	TOTAL ORGANIC CARBON (TOC)	2	100 - 100	1	0 - 0		
	Non-Spec Water	TOTAL ORGANIC CARBON (TOC)	131	75 - 125	84	0 - 21		
	S/S/S	TOTAL ORGANIC CARBON (TOC)	11	75 - 135	8	0 - 9		
SW846-9065	S/S/S	PHENOL	7	43 - 125	10	0 - 23		
SW846-9066	Non-Spec Water	PHENOL	15	68 - 119	5	0 - 12		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)
(qao2.sql)

EMS HERITAGE LABORATORIES
Table 5.1
Quality Assurance Objectives for Location ALL
PERIOD: 01-APR-91 THRU 30-SEP-91

Method	Matrix	Parameter	N	% REC	N	RPD	Limit	Units
SW846-9066	S/S/S	PHENOL	12	64 - 128	7	0 - 15		
SW846-9067	Non-Spec Water	PHENOL			1	0 - 5		
SW846-9070	S/S/S	OIL AND GREASE			1	0 - 8		
SW846-9071	S/S/S	OIL AND GREASE			8	0 - 40		
SW846-9071(MOD)	S/S/S	OIL AND GREASE	3	108 - 117	2	0 - 23		
SW846-9251	Non-Spec Water	CHLORIDE	42	76 - 124	30	0 - 5		
	S/S/S	CHLORIDE	2	115 - 115	2	0 - 0		

N = Sample count
REC = Percent Recovery (observed/actual*100)
RPD = Relative Percent Difference (2*(rep1-rep2)/(rep1+rep2)*100)

(qao2.sql)

1337 rows selected.

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	scription	Matrix	Te	Method	Description
CLP SOW 2/88	CLP PESTICIDE/PCB EXTRACTION	1	CLP	SOW 2/88	CLP PESTICIDE/PCB ORGANICS
	CLP PCB EXTRACTION	1	CLP	SOW 2/88	CLP POLYCHLORINATED BIPHENYLS (PCBS)
	CLP SEMI-VOLATILE EXTRACTION	1	CLP	SOW 2/88	CLP SEMI-VOLATILE ORGANICS
	CLP PESTICIDE/PCB EXTRACTION	2	CLP	SOW 2/88	CLP PESTICIDE/PCB ORGANICS
	CLP PCB EXTRACTION	2	CLP	SOW 2/88	CLP POLYCHLORINATED BIPHENYLS (PCBS)
	CLP SEMI-VOLATILE EXTRACTION	2	CLP	SOW 2/88	CLP SEMI-VOLATILE ORGANICS
		3	CLP	SOW 2/88	CLP SEMI-VOLATILE ORGANICS
		4	CLP	SOW 2/88	CLP SEMI-VOLATILE ORGANICS
	CLP PESTICIDE/PCB EXTRACTION	5	CLP	SOW 2/88	CLP PESTICIDE/PCB ORGANICS
	CLP PCB EXTRACTION	5	CLP	SOW 2/88	CLP POLYCHLORINATED BIPHENYLS (PCBS)
	CLP SEMI-VOLATILE EXTRACTION	5	CLP	SOW 2/88	CLP SEMI-VOLATILE ORGANICS
EPA 200.0	FAA OR ICP ACID DIGESTION	1	APHA	303A	LITHIUM
			EPA	200.7	ALUMINUM (ICP-SEQ)
			EPA	200.7	ALUMINUM ICP
			EPA	200.7	ANTIMONY (ICP-SEQ)
			EPA	200.7	ANTIMONY ICP
			EPA	200.7	BARIUM (ICP-SEQ)
			EPA	200.7	BARIUM ICP
			EPA	200.7	BERYLLIUM (ICP-SEQ)
			EPA	200.7	BERYLLIUM ICP
			EPA	200.7	BISMUTH ICP
			EPA	200.7	BORON ICP
			EPA	200.7	CADMIUM (ICP-SEQ)
			EPA	200.7	CADMIUM ICP
			EPA	200.7	CALCIUM ICP
			EPA	200.7	CHROMIUM (ICP-SEQ)
			EPA	200.7	CHROMIUM ICP
			EPA	200.7	COBALT (ICP-SEQ)
			EPA	200.7	COBALT ICP
			EPA	200.7	COPPER (ICP-SEQ)
			EPA	200.7	COPPER ICP
			EPA	200.7	DYSPROSIUM ICP
			EPA	200.7	ICP SCAN
			EPA	200.7	IRON (ICP-SEQ)
			EPA	200.7	IRON ICP
			EPA	200.7	LEAD (ICP-SEQ)
			EPA	200.7	LEAD ICP
			EPA	200.7	LITHIUM ICP
			EPA	200.7	MAGNESIUM ICP
			EPA	200.7	MANGANESE (ICP-SEQ)
			EPA	200.7	MANGANESE ICP
			EPA	200.7	MISCELLANEOUS (ICP-SEQ)

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Id	Method	Description
EPA 200.0	FAA OR ICP ACID DIGESTION	1	EPA	200.7	MOLYBDENUM ICP
			EPA	200.7	NICKEL (ICP-SEQ)
			EPA	200.7	NICKEL ICP
			EPA	200.7	POTASSIUM ICP
			EPA	200.7	SILICON ICP
			EPA	200.7	SILVER (ICP-SEQ)
			EPA	200.7	SILVER ICP
			EPA	200.7	SODIUM ICP
			EPA	200.7	STRONTIUM ICP
			EPA	200.7	THALLIUM (ICP-SEQ)
			EPA	200.7	THALLIUM ICP
			EPA	200.7	TIN ICP
			EPA	200.7	TITANIUM ICP
			EPA	200.7	TUNGSTEN ICP
			EPA	200.7	VANADIUM (ICP-SEQ)
			EPA	200.7	VANADIUM ICP
			EPA	200.7	ZINC (ICP-SEQ)
			EPA	200.7	ZINC ICP
			EPA	202.1	ALUMINUM FAA
	GFAA ACID DIGESTION	1	EPA	202.2	ALUMINUM GFAA
	FAA OR ICP ACID DIGESTION	1	EPA	204.1	ANTIMONY FAA
	GFAA ACID DIGESTION	1	EPA	204.2	ANTIMONY GFAA
			EPA	206.2	ARSENIC GFAA
			EPA	206.2	ARSENIC GFAA (3 POINT MSA)
	FAA OR ICP ACID DIGESTION	1	EPA	208.1	BARIUM FAA
	GFAA ACID DIGESTION	1	EPA	208.2	BARIUM GFAA
	FAA OR ICP ACID DIGESTION	1	EPA	210.1	BERYLLIUM FAA
	GFAA ACID DIGESTION	1	EPA	210.2	BERYLLIUM GFAA
	FAA OR ICP ACID DIGESTION	1	EPA	212.3	BORON COLORIMETRIC
			EPA	213.1	CADMIUM FAA
	GFAA ACID DIGESTION	1	EPA	213.2	CADMIUM GFAA
	FAA OR ICP ACID DIGESTION	1	EPA	215.1	CALCIUM FAA
			EPA	218.1	CHROMIUM FAA
	GFAA ACID DIGESTION	1	EPA	218.2	CHROMIUM GFAA
			EPA	218.2	CHROMIUM GFAA (3 POINT MSA)
	FAA OR ICP ACID DIGESTION	1	EPA	219.1	COBALT FAA
	GFAA ACID DIGESTION	1	EPA	219.2	COBALT GFAA
	FAA OR ICP ACID DIGESTION	1	EPA	220.1	COPPER FAA

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Tr	Method	Description
EPA 200.0	GFAA ACID DIGESTION		1	EPA 220.2	COPPER GFAA
				EPA 220.2	COPPER GFAA (3 POINT MSA)
	FAA OR ICP ACID DIGESTION		1	EPA 236.1	IRON FAA
				EPA 239.1	LEAD FAA
	GFAA ACID DIGESTION		1	EPA 239.2	LEAD GFAA
				EPA 239.2	LEAD GFAA (3 POINT MSA)
	FAA OR ICP ACID DIGESTION		1	EPA 242.1	MAGNESIUM FAA
				EPA 243.1	MANGANESE FAA
				EPA 246.1	MOLYBDENUM FAA
	GFAA ACID DIGESTION		1	EPA 246.2	MOLYBDENUM GFAA
	FAA OR ICP ACID DIGESTION		1	EPA 249.1	NICKEL FAA
	GFAA ACID DIGESTION		1	EPA 249.2	NICKEL GFAA
	FAA OR ICP ACID DIGESTION		1	EPA 258.1	POTASSIUM FAA
	GFAA ACID DIGESTION		1	EPA 270.2	SELENIUM GFAA
	FAA OR ICP ACID DIGESTION		1	EPA 272.1	SILVER FAA
	GFAA ACID DIGESTION		1	EPA 272.2	SILVER GFAA
	FAA OR ICP ACID DIGESTION		1	EPA 273.1	SODIUM FAA
	GFAA ACID DIGESTION		1	EPA 276.2	VANADIUM GFAA
	FAA OR ICP ACID DIGESTION		1	EPA 279.1	THALLIUM FAA
	GFAA ACID DIGESTION		1	EPA 279.2	THALLIUM GFAA
	FAA OR ICP ACID DIGESTION		1	EPA 282.1	TIN FAA
	GFAA ACID DIGESTION		1	EPA 282.2	TIN GFAA
	FAA OR ICP ACID DIGESTION		1	EPA 283.1	TITANIUM FAA
	GFAA ACID DIGESTION		1	EPA 283.2	TITANIUM GFAA
	FAA OR ICP ACID DIGESTION		1	EPA 286.1	VANADIUM FAA
				EPA 289.1	ZINC FAA
	GFAA ACID DIGESTION		1	EPA 289.2	ZINC GFAA
	FAA OR ICP ACID DIGESTION		2	APHA 393A	LITHIUM
				EPA 200.7	ALUMINUM (ICP-SEQ)
				EPA 200.7	ALUMINUM ICP
				EPA 200.7	ANTIMONY (ICP-SEQ)
				EPA 200.7	ANTIMONY ICP

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Te	Method	Description
EPA 200.0	FAA OR ICP ACID DIGESTION		2	EPA 200.7	BARIUM (ICP-SEQ)
				EPA 200.7	BARIUM ICP
				EPA 200.7	BERYLLIUM (ICP-SEQ)
				EPA 200.7	BERYLLIUM ICP
				EPA 200.7	BISMUTH ICP
				EPA 200.7	BORON ICP
				EPA 200.7	CADMIUM (ICP-SEQ)
				EPA 200.7	CADMIUM ICP
				EPA 200.7	CALCIUM ICP
				EPA 200.7	CHROMIUM (ICP-SEQ)
				EPA 200.7	CHROMIUM ICP
				EPA 200.7	COBALT (ICP-SEQ)
				EPA 200.7	COBALT ICP
				EPA 200.7	COPPER (ICP-SEQ)
				EPA 200.7	COPPER ICP
				EPA 200.7	DYSPROSIUM ICP
				EPA 200.7	ICP SCAN
				EPA 200.7	IRON (ICP-SEQ)
				EPA 200.7	IRON ICP
				EPA 200.7	LEAD (ICP-SEQ)
				EPA 200.7	LEAD ICP
				EPA 200.7	LITHIUM ICP
				EPA 200.7	MAGNESIUM ICP
				EPA 200.7	MANGANESE (ICP-SEQ)
				EPA 200.7	MANGANESE ICP
				EPA 200.7	MOLYBDENUM ICP
				EPA 200.7	NICKEL (ICP-SEQ)
				EPA 200.7	NICKEL ICP
				EPA 200.7	POTASSIUM ICP
				EPA 200.7	SILICON ICP
				EPA 200.7	SILVER (ICP-SEQ)
				EPA 200.7	SILVER ICP
				EPA 200.7	SODIUM ICP
				EPA 200.7	STRONTIUM ICP
				EPA 200.7	THALLIUM (ICP-SEQ)
				EPA 200.7	THALLIUM ICP
				EPA 200.7	TIN ICP
				EPA 200.7	TITANIUM ICP
				EPA 200.7	TUNGSTEN ICP
				EPA 200.7	VANADIUM (ICP-SEQ)
				EPA 200.7	VANADIUM ICP
				EPA 200.7	ZINC (ICP-SEQ)
				EPA 200.7	ZINC ICP
				EPA 202.1	ALUMINUM FAA
	GFAA ACID DIGESTION		2	EPA 202.2	ALUMINUM GFAA
	FAA OR ICP ACID DIGESTION		2	EPA 204.1	ANTIMONY FAA
	GFAA ACID DIGESTION		2	EPA 204.2	ANTIMONY GFAA
				EPA 206.2	ARSENIC GFAA
				EPA 206.2	ARSENIC GFAA (3 POINT MSA)

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	To	Method	Description
EPA 200.0	FAA OR ICP ACID DIGESTION		2	EPA 208.1	BARIUM FAA
	GFAA ACID DIGESTION		2	EPA 208.2	BARIUM GFAA
	FAA OR ICP ACID DIGESTION		2	EPA 210.1	BERYLLIUM FAA
	GFAA ACID DIGESTION		2	EPA 210.2	BERYLLIUM GFAA
	FAA OR ICP ACID DIGESTION		2	EPA 212.3	BORON COLORIMETRIC
				EPA 213.1	CADMIUM FAA
	GFAA ACID DIGESTION		2	EPA 213.2	CADMIUM GFAA
	FAA OR ICP ACID DIGESTION		2	EPA 215.1	CALCIUM FAA
				EPA 218.1	CHROMIUM FAA
	GFAA ACID DIGESTION		2	EPA 218.2	CHROMIUM GFAA
				EPA 218.2	CHROMIUM GFAA (3 POINT MSA)
	FAA OR ICP ACID DIGESTION		2	EPA 219.1	COBALT FAA
	GFAA ACID DIGESTION		2	EPA 219.2	COBALT GFAA
	FAA OR ICP ACID DIGESTION		2	EPA 220.1	COPPER FAA
	GFAA ACID DIGESTION		2	EPA 220.2	COPPER GFAA
				EPA 220.2	COPPER GFAA (3 POINT MSA)
	FAA OR ICP ACID DIGESTION		2	EPA 236.1	IRON FAA
				EPA 239.1	LEAD FAA
	GFAA ACID DIGESTION		2	EPA 239.2	LEAD GFAA
	FAA OR ICP ACID DIGESTION		2	EPA 242.1	MAGNESIUM FAA
				EPA 243.1	MANGANESE FAA
				EPA 246.1	MOLYBDENUM FAA
	GFAA ACID DIGESTION		2	EPA 246.2	MOLYBDENUM GFAA
	FAA OR ICP ACID DIGESTION		2	EPA 249.1	NICKEL FAA
	GFAA ACID DIGESTION		2	EPA 249.2	NICKEL GFAA
	FAA OR ICP ACID DIGESTION		2	EPA 258.1	POTASSIUM FAA
	GFAA ACID DIGESTION		2	EPA 270.2	SELENIUM GFAA
	FAA OR ICP ACID DIGESTION		2	EPA 272.1	SILVER FAA
				EPA 273.1	SODIUM FAA
	GFAA ACID DIGESTION		2	EPA 276.2	VANADIUM GFAA
	FAA OR ICP ACID DIGESTION		2	EPA 279.1	THALLIUM FAA

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Id	Method	Description
EPA 200.9	GFAA ACID DIGESTION		2	EPA 279.2	THALLIUM GFAA
	FAA OR ICP ACID DIGESTION		2	EPA 282.1	TIN FAA
	GFAA ACID DIGESTION		2	EPA 282.2	TIN GFAA
	FAA OR ICP ACID DIGESTION		2	EPA 283.1	TITANIUM FAA
	GFAA ACID DIGESTION		2	EPA 283.2	TITANIUM GFAA
	FAA OR ICP ACID DIGESTION		2	EPA 286.1	VANADIUM FAA
				EPA 289.1	ZINC FAA
	GFAA ACID DIGESTION		2	EPA 289.2	ZINC GFAA
	FAA OR ICP ACID DIGESTION		3	APHA 303A	LITHIUM
				EPA 200.7	ALUMINUM (ICP-SEQ)
				EPA 200.7	ALUMINUM ICP
				EPA 200.7	ANTIMONY (ICP-SEQ)
				EPA 200.7	ANTIMONY ICP
				EPA 200.7	BARIUM (ICP-SEQ)
				EPA 200.7	BARIUM ICP
				EPA 200.7	BERYLLIUM (ICP-SEQ)
				EPA 200.7	BERYLLIUM ICP
				EPA 200.7	BISMUTH ICP
				EPA 200.7	BORON ICP
				EPA 200.7	CADMIUM (ICP-SEQ)
				EPA 200.7	CADMIUM ICP
				EPA 200.7	CALCIUM ICP
				EPA 200.7	CHROMIUM (ICP-SEQ)
				EPA 200.7	CHROMIUM ICP
				EPA 200.7	COBALT (ICP-SEQ)
				EPA 200.7	COBALT ICP
				EPA 200.7	COPPER (ICP-SEQ)
				EPA 200.7	COPPER ICP
				EPA 200.7	DYSPROSIUM ICP
				EPA 200.7	ICP SCAN
				EPA 200.7	IRON (ICP-SEQ)
				EPA 200.7	IRON ICP
				EPA 200.7	LEAD (ICP-SEQ)
				EPA 200.7	LEAD ICP
				EPA 200.7	LITHIUM ICP
				EPA 200.7	MAGNESIUM ICP
				EPA 200.7	MANGANESE (ICP-SEQ)
				EPA 200.7	MANGANESE ICP
				EPA 200.7	MOLYBDENUM ICP
				EPA 200.7	NICKEL (ICP-SEQ)
				EPA 200.7	NICKEL ICP
				EPA 200.7	POTASSIUM ICP
				EPA 200.7	SILICON ICP
				EPA 200.7	SILVER (ICP-SEQ)
				EPA 200.7	SILVER ICP

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Id	Method	Description
EPA 200.0	FAA OR ICP ACID DIGESTION	3		EPA 200.7	SODIUM ICP
				EPA 200.7	STRONTIUM ICP
				EPA 200.7	THALLIUM (ICP-SEQ)
				EPA 200.7	THALLIUM ICP
				EPA 200.7	TIN ICP
				EPA 200.7	TITANIUM ICP
				EPA 200.7	TUNGSTEN ICP
				EPA 200.7	VANADIUM (ICP-SEQ)
				EPA 200.7	VANADIUM ICP
				EPA 200.7	ZINC (ICP-SEQ)
				EPA 200.7	ZINC ICP
				EPA 202.1	ALUMINUM FAA
	GFAA ACID DIGESTION	3		EPA 202.2	ALUMINUM GFAA
	FAA OR ICP ACID DIGESTION	3		EPA 204.1	ANTIMONY FAA
	GFAA ACID DIGESTION	3		EPA 204.2	ANTIMONY GFAA
				EPA 206.2	ARSENIC GFAA
	FAA OR ICP ACID DIGESTION	3		EPA 208.1	BARIUM FAA
	GFAA ACID DIGESTION	3		EPA 208.2	BARIUM GFAA
	FAA OR ICP ACID DIGESTION	3		EPA 210.1	BERYLLIUM FAA
	GFAA ACID DIGESTION	3		EPA 210.2	BERYLLIUM GFAA
	FAA OR ICP ACID DIGESTION	3		EPA 212.3	BORON COLORIMETRIC
				EPA 213.1	CADMIUM FAA
	GFAA ACID DIGESTION	3		EPA 213.2	CADMIUM GFAA
	FAA OR ICP ACID DIGESTION	3		EPA 215.1	CALCIUM FAA
				EPA 218.1	CHROMIUM FAA
	GFAA ACID DIGESTION	3		EPA 218.2	CHROMIUM GFAA
	FAA OR ICP ACID DIGESTION	3		EPA 219.1	COBALT FAA
	GFAA ACID DIGESTION	3		EPA 219.2	COBALT GFAA
	FAA OR ICP ACID DIGESTION	3		EPA 220.1	COPPER FAA
	GFAA ACID DIGESTION	3		EPA 220.2	COPPER GFAA
				EPA 220.2	COPPER GFAA (3 POINT MSA)
	FAA OR ICP ACID DIGESTION	3		EPA 236.1	IRON FAA
				EPA 239.1	LEAD FAA
	GFAA ACID DIGESTION	3		EPA 239.2	LEAD GFAA
	FAA OR ICP ACID DIGESTION	3		EPA 242.1	MAGNESIUM FAA

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Id	Method	Description
EPA 200.0	FAA OR ICP ACID DIGESTION	3	EPA	243.1	MANGANESE FAA
			EPA	246.1	MOLYBDENUM FAA
	GFAA ACID DIGESTION	3	EPA	246.2	MOLYBDENUM GFAA
	FAA OR ICP ACID DIGESTION	3	EPA	249.1	NICKEL FAA
	GFAA ACID DIGESTION	3	EPA	249.2	NICKEL GFAA
	FAA OR ICP ACID DIGESTION	3	EPA	258.1	POTASSIUM FAA
	GFAA ACID DIGESTION	3	EPA	270.2	SELENIUM GFAA
	FAA OR ICP ACID DIGESTION	3	EPA	272.1	SILVER FAA
	GFAA ACID DIGESTION	3	EPA	272.2	SILVER GFAA
	FAA OR ICP ACID DIGESTION	3	EPA	273.1	SODIUM FAA
	GFAA ACID DIGESTION	3	EPA	276.2	VANADIUM GFAA
	FAA OR ICP ACID DIGESTION	3	EPA	279.1	THALLIUM FAA
	GFAA ACID DIGESTION	3	EPA	279.2	THALLIUM GFAA
	FAA OR ICP ACID DIGESTION	3	EPA	282.1	TIN FAA
	GFAA ACID DIGESTION	3	EPA	282.2	TIN GFAA
	FAA OR ICP ACID DIGESTION	3	EPA	283.1	TITANIUM FAA
	GFAA ACID DIGESTION	3	EPA	283.2	TITANIUM GFAA
	FAA OR ICP ACID DIGESTION	3	EPA	286.1	VANADIUM FAA
			EPA	289.1	ZINC FAA
	GFAA ACID DIGESTION	3	EPA	289.2	ZINC GFAA
	FAA OR ICP ACID DIGESTION	4	APHA	303A	LITHIUM
			EPA	200.7	ALUMINUM (ICP-SEQ)
			EPA	200.7	ALUMINUM ICP
			EPA	200.7	ANTIMONY (ICP-SEQ)
			EPA	200.7	ANTIMONY ICP
			EPA	200.7	BARIUM (ICP-SEQ)
			EPA	200.7	BARIUM ICP
			EPA	200.7	BERYLLIUM (ICP-SEQ)
			EPA	200.7	BERYLLIUM ICP
			EPA	200.7	BISMUTH ICP
			EPA	200.7	BORON ICP
			EPA	200.7	CADMIUM (ICP-SEQ)
			EPA	200.7	CADMIUM ICP
			EPA	200.7	CALCIUM ICP
			EPA	200.7	CHROMIUM (ICP-SEQ)

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Fr	Method	Description
EPA 200.0	FAA OR ICP ACID DIGESTION	4		EPA 200.7	CHROMIUM ICP
				EPA 200.7	COBALT (ICP-SEQ)
				EPA 200.7	COBALT ICP
				EPA 200.7	COPPER (ICP-SEQ)
				EPA 200.7	COPPER ICP
				EPA 200.7	DYSPROSIUM ICP
				EPA 200.7	ICP SCAN
				EPA 200.7	IRON (ICP-SEQ)
				EPA 200.7	IRON ICP
				EPA 200.7	LEAD (ICP-SEQ)
				EPA 200.7	LEAD ICP
				EPA 200.7	LITHIUM ICP
				EPA 200.7	MAGNESIUM ICP
				EPA 200.7	MANGANESE (ICP-SEQ)
				EPA 200.7	MANGANESE ICP
				EPA 200.7	MOLYBDENUM ICP
				EPA 200.7	NICKEL (ICP-SEQ)
				EPA 200.7	NICKEL ICP
				EPA 200.7	POTASSIUM ICP
				EPA 200.7	SILICON ICP
				EPA 200.7	SILVER (ICP-SEQ)
				EPA 200.7	SILVER ICP
				EPA 200.7	SODIUM ICP
				EPA 200.7	STRONTIUM ICP
				EPA 200.7	THALLIUM (ICP-SEQ)
				EPA 200.7	THALLIUM ICP
				EPA 200.7	TIN ICP
				EPA 200.7	TITANIUM ICP
				EPA 200.7	TUNGSTEN ICP
				EPA 200.7	VANADIUM (ICP-SEQ)
				EPA 200.7	VANADIUM ICP
				EPA 200.7	ZINC (ICP-SEQ)
				EPA 200.7	ZINC ICP
				EPA 202.1	ALUMINUM FAA
	GFAA ACID DIGESTION	4		EPA 202.2	ALUMINUM GFAA
	FAA OR ICP ACID DIGESTION	4		EPA 204.1	ANTIMONY FAA
	GFAA ACID DIGESTION	4		EPA 204.2	ANTIMONY GFAA
				EPA 206.2	ARSENIC GFAA
	FAA OR ICP ACID DIGESTION	4		EPA 208.1	BARIUM FAA
	GFAA ACID DIGESTION	4		EPA 208.2	BARIUM GFAA
	FAA OR ICP ACID DIGESTION	4		EPA 210.1	BERYLLIUM FAA
	GFAA ACID DIGESTION	4		EPA 210.2	BERYLLIUM GFAA
	FAA OR ICP ACID DIGESTION	4		EPA 212.3	BORON COLORIMETRIC
				EPA 213.1	CADMIUM FAA

(preptest.sql)

TABLE 5.[illegible]

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Method	Description
EPA 200.0	FAA ACID DIGESTION	4	EPA 213.2	CADMIUM GFAA
	FAA OR ICP ACID DIGESTION	4	EPA 215.1	CALCIUM FAA
			EPA 218.1	CHROMIUM FAA
	GFAA ACID DIGESTION	4	EPA 218.2	CHROMIUM GFAA
	FAA OR ICP ACID DIGESTION	4	EPA 219.1	COBALT FAA
	GFAA ACID DIGESTION	4	EPA 219.2	COBALT GFAA
	FAA OR ICP ACID DIGESTION	4	EPA 220.1	COPPER FAA
	GFAA ACID DIGESTION	4	EPA 220.2	COPPER GFAA
	FAA OR ICP ACID DIGESTION	4	EPA 236.1	IRON FAA
			EPA 239.1	LEAD FAA
	GFAA ACID DIGESTION	4	EPA 239.2	LEAD GFAA
	FAA OR ICP ACID DIGESTION	4	EPA 242.1	MAGNESIUM FAA
			EPA 243.1	MANGANESE FAA
			EPA 246.1	MOLYBDENUM FAA
	GFAA ACID DIGESTION	4	EPA 246.2	MOLYBDENUM GFAA
	FAA OR ICP ACID DIGESTION	4	EPA 249.1	NICKEL FAA
	GFAA ACID DIGESTION	4	EPA 249.2	NICKEL GFAA
	FAA OR ICP ACID DIGESTION	4	EPA 258.1	POTASSIUM FAA
	GFAA ACID DIGESTION	4	EPA 270.2	SELENIUM GFAA
	FAA OR ICP ACID DIGESTION	4	EPA 272.1	SILVER FAA
			EPA 273.1	SODIUM FAA
	GFAA ACID DIGESTION	4	EPA 276.2	VANADIUM GFAA
	FAA OR ICP ACID DIGESTION	4	EPA 279.1	THALLIUM FAA
	GFAA ACID DIGESTION	4	EPA 279.2	THALLIUM GFAA
	FAA OR ICP ACID DIGESTION	4	EPA 282.1	TIN FAA
	GFAA ACID DIGESTION	4	EPA 282.2	TIN GFAA
	FAA OR ICP ACID DIGESTION	4	EPA 283.1	TITANIUM FAA
	GFAA ACID DIGESTION	4	EPA 283.2	TITANIUM GFAA
	FAA OR ICP ACID DIGESTION	4	EPA 286.1	VANADIUM FAA
			EPA 289.1	ZINC FAA

(preptest.tql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Fe	Method	Description
EPA 200.0	GFAA ACID DIGESTION		4	EPA 289.2	ZINC GFAA
	FAA OR ICP ACID DIGESTION		5	APHA 303A	LITHIUM
				EPA 200.7	ALUMINUM (ICP-SEQ)
				EPA 200.7	ALUMINUM ICP
				EPA 200.7	ANTIMONY (ICP-SEQ)
				EPA 200.7	ANTIMONY ICP
				EPA 200.7	BARIUM (ICP-SEQ)
				EPA 200.7	BARIUM ICP
				EPA 200.7	BERYLLIUM (ICP-SEQ)
				EPA 200.7	BERYLLIUM ICP
				EPA 200.7	BISMUTH ICP
				EPA 200.7	BORON ICP
				EPA 200.7	CADMIUM (ICP-SEQ)
				EPA 200.7	CADMIUM ICP
				EPA 200.7	CALCIUM ICP
				EPA 200.7	CHROMIUM (ICP-SEQ)
				EPA 200.7	CHROMIUM ICP
				EPA 200.7	COBALT (ICP-SEQ)
				EPA 200.7	COBALT ICP
				EPA 200.7	COPPER (ICP-SEQ)
				EPA 200.7	COPPER ICP
				EPA 200.7	DYSPROSIUM ICP
				EPA 200.7	ICP SCAN
				EPA 200.7	IRON (ICP-SEQ)
				EPA 200.7	IRON ICP
				EPA 200.7	LEAD (ICP-SEQ)
				EPA 200.7	LEAD ICP
				EPA 200.7	LITHIUM ICP
				EPA 200.7	MAGNESIUM ICP
				EPA 200.7	MANGANESE (ICP-SEQ)
				EPA 200.7	MANGANESE ICP
				EPA 200.7	MISCELLANEOUS (ICP-SEQ)
				EPA 200.7	MOLYBDENUM ICP
				EPA 200.7	NICKEL (ICP-SEQ)
				EPA 200.7	NICKEL ICP
				EPA 200.7	POTASSIUM ICP
				EPA 200.7	SILICON ICP
				EPA 200.7	SILVER (ICP-SEQ)
				EPA 200.7	SILVER ICP
				EPA 200.7	SODIUM ICP
				EPA 200.7	STRONTIUM ICP
				EPA 200.7	THALLIUM (ICP-SEQ)
				EPA 200.7	THALLIUM ICP
				EPA 200.7	TIN ICP
				EPA 200.7	TITANIUM ICP
				EPA 200.7	TUNGSTEN ICP
				EPA 200.7	VANADIUM (ICP-SEQ)
				EPA 200.7	VANADIUM ICP
				EPA 200.7	ZINC (ICP-SEQ)
				EPA 200.7	ZINC ICP
				EPA 202.1	ALUMINUM FAA

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Fr	Method	Description
EPA 200.0	GFAA ACID DIGESTION		S	EPA 202.2	ALUMINUM GFAA
	FAA OR ICP ACID DIGESTION		S	EPA 204.1	ANTIMONY FAA
	GFAA ACID DIGESTION		S	EPA 204.2	ANTIMONY GFAA
				EPA 206.2	ARSENIC GFAA
	FAA OR ICP ACID DIGESTION		S	EPA 208.1	BARIUM FAA
	GFAA ACID DIGESTION		S	EPA 208.2	BARIUM GFAA
	FAA OR ICP ACID DIGESTION		S	EPA 210.1	BERYLLIUM FAA
	GFAA ACID DIGESTION		S	EPA 210.2	BERYLLIUM GFAA
	FAA OR ICP ACID DIGESTION		S	EPA 212.3	BORON COLORIMETRIC
				EPA 213.1	CADMIUM FAA
	GFAA ACID DIGESTION		S	EPA 213.2	CADMIUM GFAA
	FAA OR ICP ACID DIGESTION		S	EPA 215.1	CALCIUM FAA
				EPA 218.1	CHROMIUM FAA
	GFAA ACID DIGESTION		S	EPA 218.2	CHROMIUM GFAA
				EPA 218.2	CHROMIUM GFAA (3 POINT MSA)
	FAA OR ICP ACID DIGESTION		S	EPA 219.1	COBALT FAA
	GFAA ACID DIGESTION		S	EPA 219.2	COBALT GFAA
	FAA OR ICP ACID DIGESTION		S	EPA 220.1	COPPER FAA
	GFAA ACID DIGESTION		S	EPA 220.2	COPPER GFAA
	FAA OR ICP ACID DIGESTION		S	EPA 236.1	IRON FAA
				EPA 239.1	LEAD FAA
	GFAA ACID DIGESTION		S	EPA 239.2	LEAD GFAA
				EPA 239.2	LEAD GFAA (3 POINT MSA)
	FAA OR ICP ACID DIGESTION		S	EPA 242.1	MAGNESIUM FAA
				EPA 243.1	MANGANESE FAA
				EPA 246.1	MOLYBDENUM FAA
	GFAA ACID DIGESTION		S	EPA 246.2	MOLYBDENUM GFAA
	FAA OR ICP ACID DIGESTION		S	EPA 249.1	NICKEL FAA
	GFAA ACID DIGESTION		S	EPA 249.2	NICKEL GFAA
	FAA OR ICP ACID DIGESTION		S	EPA 258.1	POTASSIUM FAA

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PREP	Description	Matrix	Method	Description
EPA 200.0	GFAA ACID DIGESTION	5	EPA 270.2	SELENIUM GFAA
	FAA OR ICP ACID DIGESTION	5	EPA 272.1	SILVER FAA
			EPA 273.1	SODIUM FAA
	GFAA ACID DIGESTION	5	EPA 276.2	VANADIUM GFAA
	FAA OR ICP ACID DIGESTION	5	EPA 279.1	THALLIUM FAA
	GFAA ACID DIGESTION	5	EPA 279.2	THALLIUM GFAA
	FAA OR ICP ACID DIGESTION	5	EPA 282.1	TIN FAA
	GFAA ACID DIGESTION	5	EPA 282.2	TIN GFAA
	FAA OR ICP ACID DIGESTION	5	EPA 283.1	TITANIUM FAA
	GFAA ACID DIGESTION	5	EPA 283.2	TITANIUM GFAA
	FAA OR ICP ACID DIGESTION	5	EPA 286.1	VANADIUM FAA
			EPA 289.1	ZINC FAA
	GFAA ACID DIGESTION	5	EPA 289.2	ZINC GFAA
EPA 335.1	CYANIDE AMENABLE DISTILLATION	1	EPA 335.1	CYANIDE AMENABLE TO CHLORINATION
			EPA 335.1	CYANIDE AMENABLE TO CHLORINATION
		4	EPA 335.1	CYANIDE AMENABLE TO CHLORINATION
			EPA 335.1	CYANIDE AMENABLE TO CHLORINATION
		5	EPA 335.1	CYANIDE AMENABLE TO CHLORINATION
			EPA 335.1	CYANIDE AMENABLE TO CHLORINATION
EPA 335.2	CYANIDE DISTILLATION	1	EPA 335.2	CYANIDE, TOTAL (MANUAL)
			EPA 335.3	CYANIDE, TOTAL (AUTOMATED)
		2	EPA 335.2	CYANIDE, TOTAL (MANUAL)
			EPA 335.3	CYANIDE, TOTAL (AUTOMATED)
		3	EPA 335.2	CYANIDE, TOTAL (MANUAL)
			EPA 335.3	CYANIDE, TOTAL (AUTOMATED)
		4	EPA 335.2	CYANIDE, TOTAL (MANUAL)
			EPA 335.3	CYANIDE, TOTAL (AUTOMATED)
		5	EPA 335.2	CYANIDE, TOTAL (MANUAL)
			EPA 335.3	CYANIDE, TOTAL (AUTOMATED)
EPA 340.1	FLUORIDE DISTILLATION	1	EPA 340.2	FLUORIDE (ION SELECTIVE ELECTRODE)
		5	EPA 340.2	FLUORIDE (ION SELECTIVE ELECTRODE)
			EPA 340.2	FLUORIDE (LEACHATE)

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	escription	Matrix	I	Method	Description
EPA 350.2	AMMONIA DISTILLATION		1	EPA 350.1	AMMONIA NITROGEN (AUTOMATED PHENATE METH
				EPA 350.3	AMMONIA NITROGEN
			2	EPA 350.1	AMMONIA NITROGEN (AUTOMATED PHENATE METH
				EPA 350.3	AMMONIA NITROGEN
			3	EPA 350.1	AMMONIA NITROGEN (AUTOMATED PHENATE METH
				EPA 350.3	AMMONIA NITROGEN
			5	EPA 350.1	AMMONIA NITROGEN (AUTOMATED PHENATE METH
				EPA 350.3	AMMONIA NITROGEN
				EPA 350.3	AMMONIA NITROGEN (LEACHATE)
EPA 420.1	PHENOLS DISTILLATION		1	EPA 420.2	PHENOLS 4AAP (AUTOMATED)
			2	EPA 420.2	PHENOLS 4AAP (AUTOMATED)
			3	EPA 420.2	PHENOLS 4AAP (AUTOMATED)
			4	EPA 420.2	PHENOLS 4AAP (AUTOMATED)
			5	EPA 420.2	PHENOLS 4AAP (AUTOMATED)
EPA 504	MICRO-EXTRACTION FOR EDB AND DCBP		1	EPA 504	ETHYLENE DIBROMIDE AND DIBROMOCHLOPROPAN
			2	EPA 504	ETHYLENE DIBROMIDE AND DIBROMOCHLOPROPAN
			3	EPA 504	ETHYLENE DIBROMIDE AND DIBROMOCHLOPROPAN
EPA 515.1	DIAZOMETHANE DERIVATIZATION FOR CHLORINA		1	EPA 515.1	CHLORINATED HERBICIDE ACIDS
			2	EPA 515.1	CHLORINATED HERBICIDE ACIDS
			3	EPA 515.1	CHLORINATED HERBICIDE ACIDS
EPA 548.1	ENDOTHALL DERIVATIZATION		1	EPA 548.1	ENDOTHALL BY GC/ECD
			2	EPA 548.1	ENDOTHALL BY GC/ECD
			3	EPA 548.1	ENDOTHALL BY GC/ECD
EPA 608	ORGANOCHLORINE PESTICIDES AND PCBS EXTRA		1	EPA 508	ORGANOCHLORINE PESTICIDES IN WATER BY GC
				EPA 608	ORGANOCHLORINE PESTICIDES AND PCBS IN WA
				EPA 608	ORGANOCHLORINE PESTICIDES BY GC:ECD
	PCB EXTRACTION		1	EPA 608	POLYCHLORINATED BIPHENYLS (PCBS)
	ORGANOCHLORINE PESTICIDES AND PCBS EXTRA		2	EPA 508	ORGANOCHLORINE PESTICIDES IN WATER BY GC
				EPA 608	ORGANOCHLORINE PESTICIDES AND PCBS IN WA
				EPA 608	ORGANOCHLORINE PESTICIDES BY GC:ECD
	PCB EXTRACTION		2	EPA 608	POLYCHLORINATED BIPHENYLS (PCBS)

(preptest.tql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Method	Description
EPA 608	ORGANOCHLORINE PESTICIDES AND PCBS EXTRA	1	EPA 608	ORGANOCHLORINE PESTICIDES IN WATER BY GC
			EPA 608	ORGANOCHLORINE PESTICIDES AND PCBS IN WA
			EPA 608	ORGANOCHLORINE PESTICIDES BY GC:ECD
	PCB EXTRACTION	3	EPA 608	POLYCHLORINATED BIPHENYLS (PCBS)
	ORGANOCHLORINE PESTICIDES AND PCBS EXTRA	5	EPA 608	ORGANOCHLORINE PESTICIDES AND PCBS IN WA
			EPA 608	ORGANOCHLORINE PESTICIDES BY GC:ECD
	PCB EXTRACTION	5	EPA 608	POLYCHLORINATED BIPHENYLS (PCBS)
EPA 625	SEMI-VOLATILE EXTRACTION (ACID FRACTION)	1	EPA 625	SEMI-VOLATILE PRIORITY POLLUTANTS (ACID
	SEMI-VOLATILE EXTRACTION (NEUTRAL/BASE/A	1	EPA 625	SEMI-VOLATILE PRIORITY POLLUTANTS (BASE/
	SEMI-VOLATILE EXTRACTION (BASE/NEUTRAL F	1	EPA 625	SEMI-VOLATILE PRIORITY POLLUTANTS (BASE/
	SEMI-VOLATILE EXTRACTION (NEUTRAL/BASE/A	2	EPA 625	SEMI-VOLATILE PRIORITY POLLUTANTS (BASE/
	SEMI-VOLATILE EXTRACTION (ACID FRACTION)	5	EPA 625	SEMI-VOLATILE PRIORITY POLLUTANTS (ACID
	SEMI-VOLATILE EXTRACTION (NEUTRAL/BASE/A	5	EPA 625	SEMI-VOLATILE PRIORITY POLLUTANTS (BASE/
	SEMI-VOLATILE EXTRACTION (BASE/NEUTRAL F	5	EPA 625	SEMI-VOLATILE PRIORITY POLLUTANTS (BASE/
FUTURE CLP ONLY	CLP PESTICIDE/PCB EXTRACTION	1	FUTURE CLP ONLY	CLP PESTICIDE/PCB ORGANICS
	CLP SEMI-VOLATILE EXTRACTION	1	FUTURE CLP ONLY	CLP SEMI-VOLATILE ORGANICS
	CLP PESTICIDE/PCB EXTRACTION	2	FUTURE CLP ONLY	CLP PESTICIDE/PCB ORGANICS
	CLP SEMI-VOLATILE EXTRACTION	2	FUTURE CLP ONLY	CLP SEMI-VOLATILE ORGANICS
		3	FUTURE CLP ONLY	CLP SEMI-VOLATILE ORGANICS
		4	FUTURE CLP ONLY	CLP SEMI-VOLATILE ORGANICS
	CLP PESTICIDE/PCB EXTRACTION	5	FUTURE CLP ONLY	CLP PESTICIDE/PCB ORGANICS
	CLP SEMI-VOLATILE EXTRACTION	5	FUTURE CLP ONLY	CLP SEMI-VOLATILE ORGANICS
ILM01	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM	1	ILM01	ALUMINUM FAA (CLP)
			ILM01	ALUMINUM ICP (CLP)
			ILM01	ANTIMONY FAA (CLP)
			ILM01	ANTIMONY ICP (CLP)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES (	1	ILM01	ARSENIC GFAA (3 POINT MSA) (CLP)
			ILM01	ARSENIC GFAA (CLP)
	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM	1	ILM01	BARIUM FAA (CLP)
			ILM01	BARIUM ICP (CLP)
			ILM01	BERYLLIUM FAA (CLP)
			ILM01	BERYLLIUM ICP (CLP)

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	escription	Matrix	1	Method	Description
ILM01	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM		1	ILM01	CADMIUM FAA (CLP)
				ILM01	CADMIUM ICP (CLP)
				ILM01	CALCIUM FAA (CLP)
				ILM01	CALCIUM ICP (CLP)
				ILM01	CHROMIUM FAA (CLP)
				ILM01	CHROMIUM ICP (CLP)
				ILM01	COBALT FAA (CLP)
				ILM01	COBALT ICP (CLP)
				ILM01	COPPER FAA (CLP)
				ILM01	COPPER ICP (CLP)
	CYANIDE DISTILLATION (CLP)		1	ILM01	CYANIDE, TOTAL (MANUAL) (CLP)
	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM		1	ILM01	IRON FAA (CLP)
				ILM01	IRON ICP (CLP)
				ILM01	LEAD FAA (CLP)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES (		1	ILM01	LEAD GFAA (CLP)
	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM		1	ILM01	LEAD ICP (CLP)
				ILM01	MAGNESIUM FAA (CLP)
				ILM01	MAGNESIUM ICP (CLP)
				ILM01	MANGANESE FAA (CLP)
				ILM01	MANGANESE ICP (CLP)
	MERCURY CVAA ACID DIGESTION OF AQUEOUS S		1	ILM01	MERCURY CVAA (CLP)
	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM		1	ILM01	NICKEL FAA (CLP)
				ILM01	NICKEL ICP (CLP)
				ILM01	POTASSIUM FAA (CLP)
				ILM01	POTASSIUM ICP (CLP)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES (		1	ILM01	SELENIUM GFAA (3 POINT MSA) (CLP)
				ILM01	SELENIUM GFAA (CLP)
	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM		1	ILM01	SILVER FAA (CLP)
				ILM01	SILVER ICP (CLP)
				ILM01	SODIUM FAA (CLP)
				ILM01	SODIUM ICP (CLP)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES (		1	ILM01	THALLIUM GFAA (CLP)
	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM		1	ILM01	VANADIUM FAA (CLP)
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL		1	ILM01	VANADIUM ICP (CLP)
	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM		1	ILM01	ZINC FAA (CLP)
				ILM01	ZINC ICP (CLP)
			2	ILM01	ALUMINUM FAA (CLP)
				ILM01	ALUMINUM ICP (CLP)
				ILM01	ANTIMONY FAA (CLP)
				ILM01	ANTIMONY ICP (CLP)

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TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Method	Description
ILM01	GFAA ACID DIGESTION OF AQUEOUS SAMPLES (	2	ILM01	ARSENIC GFAA (3 POINT MSA) (CLP)
			ILM01	ARSENIC GFAA (CLP)
	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM	2	ILM01	BARIUM FAA (CLP)
			ILM01	BARIUM ICP (CLP)
			ILM01	BERYLLIUM FAA (CLP)
			ILM01	BERYLLIUM ICP (CLP)
			ILM01	CADMIUM FAA (CLP)
			ILM01	CADMIUM ICP (CLP)
			ILM01	CALCIUM FAA (CLP)
			ILM01	CALCIUM ICP (CLP)
			ILM01	CHROMIUM FAA (CLP)
			ILM01	CHROMIUM ICP (CLP)
			ILM01	COBALT FAA (CLP)
			ILM01	COBALT ICP (CLP)
			ILM01	COPPER FAA (CLP)
			ILM01	COPPER ICP (CLP)
	CYANIDE DISTILLATION (CLP)	2	ILM01	CYANIDE, TOTAL (MANUAL) (CLP)
	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM	2	ILM01	IRON FAA (CLP)
			ILM01	IRON ICP (CLP)
			ILM01	LEAD FAA (CLP)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES (	2	ILM01	LEAD GFAA (CLP)
	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM	2	ILM01	LEAD ICP (CLP)
			ILM01	MAGNESIUM FAA (CLP)
			ILM01	MAGNESIUM ICP (CLP)
			ILM01	MANGANESE FAA (CLP)
			ILM01	MANGANESE ICP (CLP)
	MERCURY CVAA ACID DIGESTION OF AQUEOUS S	2	ILM01	MERCURY CVAA (CLP)
	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM	2	ILM01	NICKEL FAA (CLP)
			ILM01	NICKEL ICP (CLP)
			ILM01	POTASSIUM FAA (CLP)
			ILM01	POTASSIUM ICP (CLP)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES (	2	ILM01	SELENIUM GFAA (3 POINT MSA) (CLP)
			ILM01	SELENIUM GFAA (CLP)
	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM	2	ILM01	SILVER FAA (CLP)
			ILM01	SILVER ICP (CLP)
			ILM01	SODIUM FAA (CLP)
			ILM01	SODIUM ICP (CLP)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES (	2	ILM01	THALLIUM GFAA (CLP)
	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM	2	ILM01	VANADIUM FAA (CLP)
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL	2	ILM01	VANADIUM ICP (CLP)

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PREP	escription	Matrix	T	Method	Description
ILM01	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM	2		ILM01	ZINC FAA (CLP)
				ILM01	ZINC ICP (CLP)
	CYANIDE DISTILLATION (CLP)	3		ILM01	CYANIDE, TOTAL (MANUAL) (CLP)
	ACID DIGESTION OF OILS/SOLVENTS (CLP)	4		ILM01	ALUMINUM FAA (CLP)
				ILM01	ALUMINUM ICP (CLP)
				ILM01	ANTIMONY FAA (CLP)
				ILM01	ANTIMONY ICP (CLP)
				ILM01	ARSENIC GFAA (3 POINT MSA) (CLP)
				ILM01	ARSENIC GFAA (CLP)
				ILM01	BARIUM FAA (CLP)
				ILM01	BARIUM ICP (CLP)
				ILM01	BERYLLIUM FAA (CLP)
				ILM01	BERYLLIUM ICP (CLP)
				ILM01	CADMIUM FAA (CLP)
				ILM01	CADMIUM ICP (CLP)
				ILM01	CALCIUM FAA (CLP)
				ILM01	CALCIUM ICP (CLP)
				ILM01	CHROMIUM FAA (CLP)
				ILM01	CHROMIUM ICP (CLP)
				ILM01	COBALT FAA (CLP)
				ILM01	COBALT ICP (CLP)
				ILM01	COPPER FAA (CLP)
				ILM01	COPPER ICP (CLP)
	CYANIDE DISTILLATION (CLP)	4		ILM01	CYANIDE, TOTAL (MANUAL) (CLP)
	ACID DIGESTION OF OILS/SOLVENTS (CLP)	4		ILM01	IRON FAA (CLP)
				ILM01	IRON ICP (CLP)
				ILM01	LEAD FAA (CLP)
				ILM01	LEAD GFAA (CLP)
				ILM01	LEAD ICP (CLP)
				ILM01	MAGNESIUM FAA (CLP)
				ILM01	MAGNESIUM ICP (CLP)
				ILM01	MANGANESE FAA (CLP)
				ILM01	MANGANESE ICP (CLP)
				ILM01	NICKEL FAA (CLP)
				ILM01	NICKEL ICP (CLP)
				ILM01	POTASSIUM FAA (CLP)
				ILM01	POTASSIUM ICP (CLP)
				ILM01	SELENIUM GFAA (3 POINT MSA) (CLP)
				ILM01	SELENIUM GFAA (CLP)
				ILM01	SILVER FAA (CLP)
				ILM01	SILVER ICP (CLP)
				ILM01	SODIUM FAA (CLP)
				ILM01	SODIUM ICP (CLP)
				ILM01	THALLIUM GFAA (CLP)
				ILM01	VANADIUM FAA (CLP)
				ILM01	VANADIUM ICP (CLP)
				ILM01	ZINC FAA (CLP)
				ILM01	ZINC ICP (CLP)

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix 1	Method	Description
ILM01	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL	S	ILM01	ALUMINUM FAA (CLP)
			ILM01	ALUMINUM ICP (CLP)
			ILM01	ANTIMONY FAA (CLP)
			ILM01	ANTIMONY ICP (CLP)
	GFAA ACID DIGESTION OF S/S/S SAMPLES (CL	S	ILM01	ARSENIC GFAA (3 POINT MSA) (CLP)
			ILM01	ARSENIC GFAA (CLP)
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL	S	ILM01	BARIUM FAA (CLP)
			ILM01	BARIUM ICP (CLP)
			ILM01	BERYLLIUM FAA (CLP)
			ILM01	BERYLLIUM ICP (CLP)
			ILM01	CADMIUM FAA (CLP)
			ILM01	CADMIUM ICP (CLP)
			ILM01	CALCIUM FAA (CLP)
			ILM01	CALCIUM ICP (CLP)
			ILM01	CHROMIUM FAA (CLP)
			ILM01	CHROMIUM ICP (CLP)
			ILM01	COBALT FAA (CLP)
			ILM01	COBALT ICP (CLP)
			ILM01	COPPER FAA (CLP)
			ILM01	COPPER ICP (CLP)
	CYANIDE DISTILLATION (CLP)	S	ILM01	CYANIDE, TOTAL (MANUAL) (CLP)
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL	S	ILM01	IRON FAA (CLP)
			ILM01	IRON ICP (CLP)
			ILM01	LEAD FAA (CLP)
	GFAA ACID DIGESTION OF S/S/S SAMPLES (CL	S	ILM01	LEAD GFAA (CLP)
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL	S	ILM01	LEAD ICP (CLP)
			ILM01	MAGNESIUM FAA (CLP)
			ILM01	MAGNESIUM ICP (CLP)
			ILM01	MANGANESE FAA (CLP)
			ILM01	MANGANESE ICP (CLP)
	MERCURY CVAA ACID DIGESTION OF S/S/S SAM	S	ILM01	MERCURY CVAA (CLP)
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL	S	ILM01	NICKEL FAA (CLP)
			ILM01	NICKEL ICP (CLP)
			ILM01	POTASSIUM FAA (CLP)
			ILM01	POTASSIUM ICP (CLP)
	GFAA ACID DIGESTION OF S/S/S SAMPLES (CL	S	ILM01	SELENIUM GFAA (3 POINT MSA) (CLP)
			ILM01	SELENIUM GFAA (CLP)
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL	S	ILM01	SILVER FAA (CLP)
			ILM01	SILVER ICP (CLP)
			ILM01	SODIUM FAA (CLP)
			ILM01	SODIUM ICP (CLP)

PREP	Description	Matrix	Te	Method	Description
ILM01	GFAA ACID DIGESTION OF S/S/S SAMPLES (CL	5	ILM01		THALLIUM GFAA (CLP)
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL	5	ILM01		VANADIUM FAA (CLP)
			ILM01		VANADIUM ICP (CLP)
			ILM01		ZINC FAA (CLP)
			ILM01		ZINC ICP (CLP)
OLM01	CLP PESTICIDE/PCB EXTRACTION	1	OLM01		CLP PESTICIDE/PCB ORGANICS
	CLP SEMI-VOLATILE EXTRACTION	1	OLM01		CLP SEMI-VOLATILE ORGANICS
	CLP PESTICIDE/PCB EXTRACTION	2	OLM01		CLP PESTICIDE/PCB ORGANICS
	CLP SEMI-VOLATILE EXTRACTION	2	OLM01		CLP SEMI-VOLATILE ORGANICS
	CLP PESTICIDE/PCB EXTRACTION	5	OLM01		CLP PESTICIDE/PCB ORGANICS
	CLP SEMI-VOLATILE EXTRACTION	5	OLM01		CLP SEMI-VOLATILE ORGANICS
SW 7.3.4.1	TOTAL AVAILABLE SULFIDE EXTRACTION	5	SW846-9030		SULFIDE
SW846-1310	NEUTRAL WATER LEACHING METHOD (MODIFIED	1	SW846-9030		SULFIDE (LEACHATE)
		2	SW846-9030		SULFIDE (LEACHATE)
		5	EPA 340.1		FLUORIDE DISTILLATION (LEACHATE)
			EPA 350.2		AMMONIA DISTILLATION
			EPA 375.4		SULFATE (LEACHATE)
	EXTRACTION PROCEDURE TOXICITY (EPTOX)	5	SW846-3010		FAA OR ICP ACID DIGESTION OF LEACHATE SA
	NEUTRAL WATER LEACHING METHOD (MODIFIED	5	SW846-3010		FAA OR ICP ACID DIGESTION OF LEACHATE SA
	EXTRACTION PROCEDURE TOXICITY (EPTOX)	5	SW846-3020		GFAA ACID DIGESTION OF LEACHATE SAMPLES
	NEUTRAL WATER LEACHING METHOD (MODIFIED	5	SW846-3020		GFAA ACID DIGESTION OF LEACHATE SAMPLES
	EXTRACTION PROCEDURE TOXICITY (EPTOX)	5	SW846-8150		DIAZOMETHANE HERBICIDE DERIVATIZATION
	NEUTRAL WATER LEACHING METHOD (MODIFIED	5	SW846-9010		CYANIDE LEACHATE DISTILLATION
			SW846-9030		SULFIDE (LEACHATE)
SW846-1311	TOX CHAR LEACHING PROCEDURE (TCLP METALS	4	SW846-3030	MOD	ACID DIGESTION OF OILS
	TOX CHAR LEACHING PROCEDURE (TCLP W/ ORG	4	SW846-3030	MOD	ACID DIGESTION OF OILS
	TOX CHAR LEACHING PROCEDURE (TCLP W/ORG)	4	SW846-3030	MOD	ACID DIGESTION OF OILS
	TOX CHAR LEACHING PROCEDURE (TCLP METALS	5	SW846-3010		FAA OR ICP ACID DIGESTION OF LEACHATE SA
	TOX CHAR LEACHING PROCEDURE (TCLP W/ORG)	5	SW846-3010		FAA OR ICP ACID DIGESTION OF LEACHATE SA
	TOX CHAR LEACHING PROCEDURE (TCLP W/ ORG	5	SW846-3010		FAA OR ICP ACID DIGESTION OF LEACHATE SA

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TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Fr	Method	Description
SW846-1311	TOX CHAR LEACHING PROCEDURE (TCLP METALS	S		SW846-3020	GFAA ACID DIGESTION OF LEACHATE SAMPLES
	TOX CHAR LEACHING PROCEDURE (TCLP W/ORG)	S		SW846-3020	GFAA ACID DIGESTION OF LEACHATE SAMPLES
	TOX CHAR LEACHING PROCEDURE (TCLP W/ ORG	S		SW846-3020	GFAA ACID DIGESTION OF LEACHATE SAMPLES
	TOX CHAR LEACHING PROCEDURE (TCLP METALS	S		SW846-3030	MOD ACID DIGESTION OF OILS
	TOX CHAR LEACHING PROCEDURE (TCLP W/ORG)	S		SW846-3030	MOD ACID DIGESTION OF OILS
	TOX CHAR LEACHING PROCEDURE (TCLP W/ ORG	S		SW846-3030 SW846-3510	MOD ACID DIGESTION OF OILS GC SEPARATORY FUNNEL LIQUID-LIQUID EXTRA
	TOX CHAR LEACHING PROCEDURE (TCLP W/ORG)	S		SW846-3510	GC SEPARATORY FUNNEL LIQUID-LIQUID EXTRA
	TOX CHAR LEACHING PROCEDURE (TCLP W/ ORG	S		SW846-3510	GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EX
	TOX CHAR LEACHING PROCEDURE (TCLP W/ORG)	S		SW846-3510	GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EX
	TOX CHAR LEACHING PROCEDURE (TCLP W/ ORG	S		SW846-3510	TCLP GC SEPARATORY FUNNEL LIQUID-LIQUID
	TOX CHAR LEACHING PROCEDURE (TCLP W/ORG)	S		SW846-3510	TCLP GC SEPARATORY FUNNEL LIQUID-LIQUID
	TOX CHAR LEACHING PROCEDURE (TCLP W/ ORG	S		SW846-3510	TCLP GC/MS SEPARATORY FUNNEL LIQUID-LIQU
	TOX CHAR LEACHING PROCEDURE (TCLP W/ORG)	S		SW846-3510	TCLP GC/MS SEPARATORY FUNNEL LIQUID-LIQU
	TOX CHAR LEACHING PROCEDURE (TCLP W/ ORG	S		SW846-3580	GC/MS WASTE DILUTION FOR ORGANICS
	TOX CHAR LEACHING PROCEDURE (TCLP W/ORG)	S		SW846-3580	GC/MS WASTE DILUTION FOR ORGANICS
	TOX CHAR LEACHING PROCEDURE (TCLP W/ ORG	S		SW846-3580	TCLP GC WASTE DILUTION FOR ORGANICS
	TOX CHAR LEACHING PROCEDURE (TCLP W/ORG)	S		SW846-3580	TCLP GC WASTE DILUTION FOR ORGANICS
	TOX CHAR LEACHING PROCEDURE (TCLP W/ ORG	S		SW846-3580	TCLP GC/MS WASTE DILUTION FOR ORGANICS
	TOX CHAR LEACHING PROCEDURE (TCLP W/ORG)	S		SW846-3580	TCLP GC/MS WASTE DILUTION FOR ORGANICS
	TOX CHAR LEACHING PROCEDURE (TCLP W/ ORG	S		SW846-3580	WASTE DILUTION FOR ORGANICS
	TOX CHAR LEACHING PROCEDURE (TCLP W/ORG)	S		SW846-3580	WASTE DILUTION FOR ORGANICS
	ZERO HEADSPACE EXTRACTION (TCLP)	S		SW846-8015 SW846-8015	ALCOHOLS BY GC:FID TCLP ALCOHOLS BY GC:FID
	TOX CHAR LEACHING PROCEDURE (TCLP W/ORG)	S		SW846-8150	DIAZOMETHANE HERBICIDE DERIVATIZATION
	TOX CHAR LEACHING PROCEDURE (TCLP W/ ORG	S		SW846-8150	TCLP DIAZOMETHANE HERBICIDE DERIVATIZATI
	TOX CHAR LEACHING PROCEDURE (TCLP W/ORG)	S		SW846-8150	TCLP DIAZOMETHANE HERBICIDE DERIVATIZATI

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PREP	Description	Matrix	Fe	Method	Description
SW846-1311	ZERO HEADSPACE EXTRACTION (TCLP)	S		SW846-8240	TCLP VOLATILE ORGANICS (LANDBAN)
				SW846-8240	TCLP VOLATILE ORGANICS (LANDBAN)
				SW846-8240	TCLP VOLATILE ORGANICS (TOXICITY CHARACT
				SW846-8240	TCLP VOLATILE ORGANICS (TOXICITY CHARACT
SW846-3005	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM	W		SAS	GOLD (ICP-SEQ)
				SW846-6010	ALUMINUM (ICP-SEQ)
				SW846-6010	ALUMINUM ICP
				SW846-6010	ANTIMONY (ICP-SEQ)
				SW846-6010	ANTIMONY ICP
				SW846-6010	BARIUM (ICP-SEQ)
				SW846-6010	BARIUM ICP
				SW846-6010	BARIUM ICP (3 POINT MSA)
				SW846-6010	BARIUM ICP-SEQ (1 POINT MSA)
				SW846-6010	BERYLLIUM (ICP-SEQ)
				SW846-6010	BERYLLIUM ICP
				SW846-6010	BISMUTH ICP
				SW846-6010	BORON ICP
				SW846-6010	CADMIUM (ICP-SEQ)
				SW846-6010	CADMIUM ICP
				SW846-6010	CADMIUM ICP (3 POINT MSA)
				SW846-6010	CALCIUM ICP
				SW846-6010	CHROMIUM (ICP-SEQ)
				SW846-6010	CHROMIUM ICP
				SW846-6010	COBALT (ICP-SEQ)
				SW846-6010	COBALT ICP
				SW846-6010	COPPER (ICP-SEQ)
				SW846-6010	COPPER ICP
				SW846-6010	ICP SCAN
				SW846-6010	IRON (ICP-SEQ)
				SW846-6010	IRON ICP
				SW846-6010	LEAD (ICP-SEQ)
				SW846-6010	LEAD ICP
				SW846-6010	LEAD ICP (3 POINT MSA)
				SW846-6010	LITHIUM ICP
				SW846-6010	MAGNESIUM ICP
				SW846-6010	MANGANESE (ICP-SEQ)
				SW846-6010	MANGANESE ICP
				SW846-6010	MISCELLANEOUS (ICP-SEQ)
				SW846-6010	MOLYBDENUM ICP
				SW846-6010	NICKEL (ICP-SEQ)
				SW846-6010	NICKEL ICP
				SW846-6010	POTASSIUM ICP
				SW846-6010	SILICON ICP
				SW846-6010	SILVER (ICP-SEQ)
				SW846-6010	SILVER ICP
				SW846-6010	SILVER ICP (3 POINT MSA)
				SW846-6010	SODIUM ICP
				SW846-6010	STRONTIUM ICP
				SW846-6010	THALLIUM (ICP-SEQ)
				SW846-6010	THALLIUM ICP
				SW846-6010	TIN ICP
				SW846-6010	TITANIUM ICP

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TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Id	Method	Description
SW846-3005	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM		1	SW846-6010	VANADIUM (ICP-SEQ)
				SW846-6010	VANADIUM ICP
				SW846-6010	YTTRIUM ICP
				SW846-6010	ZINC (ICP-SEQ)
				SW846-6010	ZINC ICP
				SW846-7020	ALUMINUM FAA
				SW846-7040	ANTIMONY FAA
				SW846-7060	BARIUM FAA
				SW846-7060	BARIUM FAA (1 POINT MSA)
				SW846-7060	BARIUM FAA (3 POINT MSA)
				SW846-7090	BERYLLIUM FAA
				SW846-7090	BERYLLIUM FAA (3 POINT MSA)
				SW846-7130	CADMIUM FAA
				SW846-7130	CADMIUM FAA (1 POINT MSA)
				SW846-7130	CADMIUM FAA (3 POINT MSA)
				SW846-7140	CALCIUM FAA
				SW846-7190	CHROMIUM FAA
				SW846-7190	CHROMIUM FAA (3 POINT MSA)
				SW846-7200	COBALT FAA
				SW846-7210	COPPER FAA
				SW846-7380	IRON FAA
				SW846-7420	LEAD FAA
				SW846-7420	LEAD FAA (3 POINT MSA)
				SW846-7450	MAGNESIUM FAA
				SW846-7460	MANGANESE FAA
				SW846-7480	MOLYBDENUM FAA
				SW846-7520	NICKEL FAA
				SW846-7610	POTASSIUM FAA
				SW846-7760	SILVER FAA
				SW846-7770	SODIUM FAA
				SW846-7780	STRONTIUM FAA
				SW846-7840	THALLIUM FAA
				SW846-7870	TIN FAA
				SW846-7910	VANADIUM FAA
				SW846-7950	ZINC FAA
			2	SAS	GOLD (ICP-SEQ)
				SW846-6010	ALUMINUM (ICP-SEQ)
				SW846-6010	ALUMINUM ICP
				SW846-6010	ANTIMONY (ICP-SEQ)
				SW846-6010	ANTIMONY ICP
				SW846-6010	BARIUM (ICP-SEQ)
				SW846-6010	BARIUM ICP
				SW846-6010	BERYLLIUM (ICP-SEQ)
				SW846-6010	BERYLLIUM ICP
				SW846-6010	BISMUTH ICP
				SW846-6010	BORON ICP
				SW846-6010	CADMIUM (ICP-SEQ)
				SW846-6010	CADMIUM ICP
				SW846-6010	CALCIUM ICP
				SW846-6010	CHROMIUM (ICP-SEQ)
				SW846-6010	CHROMIUM ICP
				SW846-6010	COBALT (ICP-SEQ)

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TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Method	Description
SW846-3005	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM	2	SW846-6010	COBALT ICP
			SW846-6010	COPPER (ICP-SEQ)
			SW846-6010	COPPER ICP
			SW846-6010	ICP SCAN
			SW846-6010	IRON (ICP-SEQ)
			SW846-6010	IRON ICP
			SW846-6010	LEAD (ICP-SEQ)
			SW846-6010	LEAD ICP
			SW846-6010	LITHIUM ICP
			SW846-6010	MAGNESIUM ICP
			SW846-6010	MANGANESE (ICP-SEQ)
			SW846-6010	MANGANESE ICP
			SW846-6010	MOLYBDENUM ICP
			SW846-6010	NICKEL (ICP-SEQ)
			SW846-6010	NICKEL ICP
			SW846-6010	POTASSIUM ICP
			SW846-6010	SILICON ICP
			SW846-6010	SILVER (ICP-SEQ)
			SW846-6010	SILVER ICP
			SW846-6010	SODIUM ICP
			SW846-6010	STRONTIUM ICP
			SW846-6010	THALLIUM (ICP-SEQ)
			SW846-6010	THALLIUM ICP
			SW846-6010	TIN ICP
			SW846-6010	TITANIUM ICP
			SW846-6010	VANADIUM (ICP-SEQ)
			SW846-6010	VANADIUM ICP
			SW846-6010	YTTRIUM ICP
			SW846-6010	ZINC (ICP-SEQ)
			SW846-6010	ZINC ICP
			SW846-7020	ALUMINUM FAA
			SW846-7040	ANTIMONY FAA
			SW846-7080	BARIUM FAA
			SW846-7090	BERYLLIUM FAA
			SW846-7130	CADMIUM FAA
			SW846-7140	CALCIUM FAA
			SW846-7190	CHROMIUM FAA
			SW846-7200	COBALT FAA
			SW846-7210	COPPER FAA
			SW846-7380	IRON FAA
			SW846-7420	LEAD FAA
			SW846-7450	MAGNESIUM FAA
			SW846-7460	MANGANESE FAA
			SW846-7480	MOLYBDENUM FAA
			SW846-7520	NICKEL FAA
			SW846-7610	POTASSIUM FAA
			SW846-7760	SILVER FAA
			SW846-7770	SODIUM FAA
			SW846-7780	STRONTIUM FAA
			SW846-7840	THALLIUM FAA
			SW846-7870	TIN FAA
			SW846-7910	VANADIUM FAA
			SW846-7950	ZINC FAA

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TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	scription	Matrix	Te	Method	Description
SW846-3005	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM		3	SAS	GOLD (ICP-SEQ)
				SW846-6010	ALUMINUM (ICP-SEQ)
				SW846-6010	ALUMINUM ICP
				SW846-6010	ANTIMONY (ICP-SEQ)
				SW846-6010	ANTIMONY ICP
				SW846-6010	BARIUM (ICP-SEQ)
				SW846-6010	BARIUM ICP
				SW846-6010	BERYLLIUM (ICP-SEQ)
				SW846-6010	BERYLLIUM ICP
				SW846-6010	BISMUTH ICP
				SW846-6010	BORON ICP
				SW846-6010	CADMIUM (ICP-SEQ)
				SW846-6010	CADMIUM ICP
				SW846-6010	CALCIUM ICP
				SW846-6010	CHROMIUM (ICP-SEQ)
				SW846-6010	CHROMIUM ICP
				SW846-6010	COBALT (ICP-SEQ)
				SW846-6010	COBALT ICP
				SW846-6010	COPPER (ICP-SEQ)
				SW846-6010	COPPER ICP
				SW846-6010	ICP SCAN
				SW846-6010	IRON (ICP-SEQ)
				SW846-6010	IRON ICP
				SW846-6010	LEAD (ICP-SEQ)
				SW846-6010	LEAD ICP
				SW846-6010	LITHIUM ICP
				SW846-6010	MAGNESIUM ICP
				SW846-6010	MANGANESE (ICP-SEQ)
				SW846-6010	MANGANESE ICP
				SW846-6010	MOLYBDENUM ICP
				SW846-6010	NICKEL (ICP-SEQ)
				SW846-6010	NICKEL ICP
				SW846-6010	POTASSIUM ICP
				SW846-6010	SILICON ICP
				SW846-6010	SILVER (ICP-SEQ)
				SW846-6010	SILVER ICP
				SW846-6010	SODIUM ICP
				SW846-6010	STRONTIUM ICP
				SW846-6010	THALLIUM (ICP-SEQ)
				SW846-6010	THALLIUM ICP
				SW846-6010	TIN ICP
				SW846-6010	TITANIUM ICP
				SW846-6010	VANADIUM (ICP-SEQ)
				SW846-6010	VANADIUM ICP
				SW846-6010	YTTRIUM ICP
				SW846-6010	ZINC (ICP-SEQ)
				SW846-6010	ZINC ICP
				SW846-7020	ALUMINUM FAA
				SW846-7040	ANTIMONY FAA
				SW846-7080	BARIUM FAA
				SW846-7090	BERYLLIUM FAA
				SW846-7130	CADMIUM FAA

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TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix 1	Method	Description
SW846-3005	FAA OR ICP ACID DIGESTION OF AQUEOUS SAM	3	SW846-7140	CALCIUM FAA
			SW846-7190	CHROMIUM FAA
			SW846-7200	COBALT FAA
			SW846-7210	COPPER FAA
			SW846-7380	IRON FAA
			SW846-7420	LEAD FAA
			SW846-7450	MAGNESIUM FAA
			SW846-7460	MANGANESE FAA
			SW846-7480	MOLYBDENUM FAA
			SW846-7520	NICKEL FAA
			SW846-7610	POTASSIUM FAA
			SW846-7760	SILVER FAA
			SW846-7770	SODIUM FAA
			SW846-7780	STRONTIUM FAA
			SW846-7840	THALLIUM FAA
			SW846-7870	TIN FAA
			SW846-7910	VANADIUM FAA
			SW846-7950	ZINC FAA
SW846-3010	FAA OR ICP ACID DIGESTION OF LEACHATE SA	1	SW846-6010	BARIUM ICP (3 POINT MSA)
			SW846-6010	CADMIUM ICP (3 POINT MSA)
			SW846-6010	CHROMIUM ICP (3 POINT MSA)
			SW846-6010	LEAD ICP (3 POINT MSA)
			SW846-6010	MISCELLANEOUS (ICP-SEQ)
			SW846-6010	NICKEL ICP (3 POINT MSA)
			SW846-6010	SILVER ICP (3 POINT MSA)
			SW846-6010	TCLP COPPER ICP (1 POINT MSA)
			SW846-6010	TCLP NICKEL ICP (1 POINT MSA)
			SW846-7080	BARIUM FAA (1 POINT MSA)
			SW846-7080	BARIUM FAA (3 POINT MSA)
			SW846-7080	TCLP BARIUM FAA (1 POINT MSA)
			SW846-7080	TCLP BARIUM FAA (3 POINT MSA)
			SW846-7090	BERYLLIUM FAA (3 POINT MSA)
			SW846-7130	CADMIUM FAA (1 POINT MSA)
			SW846-7130	CADMIUM FAA (3 POINT MSA)
			SW846-7130	TCLP CADMIUM FAA (1 POINT MSA)
			SW846-7130	TCLP CADMIUM FAA (3 POINT MSA)
			SW846-7140	CALCIUM FAA (3 POINT MSA)
			SW846-7190	CHROMIUM FAA (3 POINT MSA)
			SW846-7190	TCLP CHROMIUM FAA (1 POINT MSA)
			SW846-7190	TCLP CHROMIUM FAA (3 POINT MSA)
			SW846-7200	COBALT FAA (3 POINT MSA)
			SW846-7210	TCLP COPPER FAA (1 POINT MSA)
			SW846-7380	IRON FAA (3 POINT MSA)
			SW846-7420	LEAD FAA (3 POINT MSA)
			SW846-7420	TCLP LEAD FAA (1 POINT MSA)
			SW846-7420	TCLP LEAD FAA (3 POINT MSA)
			SW846-7450	MAGNESIUM FAA (3 POINT MSA)
			SW846-7460	MANGANESE FAA (3 POINT MSA)
			SW846-7480	MOLYBDENUM FAA (3 POINT MSA)
			SW846-7520	NICKEL FAA (3 POINT MSA)
			SW846-7610	POTASSIUM FAA (3 POINT MSA)
			SW846-7760	SILVER FAA (3 POINT MSA)

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TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	scription	Matrix	Method	Description
SW846-3010	FAA OR ICP ACID DIGESTION OF LEACHATE SA	1	SW846-7760	TCLP SILVER FAA (1 POINT MSA)
			SW846-7760	TCLP SILVER FAA (3 POINT MSA)
			SW846-7950	ZINC FAA (3 POINT MSA)
		5	SW846-6010	ALUMINUM ICP (1 POINT MSA)
			SW846-6010	ALUMINUM ICP-SEQ (1 POINT MSA)
			SW846-6010	ANTIMONY ICP (1 POINT MSA)
			SW846-6010	BARIUM ICP (1 POINT MSA)
			SW846-6010	BARIUM ICP (3 POINT MSA)
			SW846-6010	BARIUM ICP-SEQ (1 POINT MSA)
			SW846-6010	BORON ICP (1 POINT MSA)
			SW846-6010	CADMIUM ICP (1 POINT MSA)
			SW846-6010	CADMIUM ICP (3 POINT MSA)
			SW846-6010	CADMIUM ICP-SEQ (1 POINT MSA)
			SW846-6010	CHROMIUM ICP (1 POINT MSA)
			SW846-6010	CHROMIUM ICP (3 POINT MSA)
			SW846-6010	CHROMIUM ICP-SEQ (1 POINT MSA)
			SW846-6010	COPPER ICP (1 POINT MSA)
			SW846-6010	COPPER ICP-SEQ (1 POINT MSA)
			SW846-6010	IRON ICP (1 POINT MSA)
			SW846-6010	IRON ICP-SEQ (1 POINT MSA)
			SW846-6010	LEAD ICP (1 POINT MSA)
			SW846-6010	LEAD ICP (3 POINT MSA)
			SW846-6010	LEAD ICP-SEQ (1 POINT MSA)
			SW846-6010	MAGNESIUM ICP (1 POINT MSA)
			SW846-6010	MANGANESE ICP (1 POINT MSA)
			SW846-6010	MANGANESE ICP-SEQ (1 POINT MSA)
			SW846-6010	MOLYBDENUM ICP (1 POINT MSA)
			SW846-6010	NICKEL ICP (1 POINT MSA)
			SW846-6010	NICKEL ICP (3 POINT MSA)
			SW846-6010	NICKEL ICP-SEQ (1 POINT MSA)
			SW846-6010	SILVER ICP (1 POINT MSA)
			SW846-6010	SILVER ICP (3 POINT MSA)
			SW846-6010	SILVER ICP-SEQ (1 POINT MSA)
			SW846-6010	SODIUM ICP (1 POINT MSA)
			SW846-6010	TCLP COPPER ICP (1 POINT MSA)
			SW846-6010	TCLP NICKEL ICP (1 POINT MSA)
			SW846-6010	TCLP ZINC ICP (1 POINT MSA)
			SW846-6010	VANADIUM ICP (1 POINT MSA)
			SW846-6010	VANADIUM ICP-SEQ (1 POINT MSA)
			SW846-6010	ZINC ICP (1 POINT MSA)
			SW846-6010	ZINC ICP (3 POINT MSA)
			SW846-6010	ZINC ICP-SEQ (1 POINT MSA)
			SW846-7020	ALUMINUM FAA (1 POINT MSA)
			SW846-7020	ALUMINUM FAA (3 POINT MSA)
			SW846-7040	ANTIMONY FAA (1 POINT MSA)
			SW846-7040	ANTIMONY FAA (3 POINT MSA)
			SW846-7040	TCLP ANTIMONY FAA (1 POINT MSA)
			SW846-7080	BARIUM FAA (1 POINT MSA)
			SW846-7080	BARIUM FAA (3 POINT MSA)
			SW846-7080	TCLP BARIUM FAA (1 POINT MSA)
			SW846-7080	TCLP BARIUM FAA (3 POINT MSA)
			SW846-7090	BERYLLIUM FAA (1 POINT MSA)

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TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Method	Description
SW846-3010	FAA OR ICP ACID DIGESTION OF LEACHATE SA	S	SW846-7090	BERYLLIUM FAA (3 POINT MSA)
			SW846-7130	CADMIUM FAA (1 POINT MSA)
			SW846-7130	CADMIUM FAA (3 POINT MSA)
			SW846-7130	TCLP CADMIUM FAA (1 POINT MSA)
			SW846-7130	TCLP CADMIUM FAA (3 POINT MSA)
			SW846-7140	CALCIUM FAA (1 POINT MSA)
			SW846-7140	CALCIUM FAA (3 POINT MSA)
			SW846-7190	CHROMIUM FAA (1 POINT MSA)
			SW846-7190	CHROMIUM FAA (3 POINT MSA)
			SW846-7190	TCLP CHROMIUM FAA (1 POINT MSA)
			SW846-7190	TCLP CHROMIUM FAA (3 POINT MSA)
			SW846-7200	COBALT FAA (1 POINT MSA)
			SW846-7200	COBALT FAA (3 POINT MSA)
			SW846-7200	TCLP COBALT FAA (1 POINT MSA)
			SW846-7210	COPPER FAA (1 POINT MSA)
			SW846-7210	COPPER FAA (3 POINT MSA)
			SW846-7210	TCLP COPPER FAA (1 POINT MSA)
			SW846-7380	IRON FAA (1 POINT MSA)
			SW846-7380	IRON FAA (3 POINT MSA)
			SW846-7420	LEAD FAA (1 POINT MSA)
			SW846-7420	LEAD FAA (3 POINT MSA)
			SW846-7420	TCLP LEAD FAA (1 POINT MSA)
			SW846-7420	TCLP LEAD FAA (3 POINT MSA)
			SW846-7450	MAGNESIUM FAA (1 POINT MSA)
			SW846-7450	MAGNESIUM FAA (3 POINT MSA)
			SW846-7460	MANGANESE FAA (1 POINT MSA)
			SW846-7460	MANGANESE FAA (3 POINT MSA)
			SW846-7480	MOLYBDENUM FAA (3 POINT MSA)
			SW846-7520	NICKEL FAA (1 POINT MSA)
			SW846-7520	NICKEL FAA (3 POINT MSA)
			SW846-7520	TCLP NICKEL FAA (1 POINT MSA)
			SW846-7610	POTASSIUM FAA (3 POINT MSA)
			SW846-7760	SILVER FAA (1 POINT MSA)
			SW846-7760	SILVER FAA (3 POINT MSA)
			SW846-7760	TCLP SILVER FAA (1 POINT MSA)
			SW846-7760	TCLP SILVER FAA (3 POINT MSA)
			SW846-7770	SODIUM FAA (1 POINT MSA)
			SW846-7840	TCLP THALLIUM FAA (1 POINT MSA)
			SW846-7840	THALLIUM FAA (1 POINT MSA)
			SW846-7840	THALLIUM FAA (1 POINT MSA)
			SW846-7910	VANADIUM FAA (1 POINT MSA)
			SW846-7950	TCLP ZINC FAA (1 POINT MSA)
			SW846-7950	ZINC FAA (1 POINT MSA)
			SW846-7950	ZINC FAA (3 POINT MSA)
SW846-3020	GFAA ACID DIGESTION OF AQUEOUS SAMPLES	1	SW846-7021	ALUMINUM GFAA
			SW846-7041	ANTIMONY GFAA
			SW846-7060	ARSENIC GFAA
			SW846-7060	ARSENIC GFAA (1 POINT MSA)
	GFAA ACID DIGESTION OF LEACHATE SAMPLES	1	SW846-7060	ARSENIC GFAA (1 POINT MSA)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES	1	SW846-7060	ARSENIC GFAA (3 POINT MSA)

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TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	T	Method	Description
SW846-3020	GFAA ACID DIGESTION OF LEACHATE SAMPLES		1	SW846-7060	ARSENIC GFAA (3 POINT MSA)
				SW846-7060	TCLP ARSENIC GFAA (1 POINT MSA)
				SW846-7060	TCLP ARSENIC GFAA (3 POINT MSA)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES		1	SW846-7091	BERYLLIUM GFAA
				SW846-7131	CADMIUM GFAA
				SW846-7131	CADMIUM GFAA (1 POINT MSA)
	GFAA ACID DIGESTION OF LEACHATE SAMPLES		1	SW846-7131	CADMIUM GFAA (1 POINT MSA)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES		1	SW846-7131	CADMIUM GFAA (3 POINT MSA)
	GFAA ACID DIGESTION OF LEACHATE SAMPLES		1	SW846-7131	CADMIUM GFAA (3 POINT MSA)
				SW846-7131	TCLP CADMIUM GFAA (1 POINT MSA)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES		1	SW846-7191	CHROMIUM GFAA
				SW846-7201	COBALT GFAA
				SW846-7211	COPPER GFAA (SW)
				SW846-7421	LEAD GFAA
				SW846-7421	LEAD GFAA (3 POINT MSA)
	GFAA ACID DIGESTION OF LEACHATE SAMPLES		1	SW846-7421	LEAD GFAA (3 POINT MSA)
				SW846-7421	TCLP LEAD GFAA (1 POINT MSA)
				SW846-7421	TCLP LEAD GFAA (3 POINT MSA)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES		1	SW846-7481	MOLYBDENUM GFAA
				SW846-7521	NICKEL GFAA
				SW846-7740	SELENIUM GFAA
	GFAA ACID DIGESTION OF LEACHATE SAMPLES		1	SW846-7740	SELENIUM GFAA (3 POINT MSA)
				SW846-7740	TCLP SELENIUM GFAA (1 POINT MSA)
				SW846-7740	TCLP SELENIUM GFAA (3 POINT MSA)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES		1	SW846-7761	SILVER GFAA
				SW846-7841	THALLIUM GFAA
				SW846-7841	THALLIUM GFAA (3 POINT MSA)
	GFAA ACID DIGESTION OF LEACHATE SAMPLES		1	SW846-7841	THALLIUM GFAA (3 POINT MSA)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES		1	SW846-7911	VANADIUM GFAA
			2	SW846-7021	ALUMINUM GFAA
				SW846-7041	ANTIMONY GFAA
				SW846-7060	ARSENIC GFAA
				SW846-7091	BERYLLIUM GFAA
				SW846-7131	CADMIUM GFAA
				SW846-7191	CHROMIUM GFAA
				SW846-7201	COBALT GFAA
				SW846-7211	COPPER GFAA (SW)
				SW846-7421	LEAD GFAA
				SW846-7481	MOLYBDENUM GFAA
				SW846-7521	NICKEL GFAA

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TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Method	Description
SW846-3020	GFAA ACID DIGESTION OF AQUEOUS SAMPLES	2	SW846-7740	SELENIUM GFAA
			SW846-7761	SILVER GFAA
			SW846-7841	THALLIUM GFAA
			SW846-7911	VANADIUM GFAA
		3	SW846-7021	ALUMINUM GFAA
			SW846-7041	ANTIMONY GFAA
			SW846-7060	ARSENIC GFAA
			SW846-7091	BERYLLIUM GFAA
			SW846-7131	CADMIUM GFAA
			SW846-7191	CHROMIUM GFAA
			SW846-7201	COBALT GFAA
			SW846-7211	COPPER GFAA (SW)
			SW846-7421	LEAD GFAA
			SW846-7481	MOLYBDENUM GFAA
			SW846-7521	NICKEL GFAA
			SW846-7740	SELENIUM GFAA
			SW846-7761	SILVER GFAA
			SW846-7841	THALLIUM GFAA
	GFAA ACID DIGESTION OF LEACHATE SAMPLES	5	EPA 206.2	ARSENIC GFAA (3 POINT MSA)
	GFAA ACID DIGESTION OF AQUEOUS SAMPLES	5	SW846-7060	ARSENIC GFAA (1 POINT MSA)
	GFAA ACID DIGESTION OF LEACHATE SAMPLES	5	SW846-7060	ARSENIC GFAA (1 POINT MSA)
			SW846-7060	ARSENIC GFAA (3 POINT MSA)
			SW846-7060	TCLP ARSENIC GFAA (1 POINT MSA)
			SW846-7060	TCLP ARSENIC GFAA (3 POINT MSA)
			SW846-7131	CADMIUM GFAA (1 POINT MSA)
			SW846-7131	CADMIUM GFAA (3 POINT MSA)
			SW846-7131	TCLP CADMIUM GFAA (1 POINT MSA)
			SW846-7421	LEAD GFAA (1 POINT MSA)
			SW846-7421	LEAD GFAA (3 POINT MSA)
			SW846-7421	TCLP LEAD GFAA (1 POINT MSA)
			SW846-7421	TCLP LEAD GFAA (3 POINT MSA)
			SW846-7740	SELENIUM GFAA (1 POINT MSA)
			SW846-7740	SELENIUM GFAA (3 POINT MSA)
			SW846-7740	TCLP SELENIUM GFAA (1 POINT MSA)
			SW846-7740	TCLP SELENIUM GFAA (3 POINT MSA)
			SW846-7841	THALLIUM GFAA (1 POINT MSA)
			SW846-7841	THALLIUM GFAA (3 POINT MSA)
SW846-3030 MOD	ACID DIGESTION OF OILS	4	SAS	GOLD (ICP-SEQ)
			SW846-6010	ALUMINUM (ICP-SEQ)
			SW846-6010	ALUMINUM ICP
			SW846-6010	ANTIMONY (ICP-SEQ)
			SW846-6010	ANTIMONY ICP
			SW846-6010	BARIUM (ICP-SEQ)
			SW846-6010	BARIUM ICP
			SW846-6010	BERYLLIUM (ICP-SEQ)
			SW846-6010	BERYLLIUM ICP
			SW846-6010	BISMUTH ICP
			SW846-6010	BORON ICP

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TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	T	Method	Description
SW846-3030 MOD	ACID DIGESTION OF OILS		4	SW846-6010	CADMIUM (ICP-SEQ)
				SW846-6010	CADMIUM ICP
				SW846-6010	CALCIUM ICP
				SW846-6010	CHROMIUM (ICP-SEQ)
				SW846-6010	CHROMIUM ICP
				SW846-6010	COBALT (ICP-SEQ)
				SW846-6010	COBALT ICP
				SW846-6010	COPPER (ICP-SEQ)
				SW846-6010	COPPER ICP
				SW846-6010	ICP SCAN
				SW846-6010	IRON (ICP-SEQ)
				SW846-6010	IRON ICP
				SW846-6010	LEAD (ICP-SEQ)
				SW846-6010	LEAD ICP
				SW846-6010	LITHIUM ICP
				SW846-6010	MAGNESIUM ICP
				SW846-6010	MANGANESE (ICP-SEQ)
				SW846-6010	MANGANESE ICP
				SW846-6010	MOLYBDENUM ICP
				SW846-6010	NICKEL (ICP-SEQ)
				SW846-6010	NICKEL ICP
				SW846-6010	POTASSIUM ICP
				SW846-6010	SILICON ICP
				SW846-6010	SILVER (ICP-SEQ)
				SW846-6010	SILVER ICP
				SW846-6010	SODIUM ICP
				SW846-6010	STRONTIUM ICP
				SW846-6010	THALLIUM (ICP-SEQ)
				SW846-6010	THALLIUM ICP
				SW846-6010	TIN ICP
				SW846-6010	TITANIUM ICP
				SW846-6010	VANADIUM (ICP-SEQ)
				SW846-6010	VANADIUM ICP
				SW846-6010	YITRIUM ICP
				SW846-6010	ZINC (ICP-SEQ)
				SW846-6010	ZINC ICP
				SW846-7020	ALUMINUM FAA
				SW846-7021	ALUMINUM GFAA
				SW846-7040	ANTIMONY FAA
				SW846-7041	ANTIMONY GFAA
				SW846-7060	ARSENIC GFAA
				SW846-7060	ARSENIC GFAA (3 POINT MSA)
				SW846-7080	BARIUM FAA
				SW846-7090	BERYLLIUM FAA
				SW846-7091	BERYLLIUM GFAA
				SW846-7130	CADMIUM FAA
				SW846-7131	CADMIUM GFAA
				SW846-7140	CALCIUM FAA
				SW846-7190	CHROMIUM FAA
				SW846-7191	CHROMIUM GFAA
				SW846-7200	COBALT FAA
				SW846-7201	COBALT GFAA
				SW846-7210	COPPER FAA

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	scription	Matrix	1	Method	Description
SW846-3030 MOD.	ACID DIGESTION OF OILS		4	SW846-7380	IRON FAA
				SW846-7420	LEAD FAA
				SW846-7421	LEAD GFAA
				SW846-7450	MAGNESIUM FAA
				SW846-7460	MANGANESE FAA
				SW846-7470	MERCURY CVAA
				SW846-7471	MERCURY CVAA
				SW846-7480	MOLYBDENUM FAA
				SW846-7481	MOLYBDENUM GFAA
				SW846-7520	NICKEL FAA
				SW846-7521	NICKEL GFAA
				SW846-7610	POTASSIUM FAA
				SW846-7740	SELENIUM GFAA
				SW846-7760	SILVER FAA
				SW846-7761	SILVER GFAA
				SW846-7770	SODIUM FAA
				SW846-7780	STRONTIUM FAA
				SW846-7840	THALLIUM FAA
				SW846-7841	THALLIUM GFAA
				SW846-7870	TIN FAA
				SW846-7910	VANADIUM FAA
				SW846-7950	ZINC FAA
			5	SW846-6010	TCLP COPPER ICP (1 POINT MSA)
				SW846-6010	TCLP NICKEL ICP (1 POINT MSA)
				SW846-6010	TCLP ZINC ICP (1 POINT MSA)
				SW846-7040	TCLP ANTIMONY FAA (1 POINT MSA)
				SW846-7060	ARSENIC GFAA (3 POINT MSA)
				SW846-7060	TCLP ARSENIC GFAA (1 POINT MSA)
				SW846-7060	TCLP ARSENIC GFAA (3 POINT MSA)
				SW846-7080	TCLP BARIUM FAA (1 POINT MSA)
				SW846-7080	TCLP BARIUM FAA (3 POINT MSA)
				SW846-7130	TCLP CADMIUM FAA (1 POINT MSA)
				SW846-7130	TCLP CADMIUM FAA (3 POINT MSA)
				SW846-7131	TCLP CADMIUM GFAA (1 POINT MSA)
				SW846-7190	TCLP CHROMIUM FAA (1 POINT MSA)
				SW846-7190	TCLP CHROMIUM FAA (3 POINT MSA)
				SW846-7210	TCLP COPPER FAA (1 POINT MSA)
				SW846-7420	TCLP LEAD FAA (1 POINT MSA)
				SW846-7420	TCLP LEAD FAA (3 POINT MSA)
				SW846-7421	TCLP LEAD GFAA (1 POINT MSA)
				SW846-7421	TCLP LEAD GFAA (3 POINT MSA)
				SW846-7520	TCLP NICKEL FAA (1 POINT MSA)
				SW846-7740	TCLP SELENIUM GFAA (1 POINT MSA)
				SW846-7740	TCLP SELENIUM GFAA (3 POINT MSA)
				SW846-7760	TCLP SILVER FAA (1 POINT MSA)
				SW846-7760	TCLP SILVER FAA (3 POINT MSA)
				SW846-7840	TCLP THALLIUM FAA (1 POINT MSA)
SW846-3050	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL		5	SAS	GOLD (ICP-SEQ)
				SW846-6010	ALUMINUM (ICP-SEQ)
				SW846-6010	ALUMINUM ICP
				SW846-6010	ANTIMONY (ICP-SEQ)

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PREP	Description	Matrix	Ti	Method	Description
SW846-3050	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL	S		SW846-6010	ANTIMONY ICP
				SW846-6010	BARIUM (ICP-SEQ)
				SW846-6010	BARIUM ICP
				SW846-6010	BARIUM ICP (1 POINT MSA)
				SW846-6010	BARIUM ICP (3 POINT MSA)
				SW846-6010	BARIUM ICP-SEQ (1 POINT MSA)
				SW846-6010	BERYLLIUM (ICP-SEQ)
				SW846-6010	BERYLLIUM ICP
				SW846-6010	BISMUTH ICP
				SW846-6010	BORON ICP
				SW846-6010	BORON ICP (1 POINT MSA)
				SW846-6010	CADMIUM (ICP-SEQ)
				SW846-6010	CADMIUM ICP
				SW846-6010	CADMIUM ICP (1 POINT MSA)
				SW846-6010	CADMIUM ICP (3 POINT MSA)
				SW846-6010	CALCIUM ICP
				SW846-6010	CHROMIUM (ICP-SEQ)
				SW846-6010	CHROMIUM ICP
				SW846-6010	CHROMIUM ICP (1 POINT MSA)
				SW846-6010	CHROMIUM ICP (3 POINT MSA)
				SW846-6010	CHROMIUM ICP-SEQ (1 POINT MSA)
				SW846-6010	COBALT (ICP-SEQ)
				SW846-6010	COBALT ICP
				SW846-6010	COPPER (ICP-SEQ)
				SW846-6010	COPPER ICP
				SW846-6010	ICP SCAN
				SW846-6010	IRON (ICP-SEQ)
				SW846-6010	IRON ICP
				SW846-6010	IRON ICP (1 POINT MSA)
				SW846-6010	IRON ICP-SEQ (1 POINT MSA)
				SW846-6010	LEAD (ICP-SEQ)
				SW846-6010	LEAD ICP
				SW846-6010	LEAD ICP (1 POINT MSA)
				SW846-6010	LEAD ICP (3 POINT MSA)
				SW846-6010	LEAD ICP-SEQ (1 POINT MSA)
				SW846-6010	LITHIUM ICP
				SW846-6010	MAGNESIUM ICP
				SW846-6010	MAGNESIUM ICP (1 POINT MSA)
				SW846-6010	MANGANESE (ICP-SEQ)
				SW846-6010	MANGANESE ICP
				SW846-6010	MANGANESE ICP (1 POINT MSA)
				SW846-6010	MANGANESE ICP-SEQ (1 POINT MSA)
				SW846-6010	MOLYBDENUM ICP
				SW846-6010	MOLYBDENUM ICP (1 POINT MSA)
				SW846-6010	NICKEL (ICP-SEQ)
				SW846-6010	NICKEL ICP
				SW846-6010	NICKEL ICP (1 POINT MSA)
				SW846-6010	NICKEL ICP (3 POINT MSA)
				SW846-6010	NICKEL ICP-SEQ (1 POINT MSA)
				SW846-6010	POTASSIUM ICP
				SW846-6010	SILICON ICP
				SW846-6010	SILVER (ICP-SEQ)
				SW846-6010	SILVER ICP

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Method	Description
SW846-3050	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL	S	SW846-6010	SILVER ICP (1 POINT MSA)
			SW846-6010	SILVER ICP (3 POINT MSA)
			SW846-6010	SILVER ICP-SEQ (1 POINT MSA)
			SW846-6010	SODIUM ICP
			SW846-6010	SODIUM ICP (1 POINT MSA)
			SW846-6010	STRONTIUM ICP
			SW846-6010	THALLIUM (ICP-SEQ)
			SW846-6010	THALLIUM ICP
			SW846-6010	TIN ICP
			SW846-6010	TITANIUM ICP
			SW846-6010	VANADIUM (ICP-SEQ)
			SW846-6010	VANADIUM ICP
			SW846-6010	VANADIUM ICP (1 POINT MSA)
			SW846-6010	VANADIUM ICP-SEQ (1 POINT MSA)
			SW846-6010	YTTRIUM ICP
			SW846-6010	ZINC (ICP-SEQ)
			SW846-6010	ZINC ICP
			SW846-6010	ZINC ICP (1 POINT MSA)
			SW846-6010	ZINC ICP (3 POINT MSA)
			SW846-6010	ZINC ICP-SEQ (1 POINT MSA)
			SW846-7020	ALUMINUM FAA
	GFAA ACID DIGESTION OF S/S/S SAMPLES	S	SW846-7021	ALUMINUM GFAA
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL	S	SW846-7040	ANTIMONY FAA
	GFAA ACID DIGESTION OF S/S/S SAMPLES	S	SW846-7041	ANTIMONY GFAA
			SW846-7060	ARSENIC GFAA
			SW846-7060	ARSENIC GFAA (3 POINT MSA)
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL	S	SW846-7080	BARIUM FAA
			SW846-7080	BARIUM FAA (1 POINT MSA)
			SW846-7080	BARIUM FAA (3 POINT MSA)
			SW846-7090	BERYLLIUM FAA
			SW846-7090	BERYLLIUM FAA (1 POINT MSA)
			SW846-7090	BERYLLIUM FAA (3 POINT MSA)
	GFAA ACID DIGESTION OF S/S/S SAMPLES	S	SW846-7091	BERYLLIUM GFAA
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL	S	SW846-7130	CADMIUM FAA
			SW846-7130	CADMIUM FAA (1 POINT MSA)
			SW846-7130	CADMIUM FAA (3 POINT MSA)
	GFAA ACID DIGESTION OF S/S/S SAMPLES	S	SW846-7131	CADMIUM GFAA
			SW846-7131	CADMIUM GFAA (1 POINT MSA)
			SW846-7131	CADMIUM GFAA (3 POINT MSA)
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL	S	SW846-7140	CALCIUM FAA
			SW846-7190	CHROMIUM FAA
			SW846-7190	CHROMIUM FAA (1 POINT MSA)
			SW846-7190	CHROMIUM FAA (3 POINT MSA)
	GFAA ACID DIGESTION OF S/S/S SAMPLES	S	SW846-7191	CHROMIUM GFAA

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	scription	Matrix	T	Method	Description
SW846-3050	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL		5	SW846-7200	COBALT FAA
				SW846-7200	COBALT FAA (1 POINT MSA)
	GFAA ACID DIGESTION OF S/S/S SAMPLES		5	SW846-7201	COBALT GFAA
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL		5	SW846-7210	COPPER FAA
				SW846-7210	COPPER FAA (1 POINT MSA)
				SW846-7210	COPPER FAA (3 POINT MSA)
	GFAA ACID DIGESTION OF S/S/S SAMPLES		5	SW846-7211	COPPER GFAA (SW)
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL		5	SW846-7380	IRON FAA
				SW846-7380	IRON FAA (1 POINT MSA)
				SW846-7420	LEAD FAA
				SW846-7420	LEAD FAA (1 POINT MSA)
				SW846-7420	LEAD FAA (3 POINT MSA)
	GFAA ACID DIGESTION OF S/S/S SAMPLES		5	SW846-7421	LEAD GFAA
				SW846-7421	LEAD GFAA (1 POINT MSA)
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL		5	SW846-7421	LEAD GFAA (3 POINT MSA)
				SW846-7450	MAGNESIUM FAA
				SW846-7450	MAGNESIUM FAA (1 POINT MSA)
				SW846-7460	MANGANESE FAA
				SW846-7460	MANGANESE FAA (1 POINT MSA)
				SW846-7480	MOLYBDENUM FAA
	GFAA ACID DIGESTION OF S/S/S SAMPLES		5	SW846-7481	MOLYBDENUM GFAA
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL		5	SW846-7520	NICKEL FAA
				SW846-7520	NICKEL FAA (1 POINT MSA)
				SW846-7520	NICKEL FAA (3 POINT MSA)
	GFAA ACID DIGESTION OF S/S/S SAMPLES		5	SW846-7521	NICKEL GFAA
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL		5	SW846-7610	POTASSIUM FAA
	GFAA ACID DIGESTION OF S/S/S SAMPLES		5	SW846-7740	SELENIUM GFAA
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL		5	SW846-7740	SELENIUM GFAA (1 POINT MSA)
				SW846-7740	SELENIUM GFAA (3 POINT MSA)
				SW846-7760	SILVER FAA
				SW846-7760	SILVER FAA (1 POINT MSA)
				SW846-7760	SILVER FAA (3 POINT MSA)
	GFAA ACID DIGESTION OF S/S/S SAMPLES		5	SW846-7761	SILVER GFAA
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL		5	SW846-7770	SODIUM FAA
				SW846-7770	SODIUM FAA (1 POINT MSA)
				SW846-7780	STRONTIUM FAA
				SW846-7840	THALLIUM FAA
				SW846-7840	THALLIUM FAA (1 POINT MSA)

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PREP	Description	Matrix	F	Method	Description
SW846-3050	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL		5	SW846-7840	THALLIUM FAA (1 POINT MSA)
	GFAA ACID DIGESTION OF S/S/S SAMPLES		5	SW846-7841	THALLIUM GFAA
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL		5	SW846-7841	THALLIUM GFAA (3 POINT MSA)
				SW846-7870	TIN FAA
				SW846-7910	VANADIUM FAA
				SW846-7910	VANADIUM FAA (1 POINT MSA)
	GFAA ACID DIGESTION OF S/S/S SAMPLES		5	SW846-7911	VANADIUM GFAA
	FAA OR ICP ACID DIGESTION OF S/S/S SAMPL		5	SW846-7950	ZINC FAA
				SW846-7950	ZINC FAA (1 POINT MSA)
				SW846-7950	ZINC FAA (3 POINT MSA)
SW846-3510	GC SEPARATORY FUNNEL LIQUID-LIQUID EXTRA		1	SW846-8080	ORGANOCHLORINE PESTICIDE(S) BY GC:ECD
				SW846-8080	ORGANOCHLORINE PESTICIDES BY GC:ECD (19
				SW846-8080	ORGANOCHLORINE PESTICIDES BY GC:ECD (4 P
				SW846-8080	ORGANOCHLORINE PESTICIDES BY GC:ECD (7 P
				SW846-8080	PCB/PESTICIDE SCAN GC:ECD
				SW846-8080	POLYCHLORINATED BIPHENYLS (PCBS)
	TCLP GC SEPARATORY FUNNEL LIQUID-LIQUID		1	SW846-8080	TCLP ORGANOCHLORINE PESTICIDES BY GC:ECD
	GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EX		1	SW846-8270	APPENDIX IX SEMIVOLATILE ORGANICS
				SW846-8270	IDEM SEMI-VOLATILE TARGET COMPOUND LIST
	GC/MS SEPARATORY FUNNEL LIQUID-LIQUID (A		1	SW846-8270	SEMI-VOLATILE ORGANICS (ACID FRACTION)
	GC/MS SEPARATORY FUNNEL LIQUID-LIQUID (B		1	SW846-8270	SEMI-VOLATILE ORGANICS (BASE/NEUTRAL FRA
	GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EX		1	SW846-8270	SEMI-VOLATILE ORGANICS (BASE/NEUTRAL/ACI
				SW846-8270	TCLP SEMIVOLATILE ORGANICS (LANDBAN)
	TCLP GC/MS SEPARATORY FUNNEL LIQUID-LIQU		1	SW846-8270	TCLP SEMIVOLATILE ORGANICS (LANDBAN)
	GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EX		1	SW846-8270	TCLP SEMIVOLATILE ORGANICS (TOXICITY CHA
	TCLP GC/MS SEPARATORY FUNNEL LIQUID-LIQU		1	SW846-8270	TCLP SEMIVOLATILE ORGANICS (TOXICITY CHA
	GC SEPARATORY FUNNEL LIQUID-LIQUID EXTRA		2	SW846-8080	ORGANOCHLORINE PESTICIDE(S) BY GC:ECD
				SW846-8080	ORGANOCHLORINE PESTICIDES BY GC:ECD (19
				SW846-8080	ORGANOCHLORINE PESTICIDES BY GC:ECD (4 P
				SW846-8080	ORGANOCHLORINE PESTICIDES BY GC:ECD (7 P
				SW846-8080	PCB/PESTICIDE SCAN GC:ECD
				SW846-8080	POLYCHLORINATED BIPHENYLS (PCBS)
	GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EX		2	SW846-8270	APPENDIX IX SEMIVOLATILE ORGANICS
				SW846-8270	IDEM SEMI-VOLATILE TARGET COMPOUND LIST
	GC/MS SEPARATORY FUNNEL LIQUID-LIQUID (A		2	SW846-8270	SEMI-VOLATILE ORGANICS (ACID FRACTION)
	GC/MS SEPARATORY FUNNEL LIQUID-LIQUID (B		2	SW846-8270	SEMI-VOLATILE ORGANICS (BASE/NEUTRAL FRA

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TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	Description	Matrix	Method	Description
SW846-3510	GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EX	2	SW846-8270	SEMI-VOLATILE ORGANICS (BASE/NEUTRAL/ACI
			SW846-8270	TCLP SEMIVOLATILE ORGANICS (LANDBAN)
			SW846-8270	TCLP SEMIVOLATILE ORGANICS (TOXICITY CHA
	GC SEPARATORY FUNNEL LIQUID-LIQUID EXTRA	3	SW846-8080	ORGANOCHLORINE PESTICIDES BY GC:ECD (4 P
	GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EX	3	SW846-8270	APPENDIX IX SEMIVOLATILE ORGANICS
			SW846-8270	IDEM SEMI-VOLATILE TARGET COMPOUND LIST
			SW846-8270	SEMI-VOLATILE ORGANICS (BASE/NEUTRAL/ACI
	GC SEPARATORY FUNNEL LIQUID-LIQUID EXTRA	5	SW846-8080	ORGANOCHLORINE PESTICIDE(S) BY GC:ECD
	TCLP GC SEPARATORY FUNNEL LIQUID-LIQUID	5	SW846-8080	TCLP ORGANOCHLORINE PESTICIDES BY GC:ECD
	GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EX	5	SW846-8270	TCLP SEMIVOLATILE ORGANICS (LANDBAN)
	TCLP GC/MS SEPARATORY FUNNEL LIQUID-LIQU	5	SW846-8270	TCLP SEMIVOLATILE ORGANICS (LANDBAN)
	GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EX	5	SW846-8270	TCLP SEMIVOLATILE ORGANICS (TOXICITY CHA
	TCLP GC/MS SEPARATORY FUNNEL LIQUID-LIQU	5	SW846-8270	TCLP SEMIVOLATILE ORGANICS (TOXICITY CHA
SW846-3550	SONICATION EXTRACTION FOR ORGANICS	5	SW846-8080	MONOCHLORINATED BIPHENYLS (MCBS)
			SW846-8080	ORGANOCHLORINE PESTICIDES BY GC:ECD (19
			SW846-8080	ORGANOCHLORINE PESTICIDES BY GC:ECD (4 P
			SW846-8080	ORGANOCHLORINE PESTICIDES BY GC:ECD (7 P
	GC & GC/MS SONICATION EXTRACTION FOR ORG	5	SW846-8080	PCB/PESTICIDE SCAN GC:ECD
	SONICATION EXTRACTION FOR ORGANICS	5	SW846-8080	PCB/PESTICIDE SCAN GC:ECD
	PCB SONICATION EXTRACTION	5	SW846-8080	POLYCHLORINATED BIPHENYLS (PCBS)
	GC/MS SONICATION EXTRACTION FOR ORGANICS	5	SW846-8270	APPENDIX IX SEMIVOLATILE ORGANICS
			SW846-8270	IDEM SEMI-VOLATILE TARGET COMPOUND LIST
			SW846-8270	SEMI-VOLATILE ORGANICS (ACID FRACTION)
			SW846-8270	SEMI-VOLATILE ORGANICS (BASE/NEUTRAL FRA
	GC & GC/MS SONICATION EXTRACTION FOR ORG	5	SW846-8270	SEMI-VOLATILE ORGANICS (BASE/NEUTRAL/ACI
	GC/MS SONICATION EXTRACTION FOR ORGANICS	5	SW846-8270	SEMI-VOLATILE ORGANICS (BASE/NEUTRAL/ACI
SW846-3580	WASTE DILUTION FOR ORGANICS	4	SW846-8080	MONOCHLORINATED BIPHENYLS (MCBS)
			SW846-8080	ORGANOCHLORINE PESTICIDE(S) BY GC:ECD
			SW846-8080	PCB/PESTICIDE SCAN GC:ECD
	PCB OIL EXTRACTION	4	SW846-8080	POLYCHLORINATED BIPHENYLS (PCBS)
	GC/MS WASTE DILUTION FOR ORGANICS	4	SW846-8270	IDEM SEMI-VOLATILE TARGET COMPOUND LIST
			SW846-8270	SEMI-VOLATILE ORGANICS (BASE/NEUTRAL/ACI
			SW846-8270	TCLP SEMIVOLATILE ORGANICS (LANDBAN)
			SW846-8270	TCLP SEMIVOLATILE ORGANICS (TOXICITY CHA

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	scription	Matrix	T.	Method	Description
SW846-3580	WASTE DILUTION FOR ORGANICS		5	SW846-8080	MONOCHLORINATED BIPHENYLS (MCBS)
				SW846-8080	ORGANOCHLORINE PESTICIDE(S) BY GC:ECD
				SW846-8080	ORGANOCHLORINE PESTICIDES BY GC:ECD (19
				SW846-8080	ORGANOCHLORINE PESTICIDES BY GC:ECD (4 P
				SW846-8080	ORGANOCHLORINE PESTICIDES BY GC:ECD (7 P
				SW846-8080	PCB/PESTICIDE SCAN GC:ECD
	PCB OIL EXTRACTION		5	SW846-8080	POLYCHLORINATED BIPHENYLS (PCBS)
	TCLP GC WASTE DILUTION FOR ORGANICS		5	SW846-8080	TCLP ORGANOCHLORINE PESTICIDES BY GC:ECD
	GC/MS WASTE DILUTION FOR ORGANICS		5	SW846-8270	APPENDIX IX SEMIVOLATILE ORGANICS
				SW846-8270	IDEM SEMI-VOLATILE TARGET COMPOUND LIST
				SW846-8270	SEMI-VOLATILE ORGANICS (BASE/NEUTRAL/ACI
				SW846-8270	TCLP SEMIVOLATILE ORGANICS (LANDBAN)
	TCLP GC/MS WASTE DILUTION FOR ORGANICS		5	SW846-8270	TCLP SEMIVOLATILE ORGANICS (LANDBAN)
	GC/MS WASTE DILUTION FOR ORGANICS		5	SW846-8270	TCLP SEMIVOLATILE ORGANICS (TOXICITY CHA
	TCLP GC/MS WASTE DILUTION FOR ORGANICS		5	SW846-8270	TCLP SEMIVOLATILE ORGANICS (TOXICITY CHA
SW846-5030	PURGE AND TRAP METHOD FOR ORGANIC ANALYT		5	EPA 601	PURGEABLE HALOCARBONS BY GC/ELCD
				EPA 601/602 MOD	HALOGENATED AND AROMATIC VOLATILE ORGANI
				EPA 602	PURGEABLE AROMATICS BY GC/PID ELCD (BTEX
				SW846-8010	HALOGENATED VOLATILE ORGANICS BY GC:ELCD
				SW846-8020	PURGEABLE AROMATICS BY GC/PID
				SW846-8021	HALOGENATED AND AROMATIC VOLATILE ORGANI
SW846-7470	MERCURY CVAA ACID DIGESTION OF LEACHATE		1	SW846-7470	TCLP MERCURY CVAA (1 POINT MSA)
				SW846-7470	TCLP MERCURY CVAA (3 POINT MSA)
			5	SW846-7470	TCLP MERCURY CVAA (1 POINT MSA)
				SW846-7470	TCLP MERCURY CVAA (3 POINT MSA)
SW846-8150	DIAZOMETHANE HERBICIDE DERIVATIZATION		1	SW846-8150	CHLORINATED HERBICIDES (2,4 D AND SILVEX
				SW846-8150	CHLORINATED HERBICIDES (2,4 D, SILVEX AN
				SW846-8150	TCLP CHLORINATED HERBICIDES (2,4-D AND S
	TCLP DIAZOMETHANE HERBICIDE DERIVATIZATI		1	SW846-8150	TCLP CHLORINATED HERBICIDES (2,4-D AND S
	DIAZOMETHANE HERBICIDE DERIVATIZATION		2	SW846-8150	CHLORINATED HERBICIDES (2,4 D AND SILVEX
				SW846-8150	CHLORINATED HERBICIDES (2,4 D, SILVEX AN
			3	SW846-8150	CHLORINATED HERBICIDES (2,4 D AND SILVEX
				SW846-8150	CHLORINATED HERBICIDES (2,4 D, SILVEX AN
			5	SW846-8150	CHLORINATED HERBICIDES (2,4 D AND SILVEX
				SW846-8150	CHLORINATED HERBICIDES (2,4 D, SILVEX AN
				SW846-8150	TCLP CHLORINATED HERBICIDES (2,4-D AND S
	TCLP DIAZOMETHANE HERBICIDE DERIVATIZATI		5	SW846-8150	TCLP CHLORINATED HERBICIDES (2,4-D AND S

(preptest.sql)

PREP	Description	Matrix	Method	Description
SW846-9010	CYANIDE DISTILLATION	1	ILM01	CYANIDE, TOTAL (AUTOMATED) (CLP)
	CYANIDE AMENABLE DISTILLATION	1	SW846-9010	CYANIDE, AMENABLE
	CYANIDE DISTILLATION	1	SW846-9010	CYANIDE, TOTAL (MANUAL)
	CYANIDE AMENABLE DISTILLATION	1	SW846-9012	CYANIDE AMENABLE TO CHLORINATION (AUTOMA
	CYANIDE DISTILLATION	1	SW846-9012	CYANIDE LEACHATE (AUTOMATED)
			SW846-9012	CYANIDE, TOTAL (AUTOMATED)
		2	ILM01	CYANIDE, TOTAL (AUTOMATED) (CLP)
			SW846-9010	CYANIDE, TOTAL (MANUAL)
	CYANIDE AMENABLE DISTILLATION	2	SW846-9012	CYANIDE AMENABLE TO CHLORINATION (AUTOMA
	CYANIDE DISTILLATION	2	SW846-9012	CYANIDE, TOTAL (AUTOMATED)
		3	ILM01	CYANIDE, TOTAL (AUTOMATED) (CLP)
			SW846-9012	CYANIDE, TOTAL (AUTOMATED)
		4	ILM01	CYANIDE, TOTAL (AUTOMATED) (CLP)
	CYANIDE AMENABLE DISTILLATION	4	SW846-9010	CYANIDE, AMENABLE
	CYANIDE DISTILLATION	4	SW846-9010	CYANIDE, TOTAL (MANUAL)
	CYANIDE AMENABLE DISTILLATION	4	SW846-9012	CYANIDE AMENABLE TO CHLORINATION (AUTOMA
	CYANIDE DISTILLATION	4	SW846-9012	CYANIDE, TOTAL (AUTOMATED)
		5	ILM01	CYANIDE, TOTAL (AUTOMATED) (CLP)
	CYANIDE AMENABLE DISTILLATION	5	SW846-9010	CYANIDE, AMENABLE
	CYANIDE DISTILLATION	5	SW846-9010	CYANIDE, LEACHATE (MANUAL)
			SW846-9010	CYANIDE, TOTAL (MANUAL)
	CYANIDE AMENABLE DISTILLATION	5	SW846-9012	CYANIDE AMENABLE TO CHLORINATION (AUTOMA
	CYANIDE DISTILLATION	5	SW846-9012	CYANIDE LEACHATE (AUTOMATED)
			SW846-9012	CYANIDE, TOTAL (AUTOMATED)
SW846-9065	PHENOLS DISTILLATION	1	SW846-9066	PHENOLS 4AAP (AUTOMATED)
		2	SW846-9066	PHENOLS 4AAP (AUTOMATED)
		3	SW846-9066	PHENOLS 4AAP (AUTOMATED)
		4	SW846-9066	PHENOLS 4AAP (AUTOMATED)
		5	SW846-9066	PHENOLS 4AAP (AUTOMATED)

(preptest.sql)

TABLE 5.2

SAMPLE PREPARATION METHODS

PREP	scription	Matrix Te	Method	Description
SW846-9065	PHENOLS DISILLATION	5	SW846-9066	PHENOLS 4AAP (LEACHATE)

MATRIX 1 - NON-SPECIFIC WATER

MATRIX 2 - GROUND WATER

MATRIX 3 - DRINKING WATER

MATRIX 4 - OIL

MATRIX 5 - SOIL/SEDIMENT/SLUDGES, OTHER

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SECTION 6.0

6.0 Sampling Procedures

6.1 Introduction

During normal operations, no sampling will be performed by EMS Heritage. The sampling procedures for specific projects will be addressed on a case by case basis by the project manager.

In the event that sampling is to be performed, procedures in the EPA Region IV SOP and QA Manual, dated April 1, 1986 will be used and referenced.

6.2 Sample Containers

EMS Heritage does provide sample containers and preservatives to clients. All sample containers will be for one-time use only, therefore no sample bottle cleaning will be performed at EMS Heritage. Sample containers are prepared as "kits" which make up all the containers needed for a sample with multiple tests to be performed, including additional containers required for QC sample analysis. Clients requiring coolers are shipped kits in a styrofoam cooler packed inside of a cardboard box. Those clients using their own coolers for delivery are shipped containers in a cardboard box. All shipments are sealed such that any tampering or attempt to open the shipping container is evident. There are basically two general types of container categories: 1) new pre-cleaned and 2) new, as-is from the manufacturer.

6.2.1 Pre-Cleaned Containers

The pre-cleaned containers will be used when the client's Data Quality Objectives (DQO's) demand them or when the client or QA Unit requests pre-cleaned containers. These pre-cleaned containers will primarily be used for clients performing superfund type investigations (EPA, CLP methodology) or any other sensitive sampling event. The cleaning procedures used are broken down into protocols for different test requirements (see Table 6.1, Sample Container Preparation Protocols). These pre-cleaned containers may be purchased either with or without a certificate of analysis (QA analyzed) pertaining to the container lot from the vendor. If QA analyzed containers are not available from the vendor, EMS Heritage will perform the analysis from randomly selected containers of the lot shipped when the client or QA Unit requires containers that have been QA analyzed. The use

Table 6.1

Sample Container Preparation Protocols

-Protocol A-

●Amber Glass Bottles ●Clear Glass Bottles ●Wide Mouth Amber Glass Jars
●Wide Mouth Clear Glass Jars

Cleaning Protocol A Specifications:

1. Wash containers, closures and teflon liners in hot tap water with laboratory grade non-phosphate detergent.
2. Rinse three times with tap water.
3. Rinse with 1:1 nitric acid.
4. Rinse three times with deionized water.
5. Rinse with pesticide grade methylene chloride.
6. Oven dry at 125°C. Allow to cool.
7. Remove containers, closures, and teflon liners from oven.
8. Place teflon liners in closures and place closures on container. Attendant to wear gloves and containers are not to be removed from preparation room until sealed.

Sample Containers Prepared According to Protocol A Are For Use In The Analysis Of:

Acidity/Alkalinity	Hardness	Settleable Residue/Suspended Solids	Mercury
Sulfate	Chloride	BOD (Biological Oxygen Demand)	Metals
Color	Oil & Grease	COD (Chemical Oxygen Demand)	Sulfide
Phenols	pH	Sulfite	Conductivity
Phosphate	Turbidity	TOC (Total Organic Carbon)	Cyanide
		Extractable Organics	

-Protocol B-

•40 ml Borosilicate Clear and Amber Glass Vials •10 ml Polyethylene Vials
•40 ml and 20 ml Flint Glass Vials •8 oz. and 4 oz. Septum Bottles
•Wide Mouth Clear Glass Jars*
and High Density Polyethylene Bottles (allow extra time for delivery)
*Wide Mouth Clear Glass Jars prepared according to Protocol B are supplied with Teflon-lines polypropylene closures attached

Cleaning Protocol B Specifications:

1. Wash containers, septa, and closures in hot water with laboratory grade non-phosphate detergent.
2. Rinse three times with tap water.
3. Rinse three times with deionized water.
4. Oven dry containers, septa and closures at 125°C.
5. Remove containers, septa, and closures, at 125°C.
6. Place liners in closures, teflon side down, and place on containers. Attendant to wear gloves and containers are not to be removed from preparation room until sealed.

Sample Containers Prepared According to Protocol B Are For Use In The Analysis Of:

COD (Chemical Oxygen Demand) Purgeable (Volatile) Organics
Trihalomethanes Nitrate-Nitrite TOC (Total Organic Carbon)

Note: Protocol B cleaning is performed in an environmentally controlled facility, free of volatile organic vapors.

-Protocol C-

- High Density Polyethylene Bottles and jars
- Polyethylene Cubitainers
- High Density Polyethylene Wide Mouth Jars
- High Density Polyethylene Products

Cleaning Protocol C Specifications:

1. Wash containers, closures, and teflon liners in hot tap water with laboratory grade non-phosphate detergent.
2. Rinse three times with tap water.
3. Rinse with 1:1 nitric acid.
4. Rinse three times with deionized water.
5. Air dry in contaminant-free-environment.
6. Place liners in closures and place closures on containers. Attendant to wear gloves and containers are not to be removed from preparation room until sealed.

Sample Containers Prepared According to Protocol C Are For Use In The Analysis Of:

All analysis noted for Protocol A except:
Phenols; Oils & Grease; TOC (Total Organic Carbon)

of QA analyzed containers may not be required in cases where the client will submit field blanks.

Containers that have been pre-cleaned or pre-cleaned and QA analyzed will be shipped to EMS Heritage with a custody seal. The certificate of analysis (when purchased) will be shipped inside the shipping container (box) and will remain there until the box is opened (custody seal is broken). Some client needs will not necessitate that the shipping container be opened in all instances. If this is the case, the certificate of analysis for bottle cleanliness must be retained by the client receiving the containers. In instances where preservatives must be added prior to transfer to the client and/or the original custody seal is broken on the container box, the certificate of analysis will be removed and filed for future reference. The containers will be re-sealed to establish a proper chain of custody.

All sample containers will be stored in their original packing containers. When packages of un-capped sample containers or closures are opened, they will be stored in plastic bags and sealed to prevent contamination during storage. Only EMS Heritage employees will have unsupervised access to the storage area. All other persons must be accompanied by an EMS Heritage employee while in the container storage area.

6.2.2 New, As-Is Containers

Each month EMS Heritage will use as-is sample containers to prepare blind performance evaluation samples. Any significant contamination will show up in these monthly reports, which is a check on container cleanliness. Any target analytes present at equal to or greater than the laboratory reporting detection limits will require that corrective actions be taken, including but not limited to, obtaining an alternate source of containers.

New containers used directly from the manufacturer without precleaning will have reagent water blanks analyzed for the tests which are conducted in that container type not covered in the monthly blind P.E. samples. The frequency of these analyses will be once per lot of the container type received or once per month when lot numbers are not available. These container blanks containing reagent water and preservative will be analyzed using the most sensitive techniques

routinely performed from those containers. The blank samples will be entered into the LIMS system for analysis and reporting. The QA Unit will review this final report and retain the report for cleanliness of container documentation.

6.3 Preservation

A basic requirement for preservation of samples for many types of analyses includes sample shipping and storage at 4°C immediately after collection. Wet ice is the only acceptable means of reducing temperature for all environmental samples with the exception of any biological tissue samples (i.e. fish). Biological tissue samples may be shipped with dry ice.

Chemical preservatives are to be added on-site at the time of sample collection. As a convenience to our clients and an assurance that chemical preservation is not omitted, EMS Heritage supplies containers which already contain the required preservative in the proper amount and concentration. All preservatives consist of reagent grade chemicals. Lot numbers of all chemical used are tracked so that any questions relating to the reagent (preservatives) used are traceable to the lot of reagent used for preservation.

The chemical preservatives used for preserving samples are listed in Table 6.2, Aqueous Sample Preservatives.

Table 6.3, Sample Requirements, includes all of the parameters listed in Table 5.1 (QA Targets for Precision, Accuracy and Method Detection Limits) and specifies:

- Container type
- Required sample amounts for analysis
- Preservation requirements
- Holding times
- Methods

Table 6.2
Aqueous Sample Preservatives

Reagent	Concentration	Pre-Preserved[1] Container Amount	Required pH	Test Categories
Hydrochloric Acid	Concentrated	0.1 mL/40mL	<2	Volatile Organics
Hydrochloric Acid	0.1M	See Footnote [2]	4 to 5	Acrolein, Acrylonitrile
Hydrochloric Acid	1:1	5mL/L	<2	Oil & Grease, TPH
Phosphoric Acid	Concentrated	4mL/L	<4	Phenols
Nitric Acid	Concentrated	5mL/Liter	<2	Metals, Alpha, Beta, Radium
Sulfuric acid	Concentrated	1mL/Liter	<2	Phenols, T-Phosphorus, Ammonia, COD, TKN, Nitrate-Nitrite, Oil & Grease, TOC
Sodium Hydroxide	Pellets	2 pellets/Liter	>9	Sulfide
Sodium Hydroxide	Pellets	2 pellets/Liter	>12	Cyanide
Zinc Acetate	Solid	0.1g/Liter	NA	Sulfide
Sodium Thiosulfate	Solid	80mg/Liter	NA	Coliforms, Organics
Ascorbic Acid	Solid	25mg/40mL	NA	SDWA Volatile Organics, Cyanide
Mercuric Chloride[3]	10mg/mL	1mL/Liter	NA	SDWA Herbicides, SDWA N&P Containing Pesticides
Monochloroacetic Acid Buffer	See Footnote [4]	1.2 mL/40mL	3	Carbamates

1 Preservative added per sample amount
2 To be adjusted in the field
3 Alternative preservative preferred (HCl)
4 156 mL of 2.5M Monochloroacetic acid and 100mL of 2.5M potassium acetate

Table 6.3
SAMPLE REQUIREMENTS

Test	Method	Reference	Container[1]	Water Sample Preservation[2,3]	Required Sample Quantity		Maximum Holding Time Water[4]	Maximum Holding Time S/S/S
					Water	S/S/S		
General Chemistry								
Acidity	Titrimetric	EPA 305.1	P,G	Cool, 4°C	200mL	50g	14 days	
Alkalinity	Titrimetric	EPA 310.1	P,G	Cool, 4°C	200mL	50g	14 days	
Alkalinity	Titrimetric	EPA 310.2	P,G	Cool, 4°C	200mL	50g	14 days	
Ammonia Nitrogen		EPA 350.1	P,G	Cool, 4°C H_2SO_4 to pH <2	500mL	100g	28 days	28 days
Ammonia Nitrogen		EPA 350.2	P,G	Cool, 4°C H_2SO_4 to pH <2	500mL	100g	28 days	28 days
Ammonia Nitrogen	Potentiometric	EPA 350.3	P,G	Cool, 4°C H_2SO_4 to pH <2	1L	5g	28 days	28 days
Asbestos		NIOSH 239					NA	NA
Biochemical Oxygen Demand	Potentiometric	EPA 405.1	P,G	Cool, 4°C	1L	NA	48 hours	NA
Boron	Colorimetric	EPA 212.3	P	Cool, 4°C H_2SO_4 to pH <2	200mL	NA	28 days	NA
Bromide	Colorimetric	SM405	P,G	None	50mL	NA	28 days	NA
Bromide	Titrimetric	EPA320.1	P,G	None	50mL	NA	28 days	NA
Chemical Oxygen Demand	Open Reflux	SM508A	P,G	Cool, 4°C H_2SO_4 to pH <2	100mL	100g	28 days	28 days
Chemical Oxygen Demand	Mid-Level Titrimetric	EPA410.1	P,G	Cool, 4°C H_2SO_4 to pH <2	100mL	100g	28 days	28 days
Chemical Oxygen Demand	Low Level	EPA410.2	P,G	Cool, 4°C H_2SO_4 to pH <2	100mL	100g	28 days	28 days
Chemical Oxygen Demand	Block Digester, Colorimetric	EPA 410.4	P,G	Cool, 4°C H_2SO_4 to pH <2	100mL	100g	28 days	28 days
Chloride	Colorimetric, Automated	EPA 325.1	P,G	None	100mL	5g	28 days	28 days

Table 6.3
SAMPLE REQUIREMENTS

Test	Method	Reference	Container[1]	Water Sample Preservation[2,3]	Required Sample Quantity		Maximum Holding Time Water[4]	Maximum Holding Time S/S/S
					Water	S/S/S		
Chloride	Colorimetric, Automated	EPA 325.2	P,G	None	500mL	5g	28 days	28 days
Chloride	Titrimetric, Mercuric Nitrate	EPA 325.3	P,G	None	500mL	5g	28 days	28 days
Chloride	Ion Selective Electrode	14th Ed SM 320A	P,G	None	500mL	5g	28 days	28 days
Chloride		SM 407A	P,G	None	500mL	5g	28 days	28 days
Chlorine Demand	Starch-Iodine Titration	SAS	P,G	None	1L	NA	28 days	NA
Chlorine, Total		ASTM D-808	P,G	None			NA	
Coliform Bacteria, Fecal	Microbiological	SM 909C	P,G	0.008% $Na_2S_2O_3$[5] Cool, 4°C	100mL	NA	6 hours	NA
Coliform Bacteria, Total	Microbiological	SM 909A	P,G-Sterile	0.008% $Na_2S_2O_3$[5] Cool, 4°C	100mL	NA	6 hours	NA
Color Determination	HACH	EPA 110.3	P,G	Cool, 4°C	100mL	NA	48 hours	NA
Cyanide, Amenable		EPA 335.1	P,G	Cool, 4°C NaOH to pH > 10	1L	100g	14 days[6]	14 days
Cyanide, Amenable	Colorimetric, Automated	EPA 335.2	P,G	Cool, 4°C NaOH to pH > 10	1L	100g	14 days[6]	14 days
Cyanide, Total	Manual	EPA 335.2	P,G	Cool, 4°C NaOH to pH > 10	500mL	100g	14 days[6]	14 days
Cyanide, Total	Automated	EPA 335.3	P,G	Cool, 4°C NaOH to pH > 10	500mL	100g	14 days[6]	14 days
Cyanide, Amenable	Manual	SW846-9010	P,G	Cool, 4°C NaOH to pH > 10	1L	100g	14 days[6]	14 days
Cyanide, Amenable	Automated	SW 846-9012	P,G	Cool, 4°C NaOH to pH > 10	1L	100g	14 days[6]	14 days
Cyanide, Total	Manual	SW 846-9010	P,G	Cool, 4°C NaOH to pH > 10	500mL	100g	14 days[6]	14 days

Table 6.3
SAMPLE REQUIREMENTS

Test	Method	Reference	Container[1]	Water Sample Preservation[2,3]	Required Sample Quantity		Maximum Holding Time Water[4]	Maximum Holding Time S/S/S
					Water	S/S/S		
Cyanide, Total	Automated	SW 846-9012	P,G	Cool, 4°C NaOH to pH > 10	500mL	100g	14 days[5]	14 days
Cyanide, Total Available		SW 7.3.3.2	P,G	Cool, 4°C NaOH to pH > 10	1L	100g	14 days[5]	14 days
Dissolved Oxygen	Membrane Electrode	EPA 360.1	P,G	None	300mL	NA	Analyze Immediately	NA
Dissolved Oxygen	Winkler	EPA 360.2	P,G	Fix on site and store in dark	300mL	NA	8 hours	NA
Dissolved Solids, Total	Gravimetric	EPA 160.1	P,G	Cool, 4°C	500mL	NA	7 days	NA
Fluoride	Ion Selective Electrode	EPA 340.2	P,G	Cool, 4°C	500mL	50g	28 days	28 days
Fluoride		EPA 340.1	P,G	Cool, 4°C	500mL	50g	28 days	28 days
Formaldehyde		AOAC 20.047	G	Cool, 4°C	100mL	50g	28 days	28 days
Gross Alpha		EPA 900.0	P	HNO_3 to pH < 2	1 gallon	NA	6 months	NA
Gross Beta		EPA 900.0	P	HNO_3 to pH < 2	1 gallon	NA	6 months	NA
Hardness	Calculation	SM 314A	P,G	HNO_3 to pH < 2	200mL	NA	6 months	NA
Hardness	EDTA, Titrametric	EPA 130.2	P,G	HNO_3 to pH < 2	100mL	NA	6 months	NA
Hexavalent Chromium	Colorimetric	SM 312B	P,G	None	300mL	100g	24 hours	7 days
Hexavalent Chromium	Colorimetric, Manual	SW 846-7196	P,G	None	300mL	100g	24 hours	7 days
Iodine	Leuco Crystal Violet	16th Ed SM 415A	P,G	Cool 4°C	500mL	100g	Analyze Immediately	
Kjeldahl Nitrogen, Total	Automated	EPA 351.2	P,G	Cool, 4°C H_2SO_4 to pH <2	500mL	10g	28 days	28 days
Kjeldahl Nitrogen, Total	Potentiometric	EPA 351.3	P,G	Cool, 4°C H_2SO_4 to pH ≤2	100mL	50g	28 days	28 days
Nitrogen, Total Organic	Calculation	EPA 351.3	P,G	Cool, 4°C H_2SO_4 to pH <2	100mL	50g	28 days	28 days

Table 6.3
SAMPLE REQUIREMENTS

Test	Method	Reference	Container[1]	Water Sample Preservation[2,3]	Required Sample Quantity		Maximum Holding Time Water[4]	Maximum Holding Time S/S/S
					Water	S/S/S		
Nitrogen, Total Organic	Calculation	EPA 351.4	P,G	Cool, 4°C H_2SO_4 to pH <2	500mL	100g	28 days	28 days
Nitrogen, Nitrate	Colorimetric, Brucine	EPA 352.1	P,G	Cool, 4°C H_2SO_4 to pH <2	100mL	50g	48 hours	
Nitrogen, Nitrate	Colorimetric, Automated - Cd Red.	EPA 353.2	P,G	Cool, 4°C H_2SO_4 to pH <2	100mL	50g	48 hours	
Nitrogen, Nitrite	Colorimetric, Automated	EPA 353.2	P,G	Cool, 4°C H_2SO_4 to pH <2	100mL	50g	48 hours	
Nitrogen, Nitrate	Colorimetric, Automated-Hydrazine	EPA 353.1	P,G	Cool, 4°C H_2SO_4 to pH <2	100mL	50g	48 hours	
Nitrogen, Nitrate-Nitrite	Colorimetric, Automated-Hydrazine	EPA 353.1	P,G	Cool, 4°C H_2SO_4 to pH <2	100mL	50g	28 days	
Nitrogen, Nitrite	Spectrophotometric	EPA 354.1	P,G	Cool, 4°C	100mL	50g	48 hours	
Nuisance Dust	Analytical Micro-Balance	NIOSH 500	Air Filter	NA	NA	NA	NA	NA
Oil & Grease	Gravimetric, Sep. Funnel	EPA 413.1	G	Cool, 4°C H_2SO_4 to pH <2	2x1L	NA	28 days	NA
Oil & Grease	Soxhlet, Gravimetric	SW 846-9071	G	NA	NA	50g	NA	28 days
Paint Filter Test	Paint Filter	SW 846-9095	G	NA	NA	500g	NA	NA
Percent Solids	Gravimetric	SM 209A	P,G	Cool, 4°C	250mL	50g	7 days	7 days
Percent Solids		ASTM D-2042						
Percent Solids	Centrifuge	ASTM D-96						
pH	Electrode	EPA 150.1	P,G	Cool, 4°C	50mL	NA	Analyze Immediately	NA
pH	Electrode	SW 846-9040	P,G	Cool, 4°C	50mL	NA	Analyze Immediately	NA
pH	Paper	SW 846-9041	P,G	Cool, 4°C	50mL	NA	Analyze Immediately	NA

Table 6.3
SAMPLE REQUIREMENTS

Test	Method	Reference	Container[1]	Water Sample Preservation[2,5]	Required Sample Quantity		Maximum Holding Time Water[4]	Maximum Holding Time S/S/S
					Water	S/S/S		
pH	Solids	SW 846-9045	P,G	Cool, 4°C	NA	50g	Analyze Immediately	Analyze Immediately
Phenols	Manual, 4AAP	EPA 420.1	G	Cool, 4°C H_3PO_4	500mL	100g	28 days	28 days
Phenols	Automated, 4AAP	EPA 420.2	G	Cool, 4°C H_3PO_4	500mL	50g	28 days	28 days
Phenols	Manual, 4AAP	SW 846-9065	G	Cool, 4°C H_3PO_4	500mL	50g	28 days	28 days
Phenols	Manual Distillation w/Automated, 4AAP	SW 846-9066	G	Cool, 4°C H_3PO_4	500mL	50g	28 days	28 days
Phenols	Spectrophotometric MBTH w/Distillation	SW846-9067	G	Cool, 4°C			28 days	28 days
Phosphorus, Ortho	Automated	EPA 365.1	P,G	Cool, 4°C	500mL	50g	48 hours	
Phosphorus, Ortho	Colorimetric, Manual	EPA 365.2	P,G	Cool, 4°C	500mL	50g	48 hours	
Phosphorus, Total	Colorimetric, Manual	EPA 365.4	P,G	Cool, 4°C H_2SO_4 to pH <2	500mL	50g	28 days	28 days
Radium		EPA 903.0	P,G	HNO_3 to pH <2	1 Gallon	NA	6 months	NA
Radium 226		EPA 903.1	P,G	HNO_3 to pH <2	1 Gallon	NA	6 months	NA
Residual Chlorine		EPA 330.5	P,G	None	100mL	25g	6 hours	
Saturation Index (Calculated from pH, Alkalinity, TDS, Calcium, Temperature)	Langlier	SM203	P,G	Cool, 4°C	1000mL	NA	NA	NA
Settleable Matter	Imhoff Cone	EPA 160.5	P,G	Cool, 4°C	1000mL	NA	48 hours	NA
Silica, Total		EPA 370.1	P	Cool, 4°C	200mL	NA	28 days	NA
Specific Conductance	Conductivity Bridge	EPA 120.1	P,G	Cool, 4°C	100mL	NA	28 days	NA
Specific Conductance	Conductivity Bridge	SW 846-9050	P,G	Cool, 4°C	100mL	NA	28 days	NA
Sulfate	Turbidimetric	EPA 375.4	P,G	Cool, 4°C	100mL	25g	28 days	
S[illegible]	Turbidimetric	SW 846-9038	P,G	[illegible]4°C	100mL	25g	28 days	

Table 6.3
SAMPLE REQUIREMENTS

Test	Method	Reference	Container[1]	Water Sample Preservation[2,3]	Required Sample Quantity		Maximum Holding Time Water[4]	Maximum Holding Time S/S/S
					Water	S/S/S		
Sulfide	Colorimetric, Methylene Blue	EPA 376.2	P,G	Cool, 4°C NaOH + $ZnC_2H_3O_2$ to pH >9	1L	100g	7 days	7 days
Sulfide	Titrimetric, Iodine	EPA 376.1	P,G	Cool, 4°C NaOH + $ZnC_2H_3O_2$ to pH >9	1L	100g	7 days	7 days
Sulfide	Titrimetric, Iodine	SW 846-9030	P,G	Cool, 4°C NaOH + $ZnC_2H_3O_2$ to pH >9	1L	100g	7 days	7 days
Sulfite	Titrimetric	EPA 377.1	P,G	None	500mL	NA	Analyze Immediately	NA
Sulfur	Bomb	ASTM D-129	P,G	NA	NA	Oil:2g	NA	NA
Surfactants	MBAS	EPA 425.1	P,G	Cool, 4°C	500mL	NA	48 hours	NA
Temperature		EPA 170.1	P,G	None	100mL	–	Analyze Immediately	–
Thiocyanate		SM 412L	P,G	Cool, 4°C See Method	500mL	100g		
Sulfide, Total Available Extraction	Manual	SW 7.3.4.1	P,G	Cool, 4°C NaOH + $ZnC_2H_3O_2$ to pH >9	200mL	50g	7 days	7 days
Total Halogen		ASTM D-808	P,G	None	NA	10g	NA	
Total Organic Carbon	Combustion-IR	EPA 415.1	P,G	Cool, 4°C HCl or H_2SO_4 to pH <2	250mL		28 days	28 days
Total Organic Carbon	Combustion-IR	SW 846-9060	P,G	Cool, 4°C HCl or H_2SO_4 to pH <2	250mL		28 days	28 days
Total Organic Halides	Micro-Coulometric	SW 846-9020	GW/Teflon Liner[6]	Cool, 4°C	500mL	10g	7 days	7 days
Total Recoverable Oil & Grease	Gravimetric	EPA 160.5	G	Cool, 4°C HCl to pH <2	1L	50g	28 days	28 days

Table 6.3
SAMPLE REQUIREMENTS

Test	Method	Reference	Container[1]	Water Sample Preservation[2,3]	Required Sample Quantity		Maximum Holding Time Water[4]	Maximum Holding Time S/S/S
					Water	S/S/S		
Total Solids	Gravimetric	EPA 160.3	P,G	Cool, 4°C	250mL	50g	7 days	7 days
Total Suspended Solids	Gravimetric	EPA 160.2	P,G	Cool, 4°C	500mL	NA	7 days	NA
Total Volatile Solids	550C Oven	EPA 160.4	P,G	Cool, 4°C	250mL	10g	7 days	7 days
Total Volatile Solids	Weight Percent	ASTM 2369	P,G	Cool, 4°C	250mL	10g	7 days	7 days
Turbidity	Nephelometric	EPA 180.1	P,G	Cool, 4°C	100mL	NA	48 hours	NA
Volatile Acids	Distillation	SM 504B	G	Cool, 4°C	1L	NA		NA
Volatile Suspended Solids	550C Oven	EPA 160.4	P,G	Cool, 4°C	250mL	NA	7 days	NA
Miscellaneous Physical Tests								
API (Specific Gravity)	Hydrometer	ASTM D-287	P,G	NA	NA	Oil: 100mL	NA	NA
Boiling Point	Distillation	ASTM D-86	P,G	NA	NA	Oil: 200mL	NA	NA
Cation Exchange Capacity		AOAC 57-3	P,G	Cool, 4°C	NA	100g	NA	14 days
Coating Density		ASTM 1475	P	NA	NA	NA	NA	NA
Density at 60F		ASTM D-70	P,G					
Flash Point	Pensky-Martens	ASTM D-93	G	None	120mL	NA		NA
Ignitability Potential	Solids Assessment	ASTM D-49823	P,G	NA	NA	200g	NA	
Flash Point		SW 846-1010	G	None	120mL	NA		NA
Mineral Oil Flash Point	Cleveland Open Cup	ASTM D-92	P,G	NA	NA	200g	NA	
Flash Point	Cleveland Open Cup	ASTM D-92	P,G	NA	NA	200g	NA	
Percent Bottom Sediment & Water	Centrifuge	ASTM D-96	P,G	Cool, 4°C	NA	Oil: 200mL	NA	

atrix includes solvents, fuels and other petroleum products.

Table 6.3
SAMPLE REQUIREMENTS

Test	Method	Reference	Container[1]	Water Sample Preservation[2,3]	Required Sample Quantity		Maximum Holding Time Water[4]	Maximum Holding Time S/S/S
					Water	S/S/S		
Percent Oil	Solubility	ASTM D-2042	P,G	NA	NA	Oil*: 200mL	NA	
Percent Oil	Centrifuge	ASTM D-96	P,G	NA	NA	Oil*: 200mL	NA	
Percent Water	Xylene Trap	ASTM D-95						
Percent Water	Karl Fischer Titration	ASTM 1744	P,G Airtight	None	100mL	Oil*: 100mL	NA	NA
Pounds per Cubic Foot		ASTM D-698						
Pour Point		ASTM D-97	P,G	NA	NA	Oil*: 100mL	NA	NA
Reid Vapor Pressure	Reid	ASTM D-323	Airtight	NA	NA	Oil*: 1L	NA	NA
Residue, Percent Ash		ASTM D-482	P,G	NA	NA	Oil*: 100g	NA	NA
Viscosity	Saybolt Furol	ASTM D-244	P,G	NA	NA	Oil*: 200mL	NA	
Viscosity	Saybolt Universal	ASTM D-445	P,G	NA	NA	Oil*: 200mL	NA	
Specific Gravity		ASTM D-244	P,G	NA	100g	100g	NA	NA
Specific Gravity	(Solids)	SM 213E	P,G	NA	100g	100g	NA	NA
Heat of Combustion	BTU/LB	ASTM D-240	P,G	NA	50mL	20g	NA	NA
Weight Per Gallon		ASTM D-244	P,G	NA	100g	100g	NA	NA
Metals:[5]								
Metals: Listed Below	ICP	EPA 200.7	P,G	HNO_3 to pH <2	500mL	100g	180 days	180 days
Al, As, Sb, Ba, Be, Bi, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Li, Mg, Mn, Mo, Ni, K, Si, Se, Ag, Na, Sr, Tl, Sn, Ti, V, Zn, Y (31)								
Metals: Listed Below	ICP	SW 846-6010	P,G	HNO_3 to pH <2	500mL	100g	180 days	180 days
Al, As, Sb, Ba, Be, Bi, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Li, Mg, Mn, Mo, Ni, K, Si, Se, Ag, Na, Sr, Tl, Sn, Ti, V, Zn, Y (31)								
Metals: Listed Below	FAA	EPA 200 Series	P,G	HNO_3 to pH <2	500mL	100g	180 days	180 days

*Oil matrix includes solvents, fuels and other petroleum products.

Table 6.3
SAMPLE REQUIREMENTS

Test	Method	Reference	Container[1]	Water Sample Preservation[2,3]	Required Sample Quantity		Maximum Holding Time Water[4]	Maximum Holding Time S/S/S
					Water	S/S/S		
Al, Sb, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Ag, Na, Tl, Sn, Ti, V, Zn (23)								
Metals: Listed Below	FAA	SW 846-7000 Series	P,G	HNO_3 to pH <2	500mL	100g	180 days	180 days
Al, Sb, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, Ag, Na, Sr, Tl, Sn, V, Zn (23)								
Metals: Listed Below	GFAA	EPA 200 Series	P,G	HNO_3 to pH <2	500mL	100g	180 days	180 days
Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, Se, Ag, V, Tl, Sn, Ti, Zn (19)								
Metals: Listed Below	GFAA	SW 846-7000 Series	P,G	HNO_3 to pH <2	500mL	100g	180 days	180 days
Al, As, Be, Cd, Cr, Co, Pb, Mo, Se, Ag, Tl, V (12)								
Metals: Listed Below	ICP (200.7 CLP-M)	CLP SOW 7/88	P,G	Cool, 4°C HNO_3 to pH <2	500mL	100g	180 days	180 days
Al, Sb, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Mg, Mn, Ni, K, Ag, Na, Zn, V								
Metals: Listed Below	ICP (200.7 CLP-M)	CLP SOW ILM01.0	P,G	Cool, 4°C HNO_3 to pH <2	500mL	100g	180 days	180 days
Al, Sb, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Mg, Mn, Ni, K, Ag, Na, Zn, V								
Metals: Listed Below	GFAA (CLP-M)	CLP SOW 7/88	P,G	Cool, 4°C HNO_3 to pH<2	500mL	100 g	180 days	180 days
As (206.2 CLP-M), Se (270.2 CLP-M), Pb (239.2 CLP-M), Tl (279.2 CLP-M)								
Metals: Listed Below	GFAA (CLP-M)	CLP SOW ILM01.1	P,G	Cool, 4°C HNO_3 to pH <2	500mL	100g	180 days	180 days
As (206.2 CLP-M), Se (270.2 CLP-M), Pb (239.2 CLP-M), Tl (279.2 CLP-M)								
Mercury	Manual CVAA (245.1 CLP-M)	CLP SOW 7/88	P,G	Cool, 4°C	500mL	100g	26 days	NA
Mercury	Manual CVAA (245.1 CLP-M)	CLP SOW ILM01.0	P,G	Cool, 4°C	500mL	10g	26 days	NA
Mercury	Manual CVAA (245.5 CLP-M)	CLP SOW 7/88	P,G	Soil/Sediment Cool, 4°C	NA	10g	NA	26 days

Table 6.3
SAMPLE REQUIREMENTS

Test	Method	Reference	Container[1]	Water Sample Preservation[2,3]	Required Sample Quantity		Maximum Holding Time Water[4]	Maximum Holding Time S/S/S
					Water	S/S/S		
Mercury	Manual CVAA (245.5 CLP-M)	CLP SOW ILM01.0	P,G	Soil/Sediment Cool, 4°C	NA	10g	NA	26 days
Mercury	CVAA - Manual	EPA 245.1	P,G	HNO_3 to pH <2	500mL	NA	13 days[7]	NA
Mercury	CVAA - Manual	SW 846-7470	P,G	HNO_3 to pH <2	500mL	NA	13 days[7]	NA
Mercury	CVAA - Manual, S/S/S	SW 846-7471	P,G	None	NA	10g	28 days	28 days
Organic Tests[5,6]								
2,3,7,8 TCDD[16]	GC/MS	EPA 613	G	Cool, 4°C	2L	NA	7 days to extract, 40 days to analysis	NA
2,3,7,8 TCDD[16]	GC/MS/MS	CLP SOW 8/88	G	Cool, 4°C	2L	100g	NA	NA
Organochlorine Pesticides/PCBs	GC/ECD	CLP SOW 2/88	G	Cool, 4°C	2L	100g	Extraction 5 days from VTSR**, 40 days to analysis	Extraction 10 days from VTSR**, 40 days to analysis
Organochlorine Pesticides/PCBs	GC/ECD	CLP SOW OLM01.5	G	Cool, 4°C	2L	100g		
Semi-Volatile Organics	GC/MS	CLP SOW 2/88	G	Cool, 4°C	2L	100g		
Semi-Volatile Organics	GC/MS	CLP SOW OLM01.5	G	Cool, 4°C	2L	100g		
Volatile Organics	GC/MS	CLP SOW 2/88	G - Zero Headspace	HCl to pH 2	2x40mL	40g	10 days from VTSR	10 days from VTSR
Volatile Organics	GC/MS	CLP SOW OLM01.2	G - Zero Headspace	HCl to pH2	2x40mL	40g		
Purgeable Halocarbons	GC/ELCD	EPA 601	G - Zero Headspace	Cool, 4°C, 0.008% $Na_2S_2O_3$[3]	2x40mL	40g	14 days	14 days
Halogenated and Aromatic Volatile Organics	GC/PID/ ELCD	EPA 601/602 Modified	G - Zero Headspace	Cool, 4°C, 0.008% $Na_2S_2O_3$[3]	2x40mL	40g	14 days	14 days
Purgeable Aromatics	GC/PID	EPA 602	G - Zero Headspace	Cool, 4°C, 0.008% $Na_2S_2O_3$[3] HCl to pH2[21]	2x40mL	40 g	14 days	14 days

**VTSR-Validated Time of Sample Receipt, EPA contracts only.

Table 6.3
SAMPLE REQUIREMENTS

Test	Method	Reference	Container[1]	Water Sample Preservation[2,3]	Required Sample Quantity		Maximum Holding Time Water[4]	Maximum Holding Time S/S/S
					Water	S/S/S		
Nitrosamines[11, 17]	GC/NPD	EPA 607	G	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]		NA	7 days to extraction, 40 days to analysis	NA
Organochlorine Pesticides/ PCBs[16]	GC/ECD	EPA 608	G	Cool, 4°C, pH 5-9[16]	2L	100g	7 days to extraction, 40 days to analysis	7 days to extraction, 40 days to analysis
Volatile Priority Pollutants	GC/MS	EPA 624	G - Zero Headspace	Cool, 4°C, HCl to pH2, 0.008% $Na_2S_2O_3$[5,12]	2x40mL	40g	14 days	14 days
Semi-Volatile Priority Pollutants (BNA)[16]	GC/MS	EPA 625	G	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	2L	100g	7 days to extraction, 40 days to analysis[16]	7 days to extraction, 40 days to analysis[16]
Hydrocarbon Scan	GC/FID	SW 846-8000	G	Cool, 4°C	2x40mL	100g	14 days	14 days
RCRA Listed Solvents	GC/FID	SW 846-8000	G	Cool, 4°C	2x40mL	40g	14 days	14 days
Halogenated Volatile Organics	GC/ELCD	SW 846-8010	G	Cool, 4°C, 0.008% $Na_2S_2O_3$	2x40mL	40g	14 days	14 days
Alcohols	GC/FID	SW 846-8015	G	Cool, 4°C	2x40mL	40g	14 days	14 days
Petroleum Fuels	GC/FID	SW 846-8015 Modified	G	Cool, 4°C	2x40mL	100g	14 days	14 days
Total Petroleum Hydrocarbons	FTIR	EPA 418.1	G	Cool, 4°C HCl to pH 2	2L	NA	28 days	NA
Total Petroleum Hydrocarbons	FTIR	SM 503E	G	Cool, 4°C	NA	100g	NA	28 days
Purgeable Aromatics	GC/FID	SW 846-8020	G	Cool, 4°C, 0.008% $Na_2S_2O_3$, HCl to pH2[5,12]	2x40mL	40g	14 days	14 days
Halogenated and Aromatic Volatile Organics	GC/FID/ ELCD	SW 846-8021	G	Cool, 4°C HCl to pH2, 0.008% $Na_2S_2O_3$[5,12]	2x40mL	40g		
Acrolein, Acrylonitrile, Acetonitrile	GC/FID	SW 846-8030	G	Cool, 4°C, 0.008% $Na_2S_2O_3$[5] Adjust pH to 4-5[13]	2x40mL	40g		

Table 6.3
SAMPLE REQUIREMENTS

	Method	Reference	Container[1]	Water Sample Preservation[2,3]	Required Sample Quantity		Maximum Holding Time Water[4]	Maximum Holding Time S/S/S
					Water	S/S/S		
Organochlorine Pesticides & PCBs[14]	GC/ECD	SW 846-8080	G	Cool, 4°C pH 5-9[10]	2L	100g	7 days to extract, 40 days to analysis	14 days to extract, 40 days to analysis
PCBs[14]	GC/ECD	SW 846-8080	G	Cool, 4°C	2L	100g		
Polynuclear Aromatic Hydrocarbons[14]	GC/FID	SW 846-8100	G	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	2L	100g		
Chlorinated Hydrocarbons	GC/ELCD	SW 846-8120	G	Cool, 4°C	2x40mL	40g	14 days	14 days
Organophosphorus Pesticides[14]	GC/NPD	SW 846-8141	G	Cool, 4°C, pH 5-9[10]	2L	100g	7 days to extract, 40 days to analysis	14 days to extract 40 days to analysis
Chlorinated Herbicides	GC/ECD	SW 846-8150	G	Cool, 4°C	1L	100g		
Volatile Organics	GC/MS	SW 846-8240	G	Cool, 4°C, HCl to pH 2[12]	2x40mL	40g	14 days	14 days
Volatile Organics	GC/MS	SW 846-8260	G	Cool, 4°C, HCl to pH 2[12]	2x40mL	40g		
Appendix IX Volatile Organics	GC/MS	SW 846-8240	G	Cool, 4°C, HCl to pH 2[12]	2x40mL	40g		
Semi-Volatile Organics[14]	GC/MS	SW 846-8270	G	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	2L	100g	7 days to extract, 40 days to analysis	14 days to extract 40 days to analysis
Appendix IX Semi-Volatile Organics[14]	GC/MS	SW 846-8270	G	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	2L	100g		
Polychlorinated Dibenzo-P-Dioxins and Dibenzofurans[14]	GC/MS	SW 846-8280	G	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	2L	100g		
Polynuclear Aromatic Hydrocarbons	HPLC	SW 846-8310	G	Cool, 4°C, 0.008% $Na_2S_2O_3$[5]	2L	100g		
Volatile Organic Compounds in Drinking Water	GC/PID/ELCD	EPA 502.2	G	Cool, 4°C, 0.008% $Na_2S_2O_3$, HCl to pH 2[5]	3x40mL	NA	14 days	NA
SDWA EDB & DBCP	Micro-Extraction, GC/ECD	EPA 504	G	Cool, 4°C[6]	3x40mL	NA	7 days to extract, 40 days to analysis	NA

Table 6.3
SAMPLE REQUIREMENTS

Test	Method	Reference	Container[1]	Water Sample Preservation[2,3]	Required Sample Quantity		Maximum Holding Time Water[4]	Maximum Holding Time S/S/S
					Water	S/S/S		
Nitrogen & Phosphorus Containing Pesticides	GC/NPD	EPA 507	G	Cool, 4°C, $HgCl_2$ to conc. of 10mg/L	2L	NA	28 days after extraction	NA
Volatile Organic Compounds in Drinking Water	GC/MS	EPA 524.2	G	Cool, 4°C, 0.008% $Na_2S_2O_3$[5], HCl to pH2[6]	3x40mL	NA	14 days	NA
Semi-Volatile Organic Compounds in Drinking Water	GC/MS	EPA 525	G	Cool, 4°C, 0.008% $Na_2S_2O_3$[5], HCl to pH2[6]	2x1L	NA	7 days to extract, 40 days to analysis	NA
SDWA Carbamates	HPLC	EPA 531.1	G	Monochloro-acetic Acid Buffer to pH3, Cool, 4°C	120mL	NA	28 days	NA
SDWA Herbicides	GC/ECD	EPA 515.1	G	Cool, 4°C, $HgCl_2$ to 10 mg/L conc.***	1L	NA	7 days to extract, 40 days to analysis	NA
Extraction Procedure Toxicity - Metals Only	Leachate Generation	SW 846-1310	P,G	None	100g @ 100% Solids >5,000g @ ≥.5% Solids		NA	NA
Indiana-Neutral Leaching Method	Leachate Generation	329IAC	G	None	100g @ 100% Solids >10kg @ ≥.5% Solids		NA	NA
Extraction Procedure Toxicity-Metals, Pesticides, Herbicides	Leachate Generation	SW 846-1310	G	None	100g @ 100% Solids >10kg @ ≥.5% Solids		NA	NA
Toxicity Characteristic Leaching Procedure (TCLP)-Metals Only	Leachate Generation	SW 846-1311	P,G	None	105g @ 100% Solids >5kg @ ≥.5% Solids		180 days to TCLP extraction 180 days to Analysis, except Hg - 28 days	
Toxicity Characteristic Leaching Procedure (TCLP)-All Regulated	Leachate Generation	SW 846-1311	G	None	500g @ 100% Solids 20kg @ ≥.5% Solids		See individual analyte groupings	
Toxicity Characteristic Leaching Procedure (TCLP)-Regulated Non-Volatile Organics	Leachate Generation	SW 846-1311	G	None	305g @ 100% Solids 15kg @ ≥.5% Solids		14 days to TCLP extraction, 7 days from TCLP extraction to preparative extraction, 40 days from preparative extraction to analysis	

[illegible] preservative preferred

Table 6.3
SAMPLE REQUIREMENTS

Test	Method	Reference	Container[1]	Water Sample Preservation[2,3]	Required Sample Quantity		Maximum Holding Time Water[4]	Maximum Holding Time S/S/S
					Water	S/S/S		
Toxicity Characteristic Leaching Procedure (TCLP)-Regulated Volatiles	Leachate Generation	SW 846-1311	G	None	125g @ ≤ 100% Solids 1200g @ <5% Solids		14 days to TCLP extraction, 14 days from TCLP extraction to analysis	

1. Polyethylene (P) or Glass (G). All organics containers will have a teflon-lined cap.

2. Sample preservation should be performed immediately upon sample collection. for composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.

3. When any sample is to be shipped by common carrier or sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solution sat concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

4. Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that the specific types of samples under study are stable for the longer time, and has received a variance from the Regional Administrator under § 136.3(e). Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show that this is necessary to maintain sample stability. See § 136.3(e) for details.

Table 6.3
SAMPLE REQUIREMENTS

5. Should only be used in the presence of residual chlorine. May use ascorbic acid or sodium bisulfate as allowed per regulation.

6. Maximum holding time is 24 hours when sulfide is present. Optionally all samples may be tested with lead acetate paper before pH adjustments in order to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.

7. 13 days in plastic, 28 days in glass.

8. All organics containers have teflon lined caps. Required Sample quantity is listed to include MS or back-up sample.

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

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

11. All drinking water samples must be preserved, regardless of holding time.

12. Sample receiving no pH adjustment must be analyzed within 7 days of sampling.

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

14. When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; samples preserved in this manner may be held for seven days before extraction and for forty days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re: the requirement for thiosulfate reduction of residual chlorine), and footnotes 15 and 16 (re: the analysis of benzidine).

Table 6.3
SAMPLE REQUIREMENTS

15. If 1,2-Diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0 ± 0.2 to prevent rearrangement to benzidine.

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

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

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

SECTION 7.0

7.0 Sample Custody

7.1 Introduction

The maintenance of sample chain of custody is part of the laboratory QA program. Where samples and analytical results may be needed for legal purposes, it is imperative that the laboratory, client and everyone else involved in such proceedings be able to unequivocally demonstrate that analytical results were obtained from analysis of specified samples.

A sample is in someone's "custody" if:

1. It is in their actual physical possession, or
2. It is in their view, after being in their physical possession, or
3. It is in their physical possession and locked up so that no one could tamper with it, or
4. It is kept in a secured area restricted to authorized personnel only.

7.2 Facilities and Sample Security

EMS Heritage laboratory facilities are protected with an access control system. In this way, access to all samples at all times remains controlled and documented.

Visitors to the facilities are prohibited from entering the cooler and laboratory areas unescorted. Special viewing areas have been provided to facilitate laboratory "tours".

Rules regarding custody have been established and must be followed as outlined below:

1. Samples must never be left unattended in the delivery/receiving area. If the receiving area is to be left unattended, the sample receiving door must be closed and locked.
2. All samples must be returned to their storage area/cooler at the end of the final shift.
3. All sample extracts and digestates must be placed in their respective laboratories.

7.3 Sample Custody Records

Sample custody will be supported by records which trace a sample from its point of origin to include container storage and shipment through disposal after analysis. These records will include, but are not limited to:

1. Field notebooks;
2. Field sample I.D. tags, labels;
3. Laboratory (transmittal forms), Task Orders, Request Forms;
4. Chain of Custody forms;
5. Sample extraction/preparation logs or worksheets;
6. Analytical (instrument) logs or worksheets;
7. Calibration and quality control data associated with a sample set;
8. Instrument maintenance logs;
9. Sample disposition logs; and,
10. Final reports.

Item numbers 1, 3 and 4 above are generally the responsibility of the client unless EMS Heritage performs the sampling.

7.4 Legal Chain of Custody

The laboratory will only be responsible for maintaining the records of the activities it performs. Sampling documentation for samples not collected or sub-contracted for collection by EMS Heritage will be the responsibility of the sample collector.

EMS Heritage will follow special procedures when strict Legal Chain of Custody is required. Legal Chain of Custody is a special type of sample custody in which all events associated with a specific sample must be documented in writing. In addition to the records described above, chain of custody records must include the following:

1. Sample transmittal forms or tags that have adequate space for the dated, original signatures of all individuals who handle the sample (or empty containers) from time of collection (or container receipt) through laboratory delivery.
2. Custody seals.
3. Laboratory sample storage logs that identify date, time, and individuals who remove samples from storage.
4. Secure, limited access storage areas.
5. Errors in all documentation are deleted by drawing one line through the error, writing the correction, placing the initials of the person

making the change, the date of the change and the reason for the change. All documentation is recorded in indelible black ink (no other colors allowed).

7.5 Sample Labels, Seals and Chain of Custody

All sample containers will have a sample container label attached. An example of this label is shown in Figure 7.1. Those samples requiring Legal Chain of Custody will have a custody seal placed on the closure mechanism on the sample such that any attempt to remove the seal will be obvious. An example of this seal is shown in Figure 7.2. All samples will be accompanied by a Chain of Custody as shown in Figure 7.3 when provided by EMS Heritage. Clients may substitute Chain of Custody forms of their own when desired. Labels and seals may utilize alternate forms containing identical information.

7.6 Field Sampling/Custody

When Legal Chain of Custody is required, the custody documentation will begin with the preparation and/or shipment of sample containers to the sampler(s). Sampling performed by EMS Heritage will utilize the following procedure for identifying and labeling samples in the field:

Sample Prefixes

RW	=	Residential Well
MW	=	Monitoring Well
WA	=	Water, Non-Specific
SW	=	Surface Water
SD	=	Sediment (lake, ditch, river)
SL	=	Sludge
LE	=	Leachate
SS	=	Soil Sample

Sample Suffixes

DP	=	Duplicate
FB	=	Field Blank
TB	=	Trip Blank
EB	=	Equipment Blank
BG	=	Background

When samples are already sufficiently identified by type and exact location without the need of assigning an arbitrary identification, that pre-established

Figure 7.1

CONTAINER LABEL

DATE SAMPLED _____ TIME SAMPLED _____

COMPANY NAME (TO BE SHOWN ON REPORT)

_____

SAMPLE DESCRIPTION _____

LAB USE ONLY PRESERVATIVE _____

EMS SAMPLE #

Figure 7.2

CUSTODY SEAL

Figure 7.3

CHAIN OF CUSTODY

TO ENSURE PROPER HANDLING OF SAMPLES PLEASE COMPLETE THIS ENTIRE FORM

EMS HERITAGE LABORATORIES, INC.

7901 West Morris Street
Indianapolis, Indiana 46231 (317) 243-0811 Fax (317) 243-0360

Co. Name:
Project Name:
Quote No.: PO No.:

ENVIRONMENTAL PROGRAM:
CWA NPDES_____ IWP _____ SLUDGE_____
RCRA MW_____ SW _____ DISPOSAL_____
SDWA_____ CERCLA/SUPERFUND_____ OTHER _____

Sampled by:

Analyses Requested
(Note special detection limits or methods)

Report To:
Co:
Add:
Attn:
Phone:

Accelerated Turnaround Requested _____
(Subject to Additional Charge)

Result Request by: _____ / _____ /
Mo Day
(Date must be Accepted and Approved by L

Sample ID:	Date:	Time:	Comp.	Grab	Sample Description:	No. of Containers										Remarks:	EMS Sample No.

Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
	/			/	
Relinquished by: (Signature)	Date /Time	Received by: (Signature)	Relinquished by: (Signature)	Date /Time	Received by: (Signature)
	/			/	
Relinquished by: (Signature)	Date /Time	Received for Lab by: (Signature)	Remarks:		
	/				

Distribution: Original and yellow copies accompany sample shipment to laboratory; Yellow copy returned to client.

identification will be used. Samples requiring arbitrary field number assignments will be given consecutive numbers in the following manner:

Examples:

Soil Sample #1	=	SS0001
Background Soil Sample #1	=	SS0001BG
Surface Water Sample #3	=	SW0003
Trip Blank Sample #1	=	0001TB
Surface Water Sample #3 Duplicate	=	SW0003DP

EMS Heritage field samplers will use the appropriate field data sheets as given in Figures 7.4 through 7.8 for sampling. Field records will be stored, filed and maintained by submitter (client) and project number at EMS Heritage.

7.7 Sample Dispatch

Samples to be shipped by common carrier will be properly preserved and placed in a secure shipping container. All transmittal documents including the chain of custody form will be placed inside the shipping container in water-tight plastic bags, taped to the inside lid. The container will be sealed with custody tape such that any tampering between shipment and receipt at the laboratory will be obvious to receiving personnel.

When samples are delivered by common carrier it is only necessary to sign the documents that are required by the carrier service at the time of delivery, i.e., airbills, shipping invoices, etc. After the shipping papers have been signed, the packages are entered into the Parcels Received log book. This log book contains:

1. Date package received
2. Carrier Service delivering
3. Client/Company shipped from
4. Destination
5. Type of package (i.e. samples, stock, instruments)

The next steps in laboratory custody will be the same regardless of whether samples arrive via common carrier, or are hand delivered.

Figure 7.4

EMS HERITAGE LABORATORIES, INC.

SAMPLING PROJECT SUMMARY

Submitter: _____
Site Contact: _____
Site Identification: _____
Project Number: _____ Z Numbers: _____
Samplers: _____
Sampling Date: _____
Weather Conditions: _____
Sample Iced? YES NO
Preservative Used? YES NO If Yes, Preservative Used Lot #

_____ _____

_____ _____

Sample Types (circle):				
	Lagoon	Ash	Indus Waste	Ditch
	Leachate	Soil	Waste Pile	Creek
	Sludge	Solvent	Solid	Liquid
	Oil	Sand	Drummed Waste	Truck
	Res. Well	other _____		

Sample Plan Review: grab/composite statistical/random/judgmental
Information on equipment used, facility type, products made, etc.

_____
_____
_____

Decontamination Procedures Used: _____
_____
_____

Equipment is (dedicated/decontaminated) Source of decon. water _____
Source of blank reagent water _____

Miscellaneous:
Photos taken? YES NO
Environmental Program: RCRA CERCLA SOLID WASTE UST
NPDES IWP SURFACE WATER
DISPOSAL SDWA CWA
OTHER _____

Figure 7.5

EMS HERITAGE LABORATORIES, INC.

SAMPLE DETAIL

Sample ID _____

Field Test Performed	Result	Sample Types (circle all applicable)			
		Mon. Well	Lagoon	Ash	Indus. Waste
		Res. Well	Leachate	Soil	Waste Pile
_____	_____	Creek	Oil	Sludge	Solid
		Ditch	Solvent	Sand	Liquid
_____	_____	Truck	Drum	other_____	
		Blank (Equip./Trip)		Duplicate (of_____)	
		Background			

Sample Date: __-__-__ Time: __:__ AM/PM

Containers	#	Preservatives Added	
1 L plastic	_____	H_2SO_4	_____
1 L glass	_____	HNO_3	_____
500 ml glass	_____	NaOH	_____
40 ml vial	_____	Zn-Acetate	_____
_____	_____	HCl	_____
		Sample Iced	
		No preservatives used for non-aqueous samples	_____

Additional Sample Location Information:_____

_____

Additional Sample Type Information/Observations: (depth taken, color, odor, size, clarity, density, suspended solids, colloidal, etc.)_____

_____

Deviations From Sampling Plan:_____

_____

Sampling Equipment Used:_____

_____

Sampler Signature _____

Date _____

Figure 7.6

EMS HERITAGE LABORATORIES, INC. Page ___ of ___

Monitoring Well Sampling - Project Summary

Submitter: _____ Address: _____
Site Contact: _____ County: _____
Site Identification: _____
Project Number: _____ Z Numbers: _____
Samplers: _____
Sampling Date: _____
Weather Conditions: _____

Preservative Used	Lot #
_____	_____
_____	_____
_____	_____
_____	_____

Environmental Program:
RCRA CERCLA SDWA
UST SOLID WASTE
OTHER _____

Pumping Information

Purged by: (facility / consultant / EMS) personnel Date:_____Time:_____
Pump Type: _____ size_____
make: _____ tubing_____
Bailer: (PVC / SS / Teflon / _____) rope material_____
diameter _____ length_____ capacity_____

Filtration Information

Sample Fractions Filtered:_____
Filtered by: (facility / consultant / EMS) personnel
Filtration Method: (gravity / vacuum / pressure); Devise Type_____
Filter type: (cartridge / paper), size_____, pore_____

Field Instruments Used

pH Meter _____
S.C. Meter _____
Thermometer _____

Figure 7.7

SAMPLE DETAIL

Sample I.D. _____

Field Tests		Sample type	Preservatives Added
Test	Result	Mon. well	Hcl _____
		Res. well	HNO_3 _____
Temperature	_____°C	Duplicate of _____	H_2SO_4 _____
pH	_____	Split	NAOH _____
Spec. Cond.	_____umhos	Blank (field/trip/equip.)	Zn-Acetate _____
_____	_____	_____	_____
_____	_____	_____	_____

Sample Date ___/___/___ ___:___ AM PM

Containers Used	#
1 liter plastic	_____
1 liter glass	_____
40 ml vials	_____
250 ml glass	_____
500 ml glass	_____
_____	_____
_____	_____

Monitoring Well Data
Well I.D. _____
Reference point on (steel / plastic) casing top
Casing Stick-up _____
Depth to Water _____
Well Material (PVC / SS / Teflon)
Total Well Depth _____
Inside Diameter (1 2 4 6) inch
Time to recharge one well volume -
within 1 4 8 24 48 or G.T. 48 hrs

Were METALS filtered prior to preservation? (Yes / No)_____
Color of water subsequent to filtration_____

Deviations from Sampling Plan_____
_____
_____

Other Observations

Water Appearance (clear slightly / very turbid) (color: gray / brown)
Well purged (less / greater) than (1 2 4 6 12 24 48) hours prior to sampling
Purged approx. (to dryness) / (1 2 3 4 5 8 10 G.T. 10 well volumes)
Reaction upon addition of preservatives? (YES / NO) (explain) _____
_____
_____

Figure 7.8

Equipment Decontamination Procedures

Specific Procedures Utilized to Decontaminate Equipment for this Event:

7.8 Laboratory Custody/Receiving

The following steps are taken when samples are received.

1. Examination of the shipping container. Note the presence or absence of custody seals, locks, evidence tape, etc.

2. Generating any log books applicable (i.e. recording all information into a central case file, if client requests such).

3. Removal of samples from shipping containers and inspection of any traffic reports, chain of custody documents, etc. If no chain of custody is received the lab creates a chain of custody from that point forward.

4. If a chain of custody is received, it is inspected to determine the accuracy of the document (i.e. relinquishing signatures, date and time sampled, sample locations, etc.). If any discrepancies exist, they are noted on the chain of custody and in the case or client file if applicable.

5. Inspect sample containers for any damage. If damage has occurred it is to be noted directly on the chain of custody or a sample integrity form attached to the chain of custody, and in the case file if applicable. Notify the project manager immediately to determine corrective action required. All corrective actions are recorded on the chain of custody and in the case file.

6. Examine sample bottles for their agreement with the chain of custody.

7. Sample containers are inspected for proper containers and preservation. Preservation is checked according to the following protocol:

   a. If EMS Heritage containers were supplied and used, the pH is checked on one out of 10 samples by using a disposable pipet and litmus paper.

   b. All samples that are not received in EMS-supplied containers are checked for pH, with the exception of volatile organic sample vials. VOC vials are not opened until the time of analysis, but are checked for the presence of air bubbles. Samples are also checked for proper preservation at the time of analysis.

c. If an analysis requires a specific type of preserved container and the container was not received, it is noted on the chain of custody or sample integrity form, and in the case file if applicable.

d. All preservations, if needed, should be performed under a fume hood and are performed one at a time to avoid cross contamination.

8. The analyses requested are compared to the quote for the project, the containers provided and the preservation. If the analyses to be performed are not fully specified or if the condition of the test substance does not conform to the description provided or is different from what was expected, the Project Manager is immediately notified. The Project Manager will contact the client for further instructions before proceeding.

9. The laboratory will establish whether the test substance has received all necessary preparation, or whether the client requires preparation to be undertaken or arranged by EMS Heritage.

7.9 Sample Log-In

Samples are logged into the LIMS system with the following information:

1. A computer assigned EMS Heritage sample number. If another sample is copied or a specific quote "Z sample" is used to log in a sample, this template sample number is recorded in addition to the unique sample number;

2. Project number. This project number defines a discreet project for a given set of samples;

3. Quote number. An EMS Heritage quotation;

4. Purchase Order number. A client provided billing reference number;

5. Submitter number. This is computer shorthand for the EMS Heritage client;*

*Mandatory Entry

6. Regulation. This field describes the environmental program area under which the sample is submitted;*

7. Matrix of the sample;*

8. Received identification. This entry identifies the staff receiving the sample;*

9. Lab Days. This entry states the number of days targeted for analysis;

10. Due Date. This entry gives the report due date;

11. Status. This describes the status of the sample with regard to analysis and reporting;

12. Entered. This entry identifies the staff entering the sample into LIMS;*

13. Project Manager. This is the assigned staff person for this sample/project;

14. Modified. This entry shows the last person to modify a sample record;

15. Complete. This field shows the date that all tests and tasks show completed in the computer system;

16. Date sampled. Taken from the chain of custody;

17. Time sampled. Taken from the chain of custody;

18. Sample received within holding time? - yes or no;

19. Sample properly preserved? - yes or no;

20. Sample chilled to 4°C? - yes or no;

21. Sample received in proper container? - yes or no;

22. Chain of custody received? - yes or no;

---

*Mandatory Entry

23. Chain of custody number, if applicable;

24. Method of disposal;

25. Client sample description;

26. Client reporting address;

27. Sample comments to the laboratory. This field displays any information pertinent to the sample;

28. Sample comments to appear on final report;

29. Tasks assigned. Tasks are any activity or service performed not inherent in the act of sample analysis, i.e. a special reporting package, etc.;

30. Protocol. A pre-defined grouping of tests routinely requested together;

31. Tests assigned. All tests are assigned in the order they are to appear on the final report. Those tests requiring a preparation step are linked together indicating such. The location where analysis will be performed, the priority of analysis and the final discounted price for the analysis also appear here. All test documentation includes the names of the analyst, reviewer, data entry person, all associated dates, run numbers, QC and results;

32. All information relating to each test assigned is contained in the next two blocks of the LIMS system, including the actual results;

33. Any comments relating to the individual test performed are contained in the next two blocks of the LIMS system.

The key point to the EMS Heritage Lab ID number is linking that number to the client's sample description. After the computer has assigned the Lab ID number, that number is to be written on the cap and the label of all containers.

7.10 Sample Storage

Samples are to be placed in their appropriate storage area which is specific to the analysis to be performed. Analysts will be notified immediately of

samples received with extremely short or sensitive holding times, so that analysis may be performed immediately. All sample storage areas are accessible only to EMS Heritage staff. Sample digestates and extracts will be stored separately from samples or standards and are accessible only to EMS Heritage staff. These digestates and extracts will also be signed in and out when Legal Chain of Custody is required (see Section 7.4). Standards are stored separately from all samples and VOC samples are segregated from other samples.

7.11 Log-In Accuracy

As a cross check for data entry, all paperwork is reviewed against the information entered into the LIMS system either by an assisting data entry operator, their supervisor or a Project Manager. This paperwork is retained on file. Project paperwork is forwarded to the project manager for the samples received as a further check on accuracy and as a means for project management. A log audit report from the LIMS system is checked daily by the appropriate Project Manager.

7.12 Project Schedules

Incoming samples are scheduled by sales and/or project management staff. The sample quotes, requests to send containers, "Z" template samples, etc. are forwarded to the sample shipping/receiving area, where they are matched with incoming samples/projects. Once samples are logged into the LIMS system the work assignments will appear on an analyst's worklist according to a pre-assigned list of tests per work group. These work lists are generated and distributed daily. Analysts receive worklists as needed (bi-weekly at a minimum) which lists the samples due, sorted by their maximum allowable holding time from the date sampled. This helps to insure that all samples are analyzed within holding time. Analysis within holding time takes precedence over RUSH analysis requests. As work assignments are completed, they are sent to data entry and given the status of complete in LIMS upon completion of data entry.

7.13 Inter and Intra-Lab Shipping

When it is necessary or desirable to sub-contract to another laboratory, it is crucial that the sub-contract laboratory be given complete instructions and information regarding the sample and analysis. The information required includes the list of analytes and the methods required for analysis. Sample shipments between EMS Heritage laboratory divisions will present no problem in this area, since all share a common data base which describes the

information for all samples. Chain of custody procedures will be used for all sample shipments. All shipments of samples are recorded in a logbook containing:

1. shipping date;
2. EMS sample ID numbers;
3. field sample ID numbers
4. collection date and time
5. requested analyses
6. date of sample preparation (if any)
7. location from which the samples were sent;
5. the carrier ID and shipping paper ID.

Subcontracting is permitted only when certifications, client Data Quality Objectives and/or contractual requirements are not prohibitive (e.g. CLP). Any sub-contract laboratory must be approved by the QA Officer or the QA Unit.

7.14 Documentation of Sample Disposition

All samples and laboratory waste are disposed of in adherence with all environmental regulations. Sample disposition is documented in the LIMS system by the sample custodian or his/her designee. Sample disposition is not routinely documented as to the precise fate but only for the fact that EMS Heritage no longer has the sample. Clients requiring more elaborate documentation may request this service on a case by case basis. Refer to Section 8.0, Analytical Procedures for further details of Sample and Waste Disposal.

7.15 Electronic Data Records (LIMS)

EMS Heritage Laboratories utilizes a computerized LIMS to track samples, temporarily store data for the purpose of integrated and/or electronic reporting, and to perform calculations as part of data reduction.

This LIMS system (hardware and software) is maintained and operated by a professional staff of computer programmers, analysts and operators under the direction of a data processing manager. All LIMS policies, procedures and operations are approved by laboratory management.

7.15.1 Security System

LIMS security is maintained on three levels; system resource access, information access and information manipulation access. The security

system is maintained by the data base administrator (DBA). All security policies and procedures are approved by Management. Access to information is given on a need to know basis only, and is granted according to job function. Inactive or terminated users are immediately removed from the system. All system users receive training appropriate to their job function prior to gaining access to the information.

Access to computer system resources is restricted through the assignment of a user specific login id and a confidential password to each user. No system resources are available to a user without the appropriate login id and password. This information is kept confidential and periodically modified.

Users are classified according to job function. This limits the users' access to information not specific or required for the performance of their duties. Once a user gains access to system resources as described above, the user is presented with a restricted view of all of the information available according to his/her user classification.

Data manipulation is also controlled by the user classification. For specific job functions, users may have the ability to view only, create, modify, and/or delete specific information. Users may have multiple capabilities custom tailored to their job function. As with system access, information access and manipulation is maintained by the DBA.

Once all tests on a sample are completed, the sample status becomes "released". This "released" status will not allow any data manipulation except by laboratory QA staff.

7.15.2 Analytical Records Management

All raw analytical data is stored as the original hard copy. Hard copy information includes:

1. Chain of Custody and/or Sample Submission Forms
2. Analytical Bench Sheets and Log Books
3. Instrument Printouts and Chromatograms

All hard copy information is uniquely identified for control purposes. Sample preparation procedures and final results are documented on forms containing all pertinent information and comments, including

analyst and reviewer initials. Those forms are specific to the test being performed. Tests which are directly down-loaded into the LIMS system from the instrument are reviewed and approved before release to LIMS; the hardcopy instrument readout is filed for reference.

Analytical records maintained in the LIMS are only temporarily stored for the purpose of integrated or electronic reporting. Information may be entered into LIMS in two ways, direct computer to computer transfer and manual data entry. Both data entry procedures are quality assured by checking the computerized information against the original hard copy or the electronic output from the other computer.

7.15.3 Electronic Data Transfer

Electronic Data Transfer (EDT) may be utilized to facilitate the integration of the laboratory information with a client's own data management system. All hard copy information (i.e. Certificate of Analysis, QAQC report) is distributed to the client to provide source documentation for validation of information electronically transferred. A data transfer log is maintained of all electronic transfers indicating the client, date and time of transfer and the file id and contents description. Electronic (floppy disk) copies of all information transferred are also maintained on file.

7.15.4 Software Documentation

LIMS software is documented as necessary for the proper development and maintenance of the programs. Software modifications, problems and/or failures are documented using a System Support Request (SSR) form submitted to the data processing department. All SSR's are managed by the programming staff on a priority basis. Original program documentation and modifications are documented within the program logic or data structure itself. Summaries of modifications are communicated to the users using Software Maintenance Bulletins (SMB).

7.15.5 Data Entry Validation

Data entry is validated by manually comparing hard copy documentation (Chain of Custody, Lab Bench Sheets, etc.) to LIMS reports of the information entered. At least 5% of all data entry is validated routinely in this manner. Errors found during review are corrected and re-reported if necessary. A log book and print-out of

data entry validation is kept indicating the run, date and auditor of the information and a notation of any records found in error.

7.15.6 Software/Hardware Validation

All software is functionally validated before use by the programming staff. Once software is put into production, it has essentially passed all preliminary validation criteria. Validation criteria include manual validation of calculations and manual validation of translation from data storage to report. All software is re-validated following modification.

Hardware validation is accomplished using the hardware vendors own internal checking mechanisms. No additional hardware validations are performed.

SECTION 8.0

8.0 Analytical Procedures

8.1 Introduction

EMS Heritage uses EPA approved analytical methods appropriate for the regulatory program, sample type and DQO's. The analytical methods used and their analyte lists are given in Table 5.1, QA Targets for Precision, Accuracy and Method Detection Limits, and Table 6.3, Sample Requirements. Tables 8.1 and 8.2 list the approved methods and references for the various types of matrices commonly encountered. If a client requests a method not listed in these tables, a full method validation package must be prepared, including Method Detection Limit (MDL) studies, before any analyses are reported for that method to be in compliance with this QAP. Instrument Detection Limit studies may replace the MDL studies in some situations if matrix spike/matrix spike duplicates are analyzed and approval is obtained from the Corporate QA Officer.

If applicable, alternative, modified or proposed new methods covered under this QAP must be summarized and a detailed description with method validation package must be submitted as an appendix to this QA Plan.

Many of the USEPA Contract Lab Program (CLP) methods are very similar if not identical to RCRA methods with the exception of the reporting forms and the QA protocols required. Commercial clients requesting a particular CLP SOW may opt upon consultation with EMS Heritage to accept different analytical reporting and QA protocols which do not compromise the data produced, but may not include all of the CLP forms, documentation and QA protocols. Samples analyzed under contract will be fully compliant with all contract requirements.

8.2 Standard Operating Procedures

In order to obtain reliable results, adherence to prescribed analytical methodology is required at all EMS Heritage laboratory divisions. In any operation that is performed on a repetitive basis, reproducibility is best accomplished through the use of Standard Operating Procedures (SOPs). An SOP is a written document which provides directions for the step-by-step execution of an operation, analysis or action which is commonly accepted as the method for performing certain routine or repetitive tasks. It is necessary that every aspect of an analysis or study (every step in the sample trail) be linked by one or more SOPs. EMS Heritage has adopted a formal written SOP program for all procedures. Every SOP is to be written according to the

Table 8.1

EPA APPROVED ANALYTICAL METHODS AND REFERENCES FOR WATER ANALYSES

DRINKING WATER

1. 40 CFR Part 141, Subpart C and Subpart E - Monitoring and Analytical Requirements.

2. "Methods for the Determination of Organic Compounds in Drinking Water", EPA/600/4-88/039, December 1988.

3. "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020, Revised March 1983.

4. Standard Methods for the Examination of Water and Wastewater, 16th Edition, 1985.

5. "Manual for Certification of Laboratories Analyzing Drinking Water", EPA 570/9-90/008, April 1990.

6. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water", EPA-600/4-80/032, August 1980.

Note: "500" series methods shall be used for drinking water related analyses unless client requirements dictate low detection limits achieved by those methods and analyses require no dilutions. Regulatory approval may be required for use in other matrices. Application of drinking water QC procedures may be inappropriate for some sample matrices.

SURFACE WATER, GROUNDWATER AND WASTEWATER EFFLUENTS

1. 40 CFR Part 136, Tables IA, IB, IC, ID, and IE, July 1989.

2. Methods for Chemical Analysis of Water and Wastes, revised March 1983.

3. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition (EPA SW-846), 1986 and Revision I dated December 1987.*

*USEPA notes that, for guidance purposes, the Third Edition and its Revision I supersede the Second Edition and its Updates I and II. However, for regulatory purposes, the Second Edition and Updates I and II remain in effect together with 47 methods of the Third Edition and its Revision I cited above.

4. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Second Edition (EPA SW-846), 1982 as amended by Update I (April 1984), and Update II (April 1985).

5. Methods listed in 40 CFR Part 261, Appendix II, Appendix III and Appendix X, 1990.

WATER SOURCES (SURFACE WATER AND GROUNDWATER) ANALYZED PURSUANT TO 40 CFR PART 261 (Resource Conservation and Recovery Act) and the DER Chapter 17-700 Series Rules

1. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition (EPA SW-846), 1986 and its Revision I dated December 1987.[1]

2. Methods listed in 40 CFR Part 261, Appendix II, Appendix III and Appendix X, 1990.

3. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Second Edition (EPA SW-846), 1982 as amended by Update I (April 1984), and Update II (April 1985).

4. "USEPA Contract Laboratory Program Statement of Work for Inorganic Analyses", Multi-Media, Multi-Concentration EPA SOW 7/88, July 1988.

5. "USEPA Contract Laboratory Program Statement of Work for Organic Analyses", Multi-Media, Multi-Concentration EPA SOW 2/88, February 1988.

6. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water", EPA-600/4-80/032, August 1980.

7. "USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration, Document Number ILM01."

8. "USEPA Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, Document Number OLM01".

Table 8.2

EPA APPROVED ANALYTICAL METHODS AND REFERENCES FOR SEDIMENTS, SOILS, RESIDUALS AND SOLID AND HAZARDOUS WASTES

1. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Third Edition (EPA SW-846), 1986 and its Revision I dated December 1987.*

2. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", Second Edition (EPA SW-846), 1982 as amended by Update I (April 1984), and Update II (April 1985).

3. "USEPA Contract Laboratory Program Statement of Work for Inorganic Analyses", Multi-Media, Multi-Concentration, EPA SOW 7/88, July 1988.

4. "USEPA Contract Laboratory Program Statement of Work for Organics Analyses", Multi-Media, Multi-Concentration, EPA SOW 2/88, February 1988.

5. "USEPA Contract Laboratory Program Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration, Document Number ILM01."

6. "USEPA Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, Document Number OLM01."

7. Methods listed in 40 CFR Part 261, Appendix II, Appendix III and Appendix X, 1990.

8. American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103.

*USEPA notes that, for guidance purposes, the Third Edition and its Revision I supersede the Second Edition and its Updates I and II. However, for regulatory purposes, the Second Edition and Update I and II remain in effect together with 47 methods of the Third Edition and its Revision I cited above.

guidelines given in the EMS Heritage "Standard Operating Procedure for the Development and Maintenance of Standard Operating Procedures".

All SOPs must be approved by management and distribution is strictly controlled, which precludes the use of outdated or inappropriate SOPs. Copies of all SOPs which have been replaced and retired are collected upon the retirement. Copies of all SOPs will be maintained at each division; a master copy will be maintained at the Indianapolis Division.

This procedure will assure standardization among all locations. As new SOPs are developed, they must be coordinated through the Vice President of operations to avoid overlap or duplication of existing SOPs.

SOPs prepared by EMS Heritage will be clear, comprehensive, up-to-date, and sufficiently detailed to permit duplication of results by qualified analysts. In addition, all SOPs will be:

1. Consistent with current EPA regulations, guidelines and contract requirements;

2. Consistent with instrument manufacturer's specific instruction manuals;

3. Available to clients and regulatory personnel during On-Site Laboratory Evaluations. A complete set of SOPs shall be bound together and available for inspection at such evaluations;

4. Capable of providing for the development of documentation that is sufficiently complete to record the performance of all tasks required by the protocol;

5. Capable of demonstrating the validity of data reported;

6. Capable of describing the corrective measures and feedback mechanism utilized when analytical results do not meet protocol requirements;

7. Reviewed regularly and updated as necessary when contracts, facility, or procedural modifications are made;

8. Archived for future reference in usability or evidentiary situations; and,

9. Available at specific work stations as appropriate.

8.2.1 Documented Sampling Techniques

SOP's must be in place and followed for sampling techniques and methodology as well as for sample control (including chain of custody).

8.2.2 Documented Analytical Methods

Routine analytical methods must be documented in an Analytical Methods Manual. Reference can be made to published methods, but are not a substitute for methods written specific to EMS Heritage.

Modifications to methods or non-standard methods must be approved by the QA Officer, Laboratory Director, QA Unit or Chief Chemist before use. Analytical methods in use must have a method detection limit established, determined and documented. All concerned staff will be notified of any method modifications or non-standard methods.

8.2.3 Equipment Calibration

Calibration or USEPA standards and their verification standards shall be traceable to NIST wherever possible or to another reliable source which may be determined by the QA Unit.

Calibration must be documented and this documentation will include:

1. Date(s) of calibration
2. Identification of standards used.
3. Results of calibration (raw data and summary statistics).
4. Corrective actions taken.

8.2.4 Training and Training Documentation

EMS Heritage must have an SOP for training and training documentation. Training shall continue, according to written procedures, to keep all personnel aware of new methods and technologies. Attendance at symposia, training courses, and further formal education is encouraged. Training which has been completed must be documented for each employee and kept as a part of the training records. Refer to Appendix H, Training Forms for "example" training documentation forms.

8.3 Laboratory Glassware Cleaning

8.3.1 Metals Analyses

Glassware may be segregated in the metals section according to the following categories as required to avoid cross contamination:

1. ICP/FAA water samples
2. GFAA water samples
3. Solid samples and/or non-water matrices
4. Mercury samples

Acid baths may also be segregated as required to avoid cross contamination according to the above categories. Only designated acid baths will be used. All glassware is air-dried on adsorbent covered laboratory bench tops and stored in labelled drawers adjacent to the preparation areas.

The glassware cleaning procedure for metals analysis is summarized below.

1. After preps are completed, glassware is to be rinsed with tap water and placed in a soak bath of mildly acidic water.

2. Wash with warm tap water and micro-soap. Scrub each piece thoroughly and inspect for cracks or chips while rinsing.

3. Rinse with warm tap water to remove all soap residue.

4. Rinse twice with deionized (DI) water.

5. Rinse once with 1+1 Nitric Acid.

6. Rinse three times with DI water.

7. Soak in an acid bath (approximately 30 percent Nitric Acid) for a minimum of 2 hours. Glassware must be completely submerged with no air bubbles.

8. Remove from acid bath and rinse 3 times with DI water.

9. Check pH of random pieces with pH paper. Re-rinse if pH<2 on any piece.

10. Allow to air dry on adsorbent covered lab bench.

11. Place in appropriate adsorbent lined lab drawer.

12. Final rinse of all GFAA waters glassware should be done with Milli-Q (or equivalent) water. Analysts must rinse glassware with 1+1 Nitric Acid and Milli-Q (or equivalent) DI water (three times) just prior to using for preps.

Mercury Bottles

1. Cold water rinse when test is complete.
2. Rinse three times with hot tap water.
3. Rinse 3 times with DI water.
4. Rinse 2 times with concentrated Nitric Acid.
5. Rinse 3 times with Milli-Q (or equivalent)(DI) water.
6. Check pH of random pieces with pH paper. Re-rinse if pH <2 on any piece.

EPTOX, TCLP and Other Large Glassware

Large pieces of glassware (filtering flask, etc.) do not need to be soaked in an acid bath. Large glassware must be thoroughly rinsed with 1+1 Nitric Acid and rinsed two times with DI water, followed by another rinse with 1+1 Nitric Acid and rinsing 3 times with Milli-Q (or equivalent)(DI) water.

8.3.2 Extractable Organics

1. Wash with hot soapy water, taking care to not scratch w/brush.

2. Sonicate small pieces if necessary to remove all residues.

3. Rinse with hot tap water.

4. Rinse three times with DI water.

5. Air dry, or rinse with ACS Reagent Grade Acetone.

6. Rinse with Pesticide grade Methylene Chloride.

7. Store with clean glassware in a dust free environment or cap with aluminum foil.

8. Rinse with the solvent used for analysis immediately before use.

Note: Keep all plastics away from glassware.

8.3.3 Volatile/Purgeable Organics

Purge vessels are washed in hot soapy water and rinsed with hot tap water and DI water after each use unless there are no detectable analytes. Purge vessels are replaced in the same positions after cleaning, therefore carryover from high concentration samples can be easily detected.

Volumetric glassware, syringes, etc. (i.e. used in standard preparation) are cleaned according to the following protocol:

1. Rinsed three times with tap water

2. Rinse three times with Milli-Q (or equivalent)(DI) water.

3. Syringes rinsed five times with methanol.

4. Placed in storage at room temperature until use.

8.3.4 Classics/Nutrients (General Chemistry)

1. Wash with a hot micro-soap solution, taking care not to scratch with the brush.

2. Rinse three times with hot tap water.

3. If glassware is to be used for TKN or Total Phosphorus, rinse with 1+1 HCl

4. Rinse three times with DI water.

5. Air dry.

6. Store with clean glassware in a dust free environment or cap with aluminum foil.

7. Rinse with the solvent used for analysis, if applicable.

8. Refer to specific SOPs for special decontamination procedures for distillation apparatuses, etc.

8.4 Reagent and Standard Storage

All reagents and analytical standards received into the laboratory will be labelled with the date received and the expiration date. The label will also contain a space for "first opened". All reagents and analytical standards will be delivered to the appropriate group, who will store them as appropriate.

Some bulk reagents such as acids and solvents will be delivered in large cases which may be stored until use in the storeroom. The laboratory Receiving Department will be responsible for labelling the date of receipt on the outside of the un-opened case of bulk reagents. Any containers that have been opened may no longer remain in the store room on open shelves, and must be moved to the designated storage as identified in Table 8.3, Reagent and Standard Storage. All chemicals will be stored under temperature and humidity controlled conditions. Compatibility of chemicals will be considered for storage.

8.5 Sample and Waste Disposal

It is the policy of EMS Heritage to comply with all regulations concerning proper disposal and safe handling of laboratory samples, chemicals and waste products. Documentation will consist of manifesting of all sample and chemical analysis waste products.

8.5.1 **Sample Disposal:** It is the policy of EMS Heritage Labs to hold samples for fifteen days after analysis has been complete. EMS may store samples for an extended amount of time upon request, but an additional storage fee may apply. Once a sample is ready for disposal, it may be disposed of in two ways: Internal Sample Disposal or Return to Generator.

8.5.1.1 Return to Generator: A generator may request that a sample be returned after analysis is complete. Samples will be returned by common carrier or picked up by the generator.

Table 8.3

REAGENT AND STANDARD STORAGE

CHEMICAL	METHOD OF STORAGE
Acetic Acid	Stored in original containers in cabinets designated for liquid reagent acid storage.
pH Standards	see above
Acetone	Stored in original containers in cabinets designated for flammable chemicals.
Pyridine	
Hexane	
Methanol	
Acetonitrile	
Carbon disulfide	
Methyltertbutyl ether	
Sodium hydroxide	Stored in original containers in cabinet designated for base storage.
Freon 113	Stored in original containers in cabinet designated for solvent storage.
Dimethyl sulfoxide	
Dimethyl formamide	
Phenylarsine oxide	Stored in original containers in cabinet designated for reagents.
Methylene chloride	
Sodium sulfate anhydrous	Stored in original containers in a cabinet designated for standard and reagent storage.
Ether (anhydrous)	Stored in original containers inside a vented flammable solvent storage cabinet.
Cadmium metal	Stored in original container in a cabinet designated for standard and reagent storage.
Mercuric thiocyanate	
Ammonium chloride	
Sulfanilimide	
Ferric nitrate	

Table 8.3

CHEMICAL	METHOD OF STORAGE
EDTA	Stored in original containers on benchtop.
Sodium sulfide	
Potassium Bi-Iodate	
Iodine	
Nitric acid	Stored in original containers in cabinet designated for acid storage.
Sulfuric acid	
Hydrochloric acid	
Hydrogen peroxide	
Phosphoric acid	
Hypophosphorus acid	
85% O-phosphoric acid	
Sodium hydroxide	Stored in original containers in cabinets designated for dry chemical storage.
Hydroxylamine hydrochloride	
Stannous chloride	
Potassium persulfate	
Barbituric acid	
Sodium phosphate dibasic	
Potassium ferricyanide	
4-Aminoantipyrine	
Brij 35	
Sulfamic acid	
Calcium hypochlorite	
Boric acid	
Potassium chloride	
Chloramine-T	
L-Ascorbic acid	
Magnesium chloride	
Potassium cyanide	
Potassium permanganate	Stored in original containers in a cabinet designated for standard and reagent storage.

8.5.1.2 Internal Sample Disposal (solids/others): After the proper holding time beyond analysis completion, samples may be disposed of internally. Samples ready for disposal are taken from their storage area and segregated by type of waste. The type of waste is determined by examining information available on the sample such as client descriptions and analytical results. Once the type of waste is determined, the sample bottle is clearly marked and placed in the Sample Disposal Storage Area. Samples are stored until a contracted company removes the waste, generally on a monthly or as-needed basis. The contractor packs the waste which is then sent to the Heritage Treatment Center's Lab-Depacking Program or, depending on the type of waste, sent to an incinerator.

8.5.1.3 Internal Sample Disposal (waters): After the proper holding time beyond analysis completion, water samples are disposed of internally. Samples ready for disposal are taken from their storage area and reviewed for their method of disposal. The method of disposal is determined by examining information available on the sample such as client descriptions and analytical results. All waters that are nonhazardous can be poured down the drain. If a water sample has any contaminants which would preclude disposal to a POTW (e.g. Dioxins, PCBs) it is segregated in the same fashion as solids/others. After determining the type of waste, these samples are placed in the appropriate area in Sample Disposal Storage. The samples are stored until a contracted company removes the waste according to the waste type.

8.5.1.4 Internal Sample Disposal (waste approval samples): Waste approval samples are received and entered into the computer by the QA/QC Laboratory of Heritage Treatment Center. Therefore, after a waste approval sample has been completed for at least fifteen days, the samples are returned to QA/QC lab for disposal.

8.5.2 Lab Waste Disposal: There are 7 different types of lab generated waste - Lab Prep Waste, Auto Sampler Vials, Extraction Waste, Sulfuric Acid Waste, Nitric Acid Waste, and Waste Solvents. This

waste is accumulated on a daily basis and is handled according to it's type of waste.

8.5.2.1 Lab Prep Waste: Wastes generated by sample preparation and spill clean up are placed in this category. This would include used pipets, absorbent materials and gloves or towels that have come in contact with hazardous materials. The waste is segregated by determining the type of spill, or the laboratory that generated the waste. For example, if the waste is from a nitric acid spill, the absorbent used to clean the spill will be collected and placed in the Nitric Acid Section in the Sample Disposal Area, whereas waste pipets from the prep lab for PCB's would be collected and placed in the Disposal Area for incineration along with all other PCB waste.

8.5.2.2 Auto-Sampler Vials: Vials are generated by the organics labs containing solvents from sample extracts. The vials are accumulated in storage containers in the laboratory then are placed in the Sample Disposal Area for incineration.

8.5.2.3 Extraction Waste: Extraction waste is generated from the extraction of samples containing of a mixture of soils, solids, and oils in solvents. These containers are accumulated in the laboratory, then are placed in the Sample Storage Area for incineration. Note that the area is designated for flammables because of the waste.

8.5.2.4 Sulfuric Acid Waste: Sulfuric acid waste is generated in all areas of the lab and in the General Laboratory from COD analysis. This waste acid is accumulated in Carboys and stored in acid cabinets until full. The waste acid is then placed in the sulfuric acid section of the Sample Disposal Area. It is stored in the disposal area until several Carboys are accumulated, then sent to Heritage Treatment Center (as a Small Quantity Generator) who manifests and picks up the waste upon request.

8.5.2.5 Nitric Acid Waste: The inorganics (metals) section of the laboratory generates nitric acid waste which is stored

in Carboys in acid cabinets until full. The Carboys are then placed in the nitric acid section of the Sample Disposal Area. It is stored until several Carboys are accumulated then sent to Heritage Treatment Center (as a Small Quantity Generator) who manifests it along with the sulfuric waste.

8.5.2.6 Waste Solvents: Solvents used to rinse glassware, solvents reclaimed during sample extractions, or expired solvents are accumulated in the laboratory. Bottles containing waste solvents are clearly marked and are placed in the flammable section of the Sample Disposal Area for incineration.

Samples and sample derived waste products are not routinely tracked with regard to their precise fate. If clients desire this precise tracking of the fate of their sample, this can be accommodated on a project or client specific basis with adequate advance notice and agreement on procedures.

SECTION 9.0

9.0 Calibration Procedures and Frequency

9.1 Laboratory Instrumentation

A list of laboratory instrumentation is found in Table 9.1, Instrument List.

9.2 Standards Receipt and Traceability

The Material Safety Data Sheet (MSDS) must be on file or sent with a substance before acceptance into the lab. MSDS's included with the shipping container should be in an external envelope so that it can be read and all precautions followed before opening the container.

All chemicals delivered to the lab will be accepted in the shipping and receiving area. Bulk reagents such as acids and solvents will be delivered in large cases which may be stored in the store room until use. The shipping and receiving department will label the date of receipt on the outside of the unopened case and of bulk reagents. All other reagents and analytical standards will be delivered (unopened) immediately to the appropriate Study Manager or Group Leader. The containers will be inspected to check for damage, leakage, etc. If the reagents, standards and bulk reagents taken from the store room are acceptable they will be entered into a logbook with the following information:

1. Identification of compound (CAS number, if possible)
2. Source of Standard or reagent
3. Date of receipt
4. Date first opened
5. Purity
6. Batch or Lot number
7. Stability - expiration date
8. Approximate amount

For ease and/or confidentiality, chemicals or reagents can be assigned (and all bottles labelled with) a sequential laboratory compound (project specific) identification number based on the protocol or contract number. This information is logged in the project specific logbook. Solutions and dilutions of this compound will be tracked through this number.

All manufacturer's certification and traceability statements are maintained on file. The statements will be marked with the date received and the identification of the logbook where they are referenced. When logbooks are

Table 9.1
INSTRUMENT LIST

Division	Instr. Code	Name	Manufacturer	Model
Indianapolis	16	Auto Analyzer II	Technicon	CN, N-NO_3, Phenol
	7	FTIR 1	Biorad	FTS-7
	5	GC/ECD #5 Channel 1	Hewlett Packard	5880A
	9	GC/ECD #9 Channel 1	Hewlett Packard	5880A
	24	GC/ECD #24 Channel 1	Hewlett Packard	5890
	25	GC/ECD #25 Channel 1	Hewlett Packard	5890 Series II
	5	GC/ECD #5 Channel 2	Hewlett Packard	5880A
	9	GC/ECD #9 Channel 2	Hewlett Packard	5880A
	24	GC/ECD #24 Channel 2	Hewlett Packard	5890
	25	GC/ECD #25 Channel 2	Hewlett Packard	5890 Series II
	41	GC/FID/NPD	Hewlett Packard	5890
	106	GC/FID (Dual Channel)	Hewlett Packard	5890 Series II
	104	GC/FID/PID/ELCD w/Purge & Trap	Varian	3400
	35	GC/MS 1 w/Purge & Trap	Hewlett Packard	5985 w/5840 GC
	36	GC/MS 2	Hewlett Packard	5987A w/5880 GC
	37	GC/MS 3 w/Heated Purge & Trap	Hewlett Packard	5970 w/5890 GC
	38	GC/MS 4 w/Purge & Trap	Hewlett Packard	5970 w/5890 GC
	39	GC/MS 5 w/Purge & Trap	Hewlett Packard	5970 w/5890 Series II
	40	GC/MS 6	Hewlett Packard	5970 w/5890 GC
	107	GC/MS 7 w/Purge & Trap	Hewlett Packard	5890 w/5890 GC
	160	GC/MS 8	Hewlett Packard	5971 MSD
	19	GC/PID/ELCD w/Purge & Trap	Hewlett Packard	5890
		GC/PID/FID - Portable	HNu	
	101	Gas Flow Proportional Counter	Canberra	2405
	96	HPLC 1 w/Photodiode Array Detector and Fluorescence Detector	Waters	600E
	100	HPLC 2 w/Multi-Wave Length Detector, Scanning Fluorescence Detector and Pickering Post-Column Derivitization	Waters	600E
	32	ICP, Simultaneous	Thermo Jarrell Ash	61
	29	FAA	Instrumentation Laboratories	S12

Table 9.1
INSTRUMENT LIST

Division	Instr. Code	Name	Manufacturer	Model
Indianapolis	46	ISE Meter 1 (Gen)	Beckman	PHI 34
	47	ISE Meter 2 (Metals)	Beckman	PHI 34
		Digital Ion Analyzer (Gen)	Orion	601A
	98	Auto Analyzer (Lachat)	Lachat Instr.	2300
	33	FAA (CVAA, PE2380)	Perkin Elmer	2380
	34	GFAA (PE3030)	Perkin Elmer	3030/Zeeman
	30	GFAA (PE5100-A)	Perkin Elmer	5100/Zeeman
	31	GFAA (PE5100-B)	Perkin Elmer	5100/Zeeman
	45	Spectrophotometer	Sequoia-Turner	690
	110	TOC (Combustion IR)	Rosemount Analytical/ Dohrman	DC-190
	26	TOX I	Envirotech/ Dohrman	MC-1
	27	TOX II	Xertex/Dohrman	MC-1(DX-20)
	44	Turbidimeter	Hach	2100A
	63	GC/ECD 3 (1 of 2 CH)	Hewlett Packard	5890
	63	GC/FID 1 (2 of 2 CH)	Hewlett Packard	5890
	114	Conductivity Meter	Yellow Springs Instruments	35
	125	Dissolved Oxygen meter	Yellow Springs Instruments	59
	126	Balance 1 (to 0.0001g)	Sartorius	1601 MP8
	127	Balance 2 (to 0.0001g)	American Scientific	SP180
	128	Balance 3 (Top Loading to 0.001g)	Ohaus	B300D
	129	Balance 4 (Top Loading to 0.01g)	Fisher	7240DA
	130	Balance 5 (Top Loading to 0.01g)	Mettler	PM4000
	131	Balance 6 (Top Loading to 0.01g)	Ohaus	300
	132	Balance 7 (Top Loading to 0.01g)	Fisher	S-400
	133	Balance 8 (to 0.0001g)	Mettler	AE200
	134	Balance 9 (Top Loading to 0.001g)	Ohaus	E400D
	135	Balance 10 (Top Loading to 0.001g)	Ohaus	E400D
	136	Balance 11 (Top Loading to 0.01g)	Fisher	LX500
	137	Balance 12 (microBalance to 0.00001)	Mettler	M3

Table 9.1
INSTRUMENT LIST

Division	Instr. Code	Name	Manufacturer	Model
Charlotte	92	FAA (CVAA, PE360)	Perkin Elmer	360
	91	FAA	Perkin Elmer	3030
	90	GC/NPD/FPD	Hewlett Packard	5890 Series II
	87	GC/ECD	Hewlett Packard	5890
	89	GC/FID/PID/ELCD	Hewlett Packard	5890
	88	GC/FID/ECD	Hewlett Packard	5730
	85	GC/MS 1	Hewlett Packard	5970 w/5890 GC
	86	GC/MS 2	Hewlett Packard	5970 w/5890 GC
	103	GC/MS 3	Hewlett Packard	5970 w/5890 GC
	108	GC/PID/FID	Varian	3400
	93	GFAA 1	Perkin Elmer	3030/Zeeman
	94	GFAA 2	Perkin Elmer	3030/Zeeman
	84	Auto Analyzer, Traacs	Bran & Luebbe	800 AA
	138	Conductivity Meter	Myron	EP
	139	Spectrophotometer	Milton Roy	21DV
	140	Dissolved Oxygen Meter	Yellow Springs Instruments	54A
	141	Bomb Calorimeter	Parr	1241
	142	ISE Meter #2	Orion	920A
	144	ISE Meter #1	Cole Parmer	5986.50
	145	Turbidimeter	Hach	2100A
	149	Analytical Balance, Top Loading	Ohaus	B300D
	150	Analytical Balance	Mettler	H30
Kansas City	77	Bomb Calorimeter	Parr	1241
	76	ISE 1	Fisher Scientific	Accummet 925
	72	Balance 1 (to 0.0001g)	Mettler	AE620
	73	Balance 2 (Top Loading to 0.001g)	American Scientific Products	
	74	Balance 3 (to 0.0001g)	American Scientific Products	SP 120
		Balance 4 (Top Loading to 0.001)	Denver Instrument Company	XE Model 3000D
		Balance 5 (Triple Beam to 0.1g)	Fisher	711

Table 9.1
INSTRUMENT LIST

Division	Instr. Code	Name	Manufacturer	Model
Kansas City		Digital Thermometer	Fisher	Serial #L064041
	65	GC/ECD 1 (1 of 2 CH)	Hewlett Packard	5890
	65	GC/ECD 2 (2 of 2 CH)	Hewlett Packard	5890
	115	GC/MS w/Purge & Trap	Hewlett Packard	5970 w/5890 GC
	116	GC/MS	Hewlett Packard	5970 w/5890 GC
	117	IR Spectrophotometer	Perkin Elmer	1310
	70	FAA (PE2380) w/CVAA	Perkin Elmer	2380
	71	GFAA (PE3030)	Perkin Elmer	3030/Zeeman
	28	TOC 1	Beckman	915B Tocamaster
	118	Dissolved Oxygen Meter	Yellow Springs Instruments	54A
	119	Conductivity Meter	Orion	124
Romeoville (Chicago)	120	Balance 5 (to 0.01g)	Mettler	BB300
	121	Balance 6 (to 0.001g)	Ohaus	E400
	60	Balance 2 (to 0.0001g)	Mettler	AE260-S
	99	Balance 3 (to 0.0001g)	Mettler	AF100
	61	Bomb Calorimeter	Parr	1241 Ea
	54	Conductivity meter	Cole/Parmer	1484-20
	50	GC/ECD/FID	Hewlett Packard	5890A
	51	GC/ECD/FID	Hewlett Packard	5890A
	102	GC/MS 1	Hewlett Packard	5970 w/5890 GC
	49	GC/MS w/Heated Purge & Trap	Hewlett Packard	5970 w/5890 GC
	20	FAA, CVAA, GFAA	Instrumentation Laboratories	V12E
	58	Balance 4, Top Loading	Ohaus	E300D
	57	Dissolved Oxygen Meter	Yellow Springs Instruments	54ABP
	97	FAA (CVAA, PE2380)	Perkin Elmer	2380
	105	ICP, Sequential	Perkin Elmer	P40
	22	GFAA (PE5100)	Perkin Elmer	5100/Zeeman
	55	ISE Meter 1	American Scientific Products	
	56	ISE Meter 2	Orion	SA520

Table 9.1
INSTRUMENT LIST

Division	Instr. Code	Name	Manufacturer	Model
Romeoville (Chicago)	59	Analytical Balance	American Scientific	B1240-2
	159	pH Meter	Orion	520A
	95	ISE Meter 3	Orion	520
	52	Spectrophotometer 1	Milton Roy	SPEC 21
	53	Spectrophotometer 2	Milton Roy	SPEC 21
	122	GC/MS A w/Purge and Trap	Hewlett Packard	5970 w/5890 GC
	123	GC/MS B	Hewlett Packard	5970 w/5890 GC
	124	FTIR	Matheson	Galaxy 2020
	161	Spectrophotometer 3	Milton Roy	SPEC 21

Abbreviations/Acronyms:

GC	=	Gas Chromatograph	MS	=	Mass Spectrometer
ECD	=	Electron Capture Detector	NPD	=	Nitrogen-Phosphorus Detector
FTIR	=	Fourier Transform Infra-Red	PID	=	Photoionization Detector
ELCD	=	Electrolytic Conductivity Detector	ICP	=	Inductively Coupled Argon-Plasma
FAA	=	Flame Atomic Absorption	CVAA	=	Cold Vapor Atomic Absorption
GFAA	=	Graphite Furnace Atomic Absorption	TOC	=	Total Organic Carbon
TOX	=	Total Organic Halides	FPD	=	Flame Photometric Detector
ISE	=	Ion Selective Electrode	CH	=	Channel(s)
IR	=	Infra-Red, Dispersive	FID	=	Flame Ionization Detector

archived, the associated certification file documentation is archived with the logbook.

Only standard sources approved by the QA Unit may be used. Standards will be traceable to NIST when possible.

9.3 Standard Sources and Preparation

Stock solutions are prepared by the Group Leader or their designee for the purpose of making standards and performing analyses. There must be no handling of the reagents directly from the reagent bottles. Instead, minimal amounts are to be placed in interim holding containers. Unused stock solutions must not be poured back into original containers. The possible toxicity of the reagents must be noted and respected. Stock solutions are to be made using analytical reagent grade or other appropriate grade solvents. Storage precautions must be noted and observed with regard to heat and light sensitive compounds. Solutions must be kept in the proper container tightly sealed (amber glass where necessary) with Teflon lined lids in an appropriate refrigerator. No mouth pipetting is permitted.

When preparing stock solutions, at least 0.1000 grams or 1.00 ml of reagent is to be used, when possible or practical. Direct delivery into a volumetric flask is required. Stock solution preparation noting lot numbers of reagents and solvents in addition to date and initials of person preparing the solutions must be noted and recorded on the label and in the appropriate standards logs.

Stock solutions under proper storage (refrigerated if necessary) may be kept for a period not to exceed the maximum recommended storage time. Standard solutions are prepared from the stocks by the analyst on a daily, weekly, or monthly basis as necessary.

Standard sources and preparation protocols are listed in Table 9.2, STANDARD SOURCES AND PREPARATION. This table includes the following information:

1. Instrument group

2. Source and traceability of primary standards

3. Frequency of preparation

4. How primary and working standards are stored.

Table 9.2
STANDARD SOURCES AND PREPARATION

Instrument Group	Standard Sources/ Traceability	Concentrations Received	Source Storage	Preparation from Source[1]	Lab Stock Storage	Prep Frequency
GC/MS - Volatile						
Methods 624, 8240	Supelco or equivalent	200ppm	frozen	1:10 dilution in methanol[1]	Refrig.	Weekly or as needed
Method 524	Supelco or equivalent	2000ppm	frozen	Stock solution 1:20 in methanol[1] Working solution 1:10 in methanol[1]	Refrig.	Quarterly, Every 2 weeks or as needed
CLP OLM01	Ultra or equivalent	100ppm	frozen	1:5 dilution in methanol[1]	Refrig.	Weekly or as needed
Appendix IX	AccuStandard or equivalent	Available 100-500 ppm	frozen	Dilute to 20ppm[1]	Refrig.	As needed
GC/MS - Semi-Volatile						
Methods 625, 8270	Supelco, Restek or equivalent	2000ppm	frozen	Make dilution to 160 ppm[1]	Refrig.	Every 2 weeks
Method 525	AccuStandard or equivalent	100ppm	frozen	Stock solution - 1:10 in methanol[1]	Refrig.	As needed
CLP OLM01	Ultra or equivalent	2000ppm	frozen	Stock solution - 160ppm[1]	Refrig.	As needed
Appendix IX	AccuStandard or equivalent	available from 100-250ppm	frozen	Run as received or dilute to 160ppm[1]	Refrig.	As needed

[1] Daily calibration standards are made from stock solutions at method specified concentrations.

Table 9.2
STANDARD SOURCES AND PREPARATION

Instrument Group	Standard Sources/ Traceability	Concentrations Received	Source Storage	Preparation from Source[1]	Lab Stock Storage	Prep Frequency
HPLC	Supelco Polynuclear Aromatic Hydrocarbon Mix Supelcopreme-HC or equivalent	Solutions of 2000µg/mL	Refrig.	Working stocks prepared from source stock	NA	Spiking solution extract with each sample set
	Supelco Polynuclear Aromatic Hydrocarbons Mixture 610-M or equivalent	Solutions of 100 to 2000 g/ml µ	Refrig.	Working stocks prepared from source stock	Refrig.	Semi-annual
	NIST-1647a PNA's	Solutions of 0.771 to 19.9 µg/mL	Refrig.	Working solutions prepared from source	NA	Per sequence
	AccuStandard PAH Additions to Method 610-M or equivalent	Solution of 0.1 mg/mL in CH_2Cl_2	Refrig.	Working solution prepared from source	Refrig.	Semi-annual
	USEPA QC Sample PNA I WP 485	Solution of 5 to 100 µg/mL	Refrig. if seal is broken	Working solution prepared from source	Refrig.	2 months

Table 9.2
STANDARD SOURCES AND PREPARATION

Instrument Group	Standard Sources/ Traceability	Concentrations Received	Source Storage	Preparation from Source[1]	Lab Stock Storage	Prep Frequency
HPLC	AccuStandard N-Methyl Carbamoyl Oximes and N-Methyl Carbamates in Drinking Water or equivalent	0.1 mg/mL in ACN	Refrig.	Working solution prepared from source	Room temp. protect from light	2 months
	Aldrich 4-Bromo-3,5-Dimethyl-Phenyl N-Methyl-Carbamate (BDMC) ISTD or equivalent	98% neat	Room temp.	Primary stocks ~ 1000 mg/L Intermediate stock ~ 100 mg/L Working - 5µL of Int. → 50 mL	Room Temp. protect from light	2 months 2 months Working-Daily
	AccuStandard Methiocarb (for LCS) or equivalent	Neat	Room temp.	Primary stock ~ 1000 mg/L Intermediate stock ~ 2 mg/L Working solution ~ 2PPB	Room temp. protect from light	2 months 2 months Working - Daily
	AccuStandard Aldicarb-Sulfoxide (for LCS) or equivalent	Neat	Room temp.	Primary stock ~ 1000 mg/L Intermediate stock ~ 100 mg/L Working solution ~ 100PPB	Room temp. protect from light	2 months 2 months Working - Daily

Table 9.2
STANDARD SOURCES AND PREPARATION

Instrument Group	Standard Sources/ Traceability	Concentrations Received	Source Storage	Preparation from Source[1]	Lab Stock Storage	Prep Frequency
GC/PID/ELCD	AccuStandard or equivalent	Stock solution 2000 µg/mL	Freezer 0°C	Working solutions 20µg/mL	Freezer (with minimal headspace)	4 weeks,Gaseous stds. 1 week unless validity proven
	Supelco or equivalent	Stock solution 200 - 2000 µg/mL	Freezer 0°C	Working solutions 20µg/mL	Freezer (with minimal headspace)	4 weeks,Gaseous stds. 1 week unless validity proven
	Chem Service or equivalent	Neat compounds	Refrig.	Stock solutions ~10,000 µg/mL Working solution ~20 µg/mL	Freezer (minimal headspace	As needed for special analyte lists. 4 weeks unless validity proven.
FTIR	USEPA - API reference oil, #2 fuel oil	Neat compound	Refrig.	<u>Stock solutions:</u> Calibration Std. ~7500 Spiking soln ~20,000	Refrig.	6 month exp.
				Working calibration std. from stock soln. L-1 ~8 mg/l L-2 ~15 L-3 ~77 L-4 ~380 L-5 ~770 L-6 ~2300	NA	with every calibration
				Daily verification std. L-3 ~77	NA	Daily

Table 9.2
STANDARD SOURCES AND PREPARATION

Instrument Group	Standard Sources/ Traceability	Concentrations Received	Source Storage	Preparation from Source[1]	Lab Stock Storage	Prep Frequency
ICP (LCS, ICV)	3 solutions SPEX multi-element or equivalent	50-10,000ppm multi-element mixes	Room temp.	Dil. 1:10 from source for LCS or as required	1%HNO_3	Bi-weekly or as needed
ICP (Cal. Std's)	3 solutions - SPEX multi-element or equiv.	100-5,000ppm Multi-element mixes	Room temp.	Dil. 1:50 from source or as required	5% HCl 1%HNO_3	Weekly
ICP	Perkin Elmer CLP Calibration Stds. or equiv.	1-1,000ppm	Room temp.	Intermediate solutions prepared from stock	1% HNO_3	Weekly
ICP	EPA ref. materials	1-5ppm	Room temp.	Working solution prepared from source	1% HNO_3	As needed
FAA (Cal. Stds.)	Fisher, RICCA or equiv.	1,000ppm	Room temp.	Working stock prepared from source 0.1 to 50 ppm	1% HNO_3	Monthly or as needed
FAA (LCS, ICV)	Spex multi-element or equiv.	50-2000ppm mix	Room temp.	1:500 dil. for LCS or as needed	1% HNO_3	Biweekly or as needed
FAA (Cal. Std's)	JM Specpure or equiv.	1000ppm	Room temp.	Ba, Pb-1:10 from source. Others - 1:10 intermed. from source then: 0.1-5ppm working from intermediate	2.5% HNO_3	Weekly or as needed
FAA	EPA ref. materials	1-5ppm	Room temp.	Working solution prepared from source	1% HNO_3	As needed

Table 9.2
STANDARD SOURCES AND PREPARATION

Instrument Group	Standard Sources/ Traceability	Concentrations Received	Source Storage	Preparation from Source[1]	Lab Stock Storage	Prep Frequency
ICP, FAA, GFAA (LCS)	Conostan S-21 or equiv.	Metals in oil matrix As, Se = 100 mg/L Al, Ca, Fe, K, Mg, Na = 1,000 mg/L All other metals = 400 mg/L	Room temp.	Working solution prepared from source	NA	As needed
CVAA (LCS, ICV)	NIST 1641B	1.52ppm	Room temp.		0.2% $KMnO_4$	Daily
CVAA (Cal. Std's)	Fisher, RICCA or equiv.	1000ppm	Room temp.	250ml → 25mL from source = 10ppm intermediate std. 1mL → 100mL = 0.1ppm working std.	5% HNO_3 0.2% $KMnO_4$	Daily
CVAA	EPA ref. materials	As provided	Room temp.	Working solution prepared from source	1% HNO_3	As needed
GFAA (Cal. Stds.)	Fisher, RICCA, SPEX, Specpure or equiv.	1,000ppm	Room temp.	Working solution prepared from intermediate	1% HNO_3 & 5% HNO_3	Weekly or as needed
GFAA (ICV, LCS)	EPA ref. materials	1-5ppm, As provided	Room temp.	Working solution prepared from source	1% HNO_3	As needed
GFAA (LCS)	PE pure Inorganic Ventures or equiv.	1,000ppm	Room temp.	Stock prepared from source	5% HNO_3	Semi-annually or as needed

Table 9.2
STANDARD SOURCES AND PREPARATION

Instrument Group		Standard Sources/ Traceability	Concentrations Received	Source Storage	Preparation from Source[1]	Lab Stock Storage	Prep Frequency
Conductivity Meters	CAL	Fisher or equiv.	Potassium hydrogen phthalate (KHP) granular	Room temp.	0.3g/1000mls DI (168μmhos)	.Refrig. 4°C	6 mos. or as needed
	ICV	Fisher or equiv.	Potassium chloride granules	Room temp.	0.7456g/1000ml DI (1413μmhos)	.Refrig. 4°C	6 mos. or as needed
ISE Meters	(PH)	Commercial Lab Supplies	pH, 7, 4 & 10	Room temp.	None	Room temp.	NA
Chloride	CAL	Fisher or equiv.	NaCl granules	Room temp.	1.6480g/1000mls (500ppm)(CAL)	Room temp.	6 mos. or as needed, exp. date on bottle
	ICV	Ricca or equiv.	Chloride Standard (3540ppm)	Room temp.	premade (3540ppm)(ICV)		
Fluoride	CAL	Mallinckrodt or equiv.	NaF granules (CAL)	Room temp.	0.221g/11 DI (100ppm)(CAL)	Room temp.	6 mos. or as needed, exp. date on bottle
	ICV	Ricca or equiv.	Fluoride 100ppm (ICV)	Room temp.	premade (ICV)		
Ammonia	CAL	Mallinckrodt or equiv.	Ammonium chloride granules (CAL)	Room temp.	3.819g/1c DI (1000ppm)(CAL)	Room temp.	exp. date on bottle
	ICV	Ricca or equiv.	Ammonia (ICV)	Room temp.	premade (ICV)		
Spectrometers Phenols	CAL	Chem Service or equiv.	Phenol crystals (CAL)	Room temp.	0.1g/100mls of boiled DI (CAL)	Room temp.	6 mos or as needed, exp. date on bottle
	ICV	RICCA/Mallinc-krodt or equiv.	Phenol 1000ppm (ICV)	Room temp.	Premade (ICV)		

Table 9.2
STANDARD SOURCES AND PREPARATION

Instrument Group		Standard Sources/ Traceability	Concentrations Received	Source Storage	Preparation from Source[1]	Lab Stock Storage	Prep Frequency
Nitrite	CAL	Fisher or equiv.	KNO_2 granules (CAL)	Room temp.	3.351g/500mls w/2mls $CHCl_3$ (CAL)		3 mos. or as needed, exp. date on bottle
	ICV	Red Bird or equiv.	premade (ICV)	Room temp.	premade (100ppm) (ICV)		
Nitrate	ICV	Red Bird or equiv.	Nitrate 1000ppm (ICV)	Room temp.	premade (100ppm) (ICV)	Room temp.	exp. date on bottle, semi-annually
	CAL	Fisher or equiv.	KNO_3 granules (CAL)	Room temp.	3.609g/500mls DI (CAL)		
Sulfate	ICV	Fisher or equiv.	$NaSO_4$ granules	Room temp.	1.479g/1c DI 100ppm (ICV)	Room temp.	6 mos. or as needed
	CAL	Red Bird or equiv.	1000 ppm SO_4	Room temp.	Premade 1000 ppm (CAL)		
Cyanide	ICV	Mallinckrodt or equiv.	KCN granules (ICV)	Room temp.	.251g/100, 1000ppm (ICV)	Room temp.	6 mos. or as needed
	CAL	Kodak or equiv.	KCN granules (CAL)	Room temp.	.251g/100mls, 1000ppm (CAL)		
PO_4	ICV	RICCA or equiv.	Phosphorus 1000ppm (ICV)	Room temp.	premade	Room temp.	6 mos. or as needed
	CAL	Fisher or equiv.	KH_2PO_4 granules (CAL)	Room temp.	0.1099g/500mls		

Table 9.2
STANDARD SOURCES AND PREPARATION

Instrument Group		Standard Sources/ Traceability	Concentrations Received	Source Storage	Preparation from Source[1]	Lab Stock Storage	Prep Frequency
COD Reactor	CAL	Fisher or equiv.	$K_2Cr_2O_7$ crystals (CAL)	Refrig. 4°C	12.259g/L	Refrig. 4°C	every other month
	ICV	Fisher or equiv.	KHP (ICV)	Refrig. 4°C	0.4250g/L (500ppm)		
Hexavalent Chromium	CAL	Fisher or equiv.	$K_2Cr_2O_7$ crystals 50ppm (CAL)	Room temp.	0.1414g/1000mls 50ppm	Room temp.	6 mos. or as needed, exp. date on bottle
	ICV	Hach or equiv.	premade (ICV)	Room temp.	premade 50ppm		
Alkalinity	ICV	Hach or equiv.	Sodium Bicarbonate	Room temp.	0.673g/1000mls	.Refrig. 4°C	6 mos.
TDS		Fisher or equiv.	KHP granules	Room temp.	0.3g/1000mls	.Refrig. 4°C	3 mos.
Bomb Calorimeter	Soils	Fisher or equiv.	Ethylene glycol	Flammable cabinet premade	N.A. premade	Flammable cabinet (room temp.)	as needed
	Liquids	Parr	Benzoic Acid	premade	.25 (1 tablet)	Room temp.	purchased as new
TKN Digestor	ICV	Hach	glycine p-toluenesulfonate granules	Room temp.	1.7652g/L 100ppm	Room temp.	6 mos. or as needed
Oxygen Meter	CAL	Fisher (CAL) or equiv.	glutamic acid and dextrose	Room temp.	.15g/L	Room temp.	once a month or as needed
	ICV	Fisher (ICV)	KHP	Room temp.	.15g/L		

1 Daily calibration standards are made from stock solutions at method specified concentrations. Exact dilutions and final concentrations may vary depending on the source available and the final concentrations required.

All stock and standard solutions are to be labeled with:

- Contents and level of concentration
- Discrete identifying ID
- Solvent
- Date of preparation
- Manufacturer's Lot number
- Initials of preparer
- Expiration date
- Other information which may be appropriate
- This information must also be entered into the group's standards log book

9.4 Standardization of Titrating Solutions

The laboratory uses purchased pre-standardized reagents when possible for all those solutions and methods requiring standardization. Refer to Table 9.3, Standardization Of Titrating Solutions for solutions that require standardization, the source of the primary standards used to standardize, and the frequency of standardization. Standardization must be documented in some manner.

9.5 Calibration of Thermometers

All thermometers are labelled and calibrated with a NIST certified thermometer. A logbook documents this calibration. Thermometers are calibrated every two years or more frequently as needed.

9.6 Calibration of Balances

All analytical balances except top loading balances will be checked daily (or each day of use) using a "class S" certified weight. The QA Unit will perform a weekly 5 point check of all balances in the laboratory. Logbooks will be used to document this calibration.

Table 9.3
STANDARDIZATION OF TITRATING SOLUTIONS

Solution (N)	Source of Primary Standard	Frequency of Standardization	Methods Utilized
EDTA (0.2N)	$CaCO_3$ NIST	Daily	130.2
NaOH (0.02N)	$KHC_8H_4O_4$ NIST	As Needed (Each new soln.)	305.2
H_2SO_4 (0.1N)	Na_2CO_3 NIST	As Needed (Each new soln.)	375.4, 310.1, 350.2
HCl (0.1N)	Na_2CO_3 NIST	As Needed (Each new soln.)	310.1
Phenylarsine Oxide (0.0375N)	$KH(IO_3)_2$ Fisher	Daily	345.1, 320.1
$Na_2S_2O_3$ (0.75N)	$KH(IO_3)_2$ Fisher	Daily	320.1
$Hg(NO_3)_2$ (0.141N)	NaCl NIST	Daily	325.3
$Hg(NO_3)_2$ (0.025N)	NaCl NIST	Daily	325.3
$Hg(NO_3)_2$ (0.0141N)	NaCl NIST	Daily	325.3
Phenylarsine Oxide (0.00564N)	$KH(IO_3)_2$ Fisher	Daily	330.2
KI (0.1N)	PAO Red Bird Service	Daily	330.2
KI (0.0282N)	PAO Red Bird Service	Daily	330.2
$Fe(NH_4)_2(SO_4)_2$ (N)	$K_2Cr_2O_7$ NIST	Monthly	330.4
KCN (0.0192N)	$AgNO_3$ Red Bird Service	Monthly	335.2
$Na_2S_2O_3$ (0.0375N)	$KH(IO_3)_2$ Fisher	Daily	345.1
KI (0.0225N)	PAO, $Na_2S_2O_3$	Daily	376.1
Methylene Blue	KI	Daily	376.2
$Fe(NH_4)_2(SO_4)_2$(0.25N)	$K_2Cr_2O_7$ NIST	Daily	410.1, 440.3
$Fe(NH_4)_2(SO_4)_2$(0.025N)	$K_2Cr_2O_7$ NIST	Daily	410.2
I_2	$Na_2S_2O_3$	Bi-Weekly	

9.7 Calibration of Eppendorfs/Pipettors

All pipettors required to deliver precise volumes are calibrated weekly. This calibration is documented in a logbook which identifies the specific pipettor.

9.8 Instrument Performance Parameters - Start-up QC

Performance parameters are checked at the beginning of each analytical run and are used as a check to determine acceptable instrument performance. The operating conditions are documented in a bound log book.

9.8.1 Metals Analysis Instrument Performance Parameters

Performance parameters are checked at the beginning of each analytical run. The operating conditions are documented in a bound instrument log book, one for each instrument. The following information is recorded:

GFAA, FAA:	Date, element, analyst, standard concentration, standard absorbance, comments.
CVAA:	Date, element, analyst, standard concentration, standard absorbance, blank absorbance, comments.
ICP:	Date, analyst, emission "counts" for calibration standard and blank for Ba, Cd and Sb, Ar flow, Hg (or Cd or Mn) profile, comments.
Hydride AA:	Date, element, analyst, standard concentration, standard absorbance, blank absorbance, comments.

The following minimum criteria must be met before proceeding with the analytical run, unless approval is obtained from the appropriate supervisor.

ICP:	Emission count criteria for Mn is 30,000; data is being accumulated for other elements. The Hg (or Cd) profile must be ±0.20.
CVAA:	The 3 ug/L calibration standard must be greater than or equal to 0.080 abs. The blank must have

an absorbance of less than 0.005. The calibration correlation coefficient must be at least 0.995.

FAA: The highest calibration standard (designated in log book) must have an absorbance of at least 80% of the instrument manual value (Ba and Cr require 70%). This value is found on the chart by the instrument and in the instrument manual. The correlation coefficient must be at least 0.995.

GFAA: A mid-range standard (designated in the log book; at the level of the analytical spike) must have an absorbance of at least the value in Table 9.4, GFAA Minimum Absorbance Criteria. The correlation coefficient must be at least 0.995.

Hydride AA: The 3 ug/L calibration standard must be greater than or equal to 0.080 abs. The blank must have an absorbance of less than 0.005. The calibration correlation coefficient must be at least 0.995.

9.8.2 Mass Spectrometry Performance Parameters

Each system used for the analysis of volatile compounds must be tuned to meet the abundance criteria listed below for BFB.

	Method 624/8240	Method 524
Mass	Target Value	Target Value
50	15%-40%	15%-40%
75	30%-60%	30%-80%
95	100%	100%
96	5%-9%	5%-9%
173	< 2% of 174	< 2% of 174
174	> 50%	> 50%
175	5%-9% of 174	5%-9% of 174
176	95%-101% of 174	95%-101% of 174
177	5%-9% of 176	5%-9% of 176

Table 9.4
GFAA MINIMUM ABSORBANCE CRITERIA

Element	Standard (ug/L)	Min. Abs.
As	10	0.035
Be	2.0	0.025
Cd	2.0	0.050
Cu	10	0.050
Cr	10	0.100
Pb	10	0.050
Ni	10	0.035
Sb	10	0.035
Ag	2.0	0.025
Se	10	0.025
Tl	10	0.040

These criteria cannot (routinely) be met using the AUTOTUNE file. It may be necessary to adjust the various lenses. The ratios of 69/219/502 should be around 100%/40%/4% for the MS's and 100%/25%-30%/2% on the MSD's. Run mass axis and width calibration and look at a profile scan before storing the tune and exiting the program.

The mass spectrometers are considered to be in tuning compliance for 12 hours after the injection (and passing the criteria) of the tuning compound for SW846 methods and for 8 hours for EPA 524. EPA method 624 has no time limitation on the tune or continuing calibration check, but sequences are not run for greater than 24 hours. Any analytical run which lasts longer than the method allows must include a tune check at or before the time period expires. Background correction may only be used to eliminate column bleed or instrument background ions. A hardcopy report of each tune check (spectrum and mass listing) is kept in the run folder. Background correction technique must be recorded.

Each system used for the analysis of semi-volatile compounds must be tuned to meet the abundance criteria listed below for DFTPP.

	Method 625/8270	Method 525
Mass	Target Value	Target Value
51	30%-60% of 198	10%-80% of 198
68	< 2% of 69	< 2% of 69
70	< 2% of 69	< 2% of 69
127	40%-60% of 198	10%-80% of 198
197	< 1% of 198	< 2% of 198
198	100%, Base Peak Relative Abund.	100% or > 50% of 442
199	5%-9% of 198	5%-9% of 198
275	10%-30% of 198	10%-60% of 198
365	> 1% of 198	> 1% of 198
441	present and < 443	present and < 443
442	> 40% of 198	100% or > 50% of 442
443	17%-23% of 442	15%-24% of 442

These criteria cannot (routinely) be met using the AUTOTUNE file. It may be necessary to adjust the various lenses. Run mass axis and width calibration and look at a profile scan before storing the tune and exiting the program.

The mass spectrometers are considered to be in tuning compliance for 12 hours after the injection (and passing the criteria) of the tuning compound for SW846 methods and for 8 hours for EPA 525. EPA method 625 has no time limitation on the tune or continuing calibration check, but sequences are not run for greater than 24 hours (sample capacity limitation). Any analytical run which lasts longer than the method allows from the injection of DFTPP, must include a tune check at or before the time expires. Background correction may only be used to eliminate column bleed or instrument background ions. A hardcopy report of each tune check (spectrum and mass listing) is kept in the run folder. Background correction technique must be recorded in the log book.

9.8.3 Gas Chromatography and Liquid Chromatography (HPLC) Performance Parameters

Gas Chromatography (GC) and High Performance Liquid Chromatography (HPLC) techniques require three basic checks used to evaluate the system upon start-up.

1. Column efficiency

2. Resolution (resolution and column eff.)

3. Detector efficiency

9.8.3.1 Column efficiency is measured by an artificial concept called theoretical plates. In order to compare column efficiencies one must utilize identical conditions for the following:

1. Solvent

2. Solute

3. Temperature

4. Flow Rate

5. Sample size

Broadening of the peaks (under identical instrument and method conditions, see above) indicates a decrease in the number of theoretical plates and therefore less desirable chromatography. A representative compound for the method being utilized will be chosen and a theoretical number of plates will be calculated from the calibration standard(s) run at the beginning of each sequence. The number of theoretical plates will be documented in a log book and will be used to assist in the determination of column acceptability.

Tangents are drawn to the peak at the points of inflection. The number of theoretical plates n, is given by:

$$\frac{n}{cm} = \frac{5.545\left(\frac{RT}{W_h}\right)^2}{L}$$

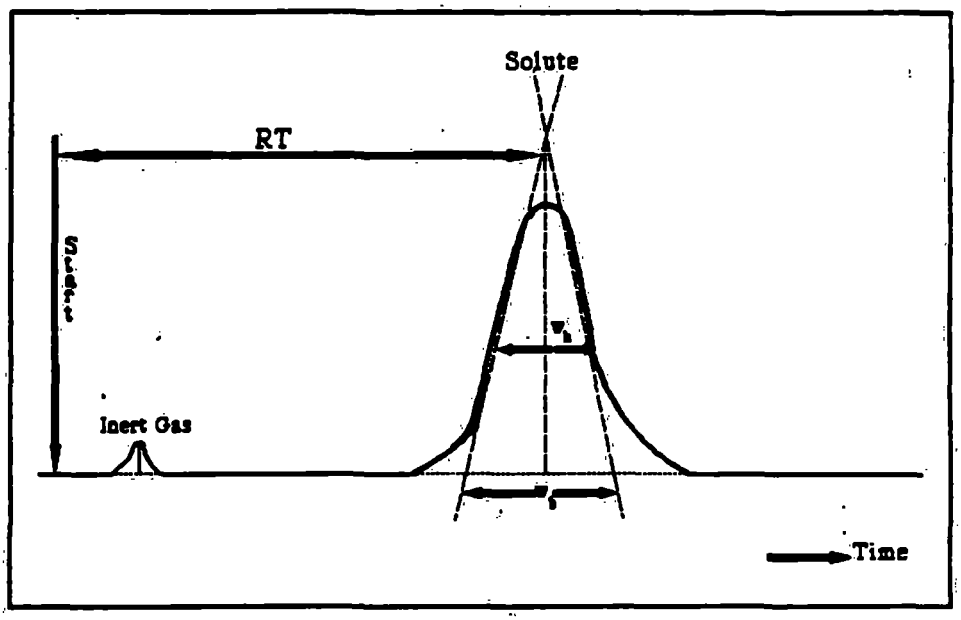
Where: RT = distance from injection to peak maximum in centimeters
W_h = peak width at half height in centimeters
L = column length in centimeters

See Figure 9.1, Calculation of Theoretical Plates.

The peak gaussian factor (PGF) will be calculated when required as per the method specified analyte and must meet the method specified criteria. The PGF will be documented in a log book. The PGF calculation is required by some drinking water methods.

Figure 9.1

CALCULATION OF THEORETICAL PLATES



$$\frac{n}{cm} = \frac{5.545\left(\frac{RT}{Wh}\right)^2}{L}$$

n = # theoretical plates
RT = distance from injection to peak maximum (retention time in centimeters)
W_h = peak width at half height
L - column length in centimeters

or;

$$n = \frac{16\left(\frac{RT}{W_b}\right)^2}{L}$$

Where: W_b = Width of peak at base

$$PGF = \frac{1.83(W_h)}{W_{1/10}}$$

Where: W_h = peak width at half height
$W_{1/10}$ = peak width at one-tenth height

9.8.3.2 Resolution is a measure of both the column and solvent efficiencies. It indicates both the separation of peak maxima (retention times) and the narrowness of peaks. Representative or method specified compounds will be utilized to calculate resolution at the beginning of the analytical run. The formula for resolution (R) is:

$$R = \frac{2d}{W_1 + W_2}$$

Where: d = difference in elution times between two peaks
W_1 = peak width for analyte 1.
W_2 = peak width for analyte 2.

See Figure 9.2, Calculation of Resolution.

Retention time windows will be established for all GC methods each time a new column is installed. The concentration of each analyte will be such that the response is approximately half scale. The standard deviation (SD) from 3 injections shall be used to establish the retention time windows. For multi-response analytes, one major peak will be chosen for the calculation.

The performance criterion is:

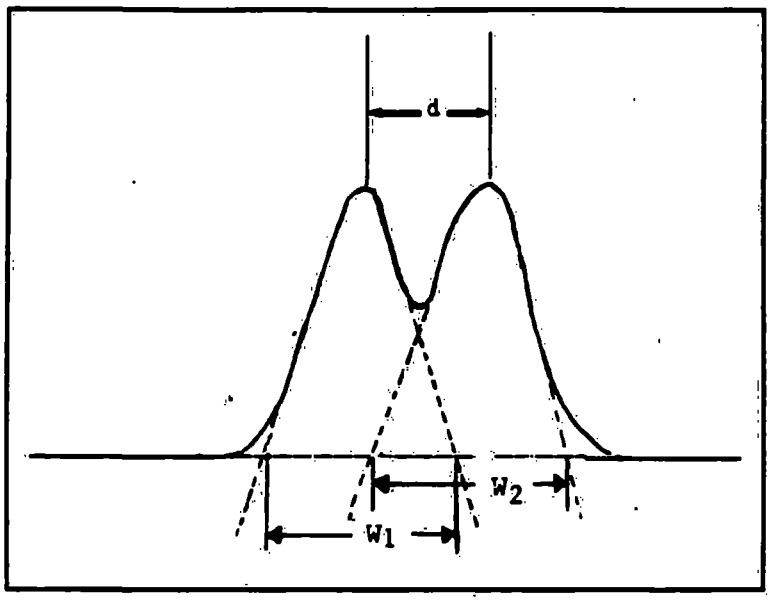
RetentionTime: ±3(*SD*)

For multi-response analytes the analyst should utilize the retention time window, but will primarily rely on pattern recognition.

9.8.3.3 Detector efficiency will be monitored from the analysis of method specified and/or representative compounds

Figure 9.2

CALCULATION OF RESOLUTION



$$R = \frac{2d}{W_1 + W_2}$$

Where d = difference in elution times between two peaks.
W_1 = peak width for analyte 1.
W_2 = peak width for analyte 2.

chosen such that their response will indicate the optimum minimum acceptable response from the detector. Many methods (i.e.GC/MS) specify compounds called System Performance Check Compounds (SPCC's). SPCC's must meet the minimum RF required by the method for both initial and continuing calibrations. Specifically, USEPA CLP lists minimum RF requirements for each analyte which must be met for both initial and continuing calibrations.

Methods that do not list minimum RF's (detectors other than mass spectrometers) will monitor a chosen analyte or analytes and compare that response to a mean RF ($\overline{RF}$).

Minimum RF: ± *20% Difference of the established mean*

9.8.4 Miscellaneous equipment and instrumentation performance requirements are listed below:

Analytical Balance : ± 0.5% of class "S" weight true value

Spectrophotometer : ± 5% of NIST or other standard glass filters intensity

Ovens : ± 3°C of set point

Furnaces : ± 20°C of set point

Conductivity Meter : ± 1% of cell constant's established mean

Refrigerators/Coolers : ± 2°C of set point

Freezers : ± 3°C of set point

Incubators : ± 1°C of set point

D.I. Water System : Conductivity ≤ 1.0 μmhos/cm (or 1.0 MΩ·cm)

Zero Headspace Extractors : Maintain 50 PSI for 1 hour

EP, TCLP Extractors : ± 2 RPMs of specified RPM

9.9 Instrument Calibration Criteria

Instrument Calibration frequency and criteria are detailed in Table 9.5, Instrument Calibration. All linear calibration curves will be fitted by the least squares linear regression technique. This procedure will also be used for calibration curves that require log transforms or similar transforms. The formula for calculation of the regression line is given in Section 12.0, Data Reduction, Validation and Reporting.

Each item of equipment shall, when appropriate, be labeled, marked or otherwise identified to indicate its calibration status, except for those items of equipment which are calibrated more frequently than every 6 months.

Table 9.5
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/ Rejection Criteria - Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification[1]	Acceptance/ Rejection Criteria - Initial Calibration Verification	Frequency of Continuing Calibration Verification[1]	Acceptance/ Rejection Criteria - Continuing Calibration Verification
FAA	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 analytical samples	90-110%R
	EPA600/4-79/080	4				90-110%R		90-110%R
	CLP	4				90-110%R		90-110%R
CVAA	SW-846	4				80-120%R		80-120%R
	EPA600/4-79/080	4				80-120%R		80-120%R
	CLP	4				80-120%R		80-120%R
ICP	SW-846	1				90-110%R		90-110%R
	EPA600/4-79/080	1				90-110%R		90-110%R
	CLP	1				90-110%R		90-110%R
GFAA	SW-846	4				85-115%R		85-115%R
	EPA600/4-79/080	4				85-115%R		85-115%R
	CLP	4				90-110%R		90-110%R
pH Meter	SW-846	3	±0.1 STD units of true value			± 0.1 STD units of true value		± 0.1 STD unit of true value
	CLP	3						

Table 9.5
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/ Rejection Criteria - Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification[1]	Acceptance/ Rejection Criteria - Initial Calibration Verification	Frequency of Continuing Calibration Verification[2]	Acceptance/ Rejection Criteria - Continuing Calibration Verification
GC/MS-volatiles	SW-846 (8240,8260)	5	%RSD<30% (CCC) 1,1-dichloroethene; chloroform 1,2-dichloropropene; 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%	daily 12 hr.	CCC %D <25% same SPCC criteria as initial calibration
	40CFR136, 624	5	all cmpds %RSD <35% or use calibration curve	As needed	As needed	± 20%R	daily 24 hr.	Compare w/Table 9.5 "Q" (attached)
	CLP SOW 2/88	5	same as SW846	As needed	As needed, usually w/PE's	± 20%R	daily 12 hr.	same as SW-846

Table 9.5
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/ Rejection Criteria - Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification[1]	Acceptance/ Rejection Criteria - Initial Calibration Verification	Frequency of Continuing Calibration Verification[1]	Acceptance/ Rejection Criteria - Continuing Calibration Verification
GC/MS-volatiles	CLP SOW OLMO1.5	5	min RF Bromoform 0.10 Vinyl Chloride 0.10 1,1-dichloroethene 0.10 1,1-dichloroethane 0.20 Chloroform 0.20 1,2-dichloroethane 0.10 1,1,1-trichloroethane 0.10 carbon tetrachloride 0.10 bromodichloromethane 0.20 cis-1,3-dichloropropene 0.20 trichloroethene 0.30 dibromochloromethane 0.10 1,1,2-trichloroethane 0.10 benzene 0.50 trans-1,3-dichloropropene 0.10 bromoform 0.10 tetrachloroethene 0.20 1,1,2,2-tetrachloroethane 0.50 toluene 0.40 chlorobenzene 0.50 ethylbenzene 0.10 styrene 0.30 xylene (total) 0.30 bromofluorobenzene 0.20 all % RSD <20.5 Other target compounds must meet minimum RF of 0.10 No %RSD criteria	As needed	As needed, usually w/PE's	± 20%R	Daily every 12 hours	RF criteria same as initial cal. %D <25.0
	EPA 524.2	5	% RSD <20% or use cal curve - all target compounds	As needed	As needed	± 20%R	Daily, every 8 hours	All compounds RF%D <30% ISTD areas >30%, <150% of initial cal.

Table 9.5
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/ Rejection Criteria - Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification[1]	Acceptance/ Rejection Criteria - Initial Calibration Verification	Frequency of Continuing Calibration Verification[1]	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%R	Daily, every 12 hours	CCC % D < 25% same SPCC criteria as initial cal.
	40CFR136 625	5	%RSD < 35% or cal. curve all compounds	As needed	As needed	± 20%R	Daily every 24 hours	% D < 20%
	CLP SOW 2/88	5	Same as SW846-8270	As needed	As needed w/PE's	± 20%R	Daily every 12 hours	Same as SW846-8270

Table 9.5
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/ Rejection Criteria - Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification[1]	Acceptance/ Rejection Criteria - Initial Calibration Verification	Frequency of Continuing Calibration Verification[1]	Acceptance/ Rejection Criteria - Continuing Calibration Verification
GC/MS - semi-volatiles	CLP SOW OLM01.5	5	min. RF phenol 0.80 bis(2-chloroethyl)ether 0.70 2-chlorophenol 0.80 1,3-dichlorobenzene 0.60 1,4-dichlorobenzene 0.50 1,2-dichlorobenzene 0.40 2-methylphenol 0.70 4-methylphenol 0.60 N-nitrosodipropylamine 0.50 hexachloroethane 0.30 nitrobenzene 0.20 isophorone 0.40 2-nitrophenol 0.10 2,4-dimethylphenol 0.20 bis(2-chloroethoxy)methane 0.30 2,4-dichlorophenol 0.20 1,2,4-trichlorobenzene 0.20 naphthalene 0.70 4-chloro-3-methylphenol 0.20 2-methylnaphthalene 0.50 2,4,6-trichlorophenol 0.20 2,4,5-trichlorophenol 0.20 2-chloronaphthalene 0.80 acenaphthylene 1.30 2,6-dinitrotoluene 0.20 acenaphthene 0.80 dibenzofuran 0.80 2,4-dinitrotoluene 0.20 4-chlorophenylphenylether 0.40 fluorene 0.90 4-bromophenylphenylether 0.10 hexachlorobenzene 0.80					%D < 25 RF criteria same as initial calibration

Table 9.5
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/ Rejection Criteria - Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification[1]	Acceptance/ Rejection Criteria - Initial Calibration Verification	Frequency of Continuing Calibration Verification[1]	Acceptance/ Rejection Criteria - Continuing Calibration Verification
GC/MS - semi-volatiles	CLP SOW OLM01.5		pentachlorophenol 0.05 phenanthrene 0.70 anthracene 0.70 fluoranthene 0.60 pyrene 0.60 benz(a)anthracene 0.80 chrysene 0.70 benzo(b)fluoranthene 0.70 benzo(k)fluoranthene 0.70 benzo(a)pyrene 0.70 indeno(1,2,3,cd)pyrene 0.50 dibenz(a,h)anthracene 0.40 benzo(ghi)perylene 0.50 nitrobenzene d5 0.20 2-fluorobiphenyl 0.70 terphenyl-d_{14} 0.50 phenol-d_5 0.80 2-fluorophenol 0.60 2-chlorophenol-d_4 0.80 1,2-dichlorobenzene-d_4 0.40 %RSD < 20.5%. Other target compounds have no %RSD but must have RF > 0.01					
	EPA525	6	%RSD < 30% all compounds. Chromatographic separation of isomers	As needed	As needed	± 20%R	daily, every eight hours	RF %D < 30% ISTD areas > 30% < 150% from initial cal.

Table 9.5
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/ Rejection Criteria - Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification[1]	Acceptance/ Rejection Criteria - Initial Calibration Verification	Frequency of Continuing Calibration Verification[1]	Acceptance/ Rejection Criteria - Continuing Calibration Verification
GC/NPD	N-P containing pesticides EPA 507	3	RF < 20% RSD or single point (single point must be within 20% of sample concentration)	As needed when CCV > 20% diff., upon detection of analyte after running low level single point to demonstrate detectability[2]	quarterly	20%D	2 times daily, beginning and end of day	20%D
	Organophosphorus pesticides SW-846 8141	5	RF < 20% RSD or cal. curve		quarterly	15%D	Daily	15%D
	Simetryn & Terbutryn EPA 619	3	RF < 10% RSD or cal. curve	Daily	As needed and with the prep of new std.	10%D	Each working shift	10%D
	Nitrosamines EPA 607	3	RF < 10% RSD or cal. curve	Daily	As needed and with the prep of new std.	15%D	Each working day	15%D
GC/FID	SW-846 8015	5	RF < 20% RSD or cal. curve	As needed, when CCV > 15%D	Quarterly	15%D	Daily	15%D
	SW-846 8100	5	RF < 20% RSD or cal. curve	With each analytical sequence	As needed, with prep of new std.	15%D	Daily	15%D
	SW-846 8030	5	RF < 20% RSD or cal. curve	As needed when CCV > 15% D	As needed with prep of new standard	15%D	Daily, 10%, ending	15%D

Table 9.5
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/ Rejection Criteria - Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification[1]	Acceptance/ Rejection Criteria - Initial Calibration Verification	Frequency of Continuing Calibration Verification[1]	Acceptance/ Rejection Criteria - Continuing Calibration Verification
HPLC	EPA 531.1	3-5	RF < 20% RSD or single point or calibration curve	As needed, when CCV > 20%D	Quarterly	20%D	Min. of 2 1 beg, 1 end	20%D
	SW-846 8310	5	RF < 20% RSD or cal. curve	As needed, when CCV > 15%D or every 6 months	As needed, with prep of new std.	15%D	Daily, 10%	15%D
	EPA 610	3	RF < 10% RSD or cal. curve	When CCV > 15%D	As needed, with prep of new std.	15%D CCV vs. cal. curve	Daily 10%	15%D
GC-PID/ ELCD	EPA 502.2	3-5	RF < 10% RSD or cal. curve or single point cal.	When CCV > 20%D	As needed, with prep of new std. or quarterly	20%D	Daily	20%D
	EPA 601	3	RF < 10% RSD or cal. curve	As needed, when ICV or CCV > Table 2 criteria	As needed, with prep of new std.	See method 601 Table 2 criteria ~ 30%D (Q Value)	Daily Note: ICV = CCV in this case (different source than calibration stds.)	For % Rec. see method 601 Table 2 (Q Value)
	EPA 602	3	RF < 10% RSD or cal. curve	As needed, when ICV or CCV > Table 2 criteria		See method 602 Table 2 Criteria ~ 25%D (Q Value)		For % Rec. see method Table 2 (Q Value)
	SW-846 8010	5	RF < 20% RSD or cal. curve	As needed, when CCV > 15%D	As needed, with prep of new std.	15%D	Daily 10%, ending	15%D
	SW-846 8020					15%D		15%D

Table 9.5
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/ Rejection Criteria - Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification[1]	Acceptance/ Rejection Criteria - Initial Calibration Verification	Frequency of Continuing Calibration Verification[1]	Acceptance/ Rejection Criteria - Continuing Calibration Verification
GC-PID/ ELCD	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%, ending	15%D
FTIR	EPA 418.1	5	20%D Correlation Coeff. (r) ≥ 0.995	When CCV is > 20%D	As needed, with prep of new std.	20%D	Beg. and end of each sequence	20%D
	Standard Methods 503	5	20%D Correlation Coeff. (r) ≥ 0.995	When CCV is > 20%D	As needed, with prep of new std.	20%D	Beg. and end of each sequence	20%D
GC-ECD	EPA 548.1 (Endothall)	3	Linearity < 20% RSD	Each Run	As needed with each new std. quarterly at a minimum	80-110%	Every fifth injection	Primary column %D <15. Conf. column %D <20. R.T. Shift, Capp. columns <0.3%. RT Shift Mega-Bore Columns <1.5%
	CLP-SOW 2/88	3	Linearity <20% RSD Generate calibration curve for all single analytes detected in samples where the % RSD ≥ 10% Retention time windows: Wide Bore capp. column: ± 0.75% Narrow Bore Capp. column: ± 0.15%	Each run or every 72 hours	As needed with each new std. quarterly at a minimum	80-110%	Every fifth injection	Primary column %D <15. Conf. column %D <20. R.T. Shift, Capp. columns <0.3%. RT Shift Mega-Bore Columns <1.5% Breakdown criteria: DDT <20% Endrin <20% Combined <30%

Table 9.5
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/ Rejection Criteria - Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification[1]	Acceptance/ Rejection Criteria - Initial Calibration Verification	Frequency of Continuing Calibration Verification[1]	Acceptance/ Rejection Criteria - Continuing Calibration Verification
GC-ECD	EPA 508	3	Linearity <20% RSD	Each Run	As needed. With each new std. Quarterly at a minimum.	80-110%R	Every fifth injection	Primary column %D <15. Conf. column %D <20. R.T. Shift, Capp. columns <0.3%. RT Shift Mega-Bore Columns <1.5% Breakdown criteria: DDT <20% Endrin <20%
	EPA 504	5	Linearity <20% RSD	Each Run	As needed. With each new std. Quarterly at a minimum	80-110%R	Every fifth injection	Primary column %D <15. Conf. column %D <20. R.T. Shift, Capp. columns <0.3%. RT Shift Mega-Bore Columns <1.5%
	APHA 509A (Standard Methods)	3	Linearity <20% RSD	Each Run	As needed. With each new std. Quarterly at a minimum	80-110%R	Every fifth injection	Primary column %D <15. Conf. column %D <20. R.T. Shift, Capp. columns <0.3%. RT Shift Mega-Bore Columns <1.5% Breakdown criteria: DDT <20% Endrin <20% Combined <30%

Table 9.5
INSTRUMENT CALIBRATION

Instrument	Method References	# Standards Initial Calibration	Acceptance/ Rejection Criteria - Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification[1]	Acceptance/ Rejection Criteria - Initial Calibration Verification	Frequency of Continuing Calibration Verification[1]	Acceptance/ Rejection Criteria - Continuing Calibration Verification
GC-ECD	EPA 608	3	Linearity <20% RSD	Each Run	As needed. With each new std. Quarterly at a minimum	80-110%R	Every fifth injection	Primary column %D <15. Conf. column %D <20. R.T. Shift, Capp. columns <0.3%. RT Shift Mega-Bore Columns <1.5% Breakdown criteria: DDT <20% Endrin <20% Combined <30%
	SW-846 8080 SW-846 8150	5	Linearity <20% RSD	Each Run	As needed. With each new std. Quarterly at a minimum	80-110%R	Every fifth injection	Primary column %D <15. Conf. column %D <20. R.T. Shift, Capp. columns <0.3%. RT Shift Mega-Bore Columns <1.5% Breakdown criteria: DDT <20% Endrin <20% Combined <30%

Table 9.5
INSTRUMENT CALIBRATION

Instrument	Method Reference	# Standards Initial Calibration	Acceptance/ Rejection Criteria - Initial Calibration	Frequency of Calibration	Frequency of Initial Calibration Verification[1]	Acceptance/ Rejection Criteria - Initial Calibration Verification	Frequency of Continuing Calibration Verification[1]	Acceptance/ Rejection Criteria - Continuing Calibration Verification
GC-ECD	EPA 515.1	3	Linearity <20% RSD	Each Run	As needed. With each new std. Quarterly at a minimum	80-110%R	Every fifth injection and beginning and end of run.	Primary column %D <15. Conf. column %D <20. R.T. Shift, Capp. columns <0.3%. RT Shift Mega-Bore Columns <1.5%
	EPA OLM01.3	3+Instr. Blank Multi-Comp. Targets Calib. as single point	All peaks 100% resolved. Performance evaluation mixtures (PEMs) ≤ 25.0 RPD. 1 Chromatogram from each of 2 indiv. A&B must yield peak highs of 50-100% of full scale. Resolution of midpoint std. mixes A&B ≥ 90% linearity ≤ 20% RSD except: Surrogates ≤ 30% Any 2 targets ≤ 30% Resolution check mix ≥ 60% Breakdown of DDT & Endrin ≤20%, Combined < 30%	Each Run	As needed. With each new std. Quarterly at a minimum	80-110%R	Every 12 hours (PEM or indiv. A&B)	PEMs and Indiv. A&B within RT windows of init. calibration. PEMs RPD ≤ 25.0. Resolution of PEM must be 100%. Resolution of indiv. A&B ≥ 90% Breakdown of DDT & Endrin ≤ 20% Combined ≤ 30%

1 Number of Standards Run is 1, unless noted otherwise
2 Only when an unusually large analyte list requires analysis of more than one standard mix for injection by GC/NPD.

Table 9.5 - Attachment
GC/MS - Volatiles
Continuing Calibration Check - EPA Method 624

	Range for "Q" in ug/L
Benzene	12.8-27.2
Bromoform	14.2-25.8
Carbon tetrachloride	14.6-25.4
Chlorobenzene	13.2-26.8
Chloroethane	7.6-32.4
2-Chloroethylvinyl-ether	D-44.8
Chloroform	13.5-26.5
Dibromochloromethane	13.5-26.5
Bromodichloromethane	13.1-26.9
1,4-Dichlorobenzene	12.6-27.4
1,1-Dichloroethane	14.5-25.5
1,2-Dichloroethane	13.6-26.4
1,1-Dichloroethene	10.1-29.9
1,2-Dichloropropane	6.8-33.2
trans-1,3-Dichloropropene	10.0-30.0
Ethylbenzene	11.8-28.2
Bromomethane	2.8-37.2
Chloromethane	D-40.8
Methylene Chloride	12.1-27.9
1,1,2,2-Tetrachloroethane	12.1-27.9
Tetrachloroethene	14.7-25.3
Toluene	14.9-25.1
trans-1,2-Dichloroethene	13.9-26.1
1,1,1-Trichloroethane	15.0-25.0
1,1,2-Trichloroethane	14.2-25.8
Trichloroethene	13.3-26.7
Trichlorofluoromethane	9.6-30.4
Vinyl Chloride	0.8-39.2

10.0 Preventive Maintenance

10.1 Wherever practical, maintenance agreements have been executed with instrument manufacturers. Such is the case with the following major lab instrumentation:

GC Equipment

GC/MS Equipment

HPLC Equipment

FTIR Equipment

Atomic Spectroscopy Equipment

Lab Data Management Systems

For those instruments for which no maintenance agreements are available, an attempt has been made to maintain at least 2 functional instruments (eg. TOX, pH Meters, EP Extractors, DO Meters, Conductivity Meters, Balances, etc.). If adequate in-house expertise exists, maintenance agreements may be cancelled upon approval of the Lab Director.

10.2 A log for each instrument is maintained by the appropriate group leader and/or analyst. Information maintained in this log must include, but is not necessarily limited to:

1. Name of the item or equipment
2. Manufacturer's name, type identification, and serial number or other unique identification.
3. Date received and date placed in service.
4. Current location, where appropriate.
5. Condition when received (e.g., new, used, reconditioned).
6. A daily "response check" or "sensitivity check" (curve verification data).
7. A record of problems and their solutions.

8. A record of maintenance and preventive maintenance service calls noting what was done each time.

9. Initials of analyst and dates.

10.3 Group leaders are required to maintain a supply of items critical to the performance of their instruments (eg. electron multipliers for GC/MS, D_2 lamps for AA, key circuit boards). Blanket purchase authority is given to group leaders for any item valued at less than $1,000.00 for each item to a maximum of $5,000.00 per group; the Lab Director must approve more costly items and/or higher maximums per group.

10.4 Logbooks are also maintained for all equipment/instrumentation monitoring activities, such as:

1. Balances - accuracy checks

2. Ovens - temperature monitoring

3. Refrigerators - temperature monitoring

4. Incubators - temperature monitoring

5. Deionized Water Systems - resistivity conductivity checks

6. Zero Headspace Extractors - leak tests

7. Hot Plates - surface temperature monitoring

8. Fume Hoods - air flow

9. Extractors (EP, TCLP) - RPM checks

10. Gas Tanks - changes

10.5 Table 10.1, Routine Preventive Maintenance provides the following information:

1. Instrument/Equipment type

2. Specific activity

3. Frequency

All routine maintenance is documented in a logbook specific to the instrument or equipment. Service calls and all repairs will also be documented in this same logbook.

To minimize the impact of major equipment failures, sufficient equipment redundancy has been established within each laboratory and throughout the network. Where there is no such redundancy, samples are shipped to other EMS locations for analysis (certifications and contracts permitting). Flame atomic absorption may be a suitable replacement technique for ICP.

Preventive maintenance procedures to be employed are described in detail in instrument manuals.

Table 10.1
ROUTINE PREVENTIVE MAINTENANCE

Instrument/Equipment Type	Specific Activity	Frequency
Gas Chromatography/Mass Spectrometry (Volatiles)	Changing transfer lines	As needed
	Changing septa	Every 20-30 injections*
	Clean source	As needed
	Change trap (purge & trap)	As needed
	Change column	Every 3-4 months or as needed
	Flush sample lines with methanol* (P & Trap)	As needed
	Replace gas filters and traps	Every other carrier gas cylinder
Gas Chromatography/Mass Spectrometry (Semi-Volatiles)	Change injection liner	Daily or each day of use
	Change septum	Daily or each day of use
	Trim head of column	Daily or each day of use
	Bake the source	When response to DFTPP initial standards decrease below acceptable levels
	Clean the source	When baking fails
	Replace gas filters and traps	Every other carrier gas cylinder
	Check syringe/replace	Daily or each day of use
Gas Chromatography/ECD	Change port liners	Twice per week or after 3 days use
	Clean detectors	As needed
	Remove front 6" of column	As needed
Gas Chromatography/ECD	Change septa	Twice per week or after 3 days use

* when criteria can't be met

Table 10.1
ROUTINE PREVENTIVE MAINTENANCE

Instrument/Equipment Type	Specific Activity	Frequency
Gas Chromatography/ECD	Replace gas filters and traps	Every other carrier gas cylinder
	Check syringe/replace	Daily (minimum) or each day of use
	ECD leak test (swipe)	Every 6 months
Gas Chromatography/PID, ELCD, NPD, FPD, FID	Change port liners	As needed
	Clean detectors	As needed
	Remove front 6" of column	As needed
	Change septa	As needed
	Replace gas filters and traps	Every other carrier gas cylinder
	Check syringe/replace	As needed
	Change/Add Solvent (ELCD)	As needed or as per Mfg'r Guidelines
	Clean window (PID, FPD)	As needed
	Change resin (ELCD)	As needed or as per Mfg'rs Guidelines
	Change trap (purge and trap)	As needed
High Performance Liquid Chromatograph (HPLC)	Change seals	As needed
	Replace pre-column	As needed
	Change lamps	As needed
Fourier Transform-Infra-Red (FTIR)	Purge System w/Nitrogen	Each use

Table 10.1
ROUTINE PREVENTIVE MAINTENANCE

Instrument/Equipment Type	Specific Activity	Frequency
Flame Atomic Absorption	Check gas supply pressure	Daily or each day of use
	Empty drain container	Daily or each day of use
	Inspect capillary tube	Daily or each day of use
	Clean burner heads (acid soak)	Daily or each day of use
	Aspirate DI water for 15 minutes to flush nebulizer and premix chamber	Daily or each day of use
	Check nebulizer uptake rate	Weekly
	Clean premix chamber	Weekly
	Inspect windows	Weekly
	Inspect glass bead	Monthly
	Inspect O-rings	Monthly
	Inspect nebulizer	Monthly
	Inspect frangible diaphragm (where applicable)	Monthly
Graphite Furnace Atomic Absorption	Check Argon supply pressure	Daily or each day of use
	Inspect furnace windows	Daily or each day of use
	Inspect graphite tube and platform	Daily or each day of use
	Check rinse solution and drain container	Daily or each day of use
	Inspect autosampler tip alignment and condition	Daily or each day of use
	Inspect contact cylinders	Weekly

Table 10.1
ROUTINE PREVENTIVE MAINTENANCE

Instrument/Equipment Type	Specific Activity	Frequency
Graphite Furnace Atomic Absorption	Clean and refill cooling water recirculators	Quarterly
	Check exhaust system	Weekly
	Clean computer cooling fans	Yearly
Inductively Coupled Plasma (ICP)	Check argon supply pressure	Daily or each day of use
	Clean nebulizer	Daily or each day of use
	Change peristaltic pump tubing	Weekly
	Clean entrance slit	Monthly
	Change torch	Quarterly
	Inspect focusing mirror (simultaneous ICP)	Quarterly
	Check oil in vacuum pump (simultaneous ICP)	Twice per year
	Clean filters on instrument	Yearly
Total Organic Carbon (TOC)	Change catalyst	Bi-monthly or as needed
	Re-charge acid	Weekly
Total Organic Halogens (TOX)	Clean inlet tube	Weekly
	Clean filtration cell and electrodes	Each use
	Recondition filtration cell reference sidearm	Monthly
	Clean pyrolysis and quartz exit tubes	Each use
Balances	Check with an external class "S" weight	Each use or daily
	Change desiccants	Weekly

Table 10.1
ROUTINE PREVENTIVE MAINTENANCE

Instrument/Equipment Type	Specific Activity	Frequency
Balances	Clean pans and compartments	Each use
	Check alignment (leveling)	Each use
	Service Engineer visit	Every 6 months
Auto Analyzer	Change tubing	Quarterly
	Clean tubing w/10% HCl	Monthly
	Oil pump	Monthly
	Change Cadmium reduction column	Quarterly
Gas Flow Proportional Counter (Gross Alpha Beta)	Change gases	As needed
	Change gas line filters	Every other carrier gas cylinder
Spectrophotometer	Check wavelength with standard filter	Quarterly
Turbidimer	Clean optics	As needed
Conductivity Meter	Clean electrodes	As needed
Dissolved Oxygen Probe	Replace membrane	As needed
Recorder	Dust and clean	As needed
	Clean the carriage rod for smooth operation	As needed
	Lubricate the servomotor with two drops of light oil	Quarterly
Deionized Water System	Conductivity Check, in-line meter	Daily
	Ion exchange beds replaced	As needed
	Conductivity check by lab S.C. meter	Weekly (Daily if no in-line meter)

Table 10.1
ROUTINE PREVENTIVE MAINTENANCE

Instrument/Equipment Type	Specific Activity	Frequency
Milli-Q D.I. Water System	Conductivity Check, in-line meter	Daily
	Replace cartridges	As needed
	Conductivity check with lab S.C. meter	Weekly
Oven	Check temperature	Each use
	Oil Motor	Quarterly
Refrigerators/Coolers/Freezers	check temperature	Daily
	Clean cooling coils	Annually
Vacuum pumps & air compressors	Lubricate	As needed
	Check belts, etc.	As needed
Zero Headspace Extractors	Leak test	Each use
Rotary Extractors (TCLP, EP)	RPM check	Daily or each day of use
Hot Plates	Surface temperature checks	Semi-annually
Incubators	Temperature monitoring	Daily or each day of use
Fume Hoods	Check air flow	Monthly
	Replace charcoal filters if applicable	As needed

SECTION 11.0

11.0 Quality Control Checks, Routines to Assess Precision and Accuracy and Calculation of Method Detection Limits

11.1 Quality Control Checks - Field QC

The laboratory has little to no control over what type of Field QC is collected and submitted for analysis by clients, unless the sampling is performed by EMS Heritage and the client agrees to the increased costs associated with Field QC sample analysis. The implementation of proposed (January 23, 1989) mandatory field and laboratory QC requirements by EPA in the RCRA program will further the EPA goal of providing more reliable analytical data and help assure that this Quality Assurance Plan (QAP) is followed for Field QC sample collection and submission. The proposed mandatory Field QC samples are as follows:

1. Field Duplicate
2. Field Blank
3. Equipment Blank
4. Trip Blank

The following types of QC checks and the stated frequency are the basic minimum requirements of this QAP. Deviations from these minimum requirements (i.e. less than 5 samples in a set, weekly or daily monitoring, etc.) are the responsibility and decision of the client and shall be proposed in a site specific QC plan (if required) with appropriate justification. See Appendix D for definition of all terms and QC types.

11.1.1 Sampling events with 10 or more samples of a similar matrix will require the following Field QC:

1. Equipment Blanks: At lease one equipment blank on clean sampling equipment will be submitted and analyzed for every 20 samples in each analyte group for water matrices. This blank will be prepared in the field before sampling begins by filling or rinsing the precleaned equipment with analyte free water, filling the appropriate container(s) and preserving and documenting the sample in the same manner as the other collected samples. Suitable blanks for analyte groups of interest

will be collected and analyzed for each type of equipment set (i.e., bailer, filtration system; or cover, stainless steel pan and spatula, etc.) to be used in sampling. EMS Heritage does not believe it is appropriate to use an aqueous equipment blank for non-aqueous (solid) matrices because different analytical procedures are utilized which have different detection levels at unnecessary expense to the client. The USEPA does not generally require collection of field blanks for solid matrices, however, if their collection is required the use of acid washed beach sand is a recommended blank matrix in place of the rinsing with analyte free water cited above. The use of this solid matrix will be interference free, will generally allow the use of identical methods and will provide similar if not lower detection limits.

If equipment is cleaned on site, then additional equipment blanks will be collected and analyzed for each equipment group at a rate of one blank or 5% of the equipment sets that must be cleaned, whichever is greater. These blanks will be collected and analyzed as described in the preceding paragraph.

If no equipment is involved in sampling (i.e., grab samples using sample container) or passage of blank matrix through the sampling device is not possible (i.e., dedicated well pumps) then a Field Blank will be collected in place of an Equipment Blank.

2. Trip Blanks: At least one trip blank for each proposed volatile organic method (601, 624, 8020, 8021, 8240, etc.) shall be prepared and analyzed for each cooler to be used for storage and transport of volatile samples. This type of blank will require the submission of two or more 40mL vials per blank. Trip blanks will generally only be collected for water samples. Trip blanks are prepared in the laboratory, placed in the cooler before shipment to the field and are returned unopened to the lab.

3. Field Duplicate: During each independent sampling event, at least one sample or 10% of the samples, whichever is greater, shall be collected in duplicate for analysis. This requirement shall apply to each and all parameter groups and matrices that are sampled.

11.1.2 Sampling events involving 5 to 10 samples of a similar matrix will require the following Field QC:

1. Equipment Blanks: If equipment is cleaned in the field, one equipment blank for each parameter group shall be collected and analyzed on the field decontaminated equipment. If no equipment is cleaned, then one equipment blank that is prepared on-site on the precleaned equipment shall be collected and analyzed for each parameter group. If no equipment is involved in sampling (i.e. grab sample using sample container) or passage of blank matrix through the sampling device is not possible (i.e., dedicated well pumps) then a Field Blank will be collected in place of an Equipment Blank.

2. Field Duplicates: One field duplicate shall be collected and analyzed for all parameter groups and matrices.

11.1.3 Sampling events involving less than 5 samples of a similar matrix will require the following field QC:

1. One equipment blank on either precleaned or field decontaminated equipment (see above) will be collected and analyzed for each parameter group.

11.1.4 Additional QC types and/or submittal frequency of field quality control blanks may be required and are dependent on the methods of analysis and the Data Quality Objectives of a specific project and/or mandatory QC requirements. An example would be the collection and analysis of field blanks (see Appendix D for definition) in addition to the minimum requirements specified above.

11.1.5 QC checks on field measurements will require at least one duplicate sample analysis for every 10 field measurements. Field QC samples are treated as any other sample for analysis.

11.2 Quality Control Checks - Laboratory QC

EMS Heritage will follow the minimum quality control requirements specified by each method. Table 11.5, Analytical Run Requirement/Frequency mandates the specific requirements that will be used. Those minimum requirements may be exceeded for specific methods. Please refer to

Appendix D, Definitions and Acronyms for definitions and acronyms used by EMS Heritage for QC types.

11.2.1 If no quality control requirements are listed in the method, or if the method quality control requirements are less stringent that those listed below, the laboratory will follow the general guidelines listed below:

1. Method Reagent Blank, or Prep Blank (BLA02) - Prepared and analyzed at a rate of one per sample prep set (see definitions in Appendix D for sample set, etc.)

2. Matrix Spike (SPI02) - Prepared and analyzed at a minimum of one sample in a sample set (or 5%, whichever is greater) with similar matrices for a specified method. If a set contains samples of different matrices, matrix spikes should be prepared and analyzed for each matrix type by the specified method.

3. Reagent Water/Reagent Matrix Spikes or Laboratory Control Sample (LCS) - A control sample of known analyte concentration and source which has been processed through the entire method (digested/extracted, etc.); may be used as an additional QC check to monitor the effectiveness of the method (not subject to matrix interferences). This LCS (Laboratory Control Sample) should be of the same matrix as samples but must be spiked using a standard from a different source than the calibration standards (EPA or NBS traceable when possible). If used, these must be analyzed at a frequency of one sample in a sample set, or 5%, whichever is greater, for a specified method.

4. Quality Control Check Standards or Performance Evaluation Standards (PE) - At a minimum these blind check samples shall be analyzed in duplicate semiannually. Results of all blind performance evaluation (PE) samples will be summarized in the QA report to management and forwarded to clients upon request. EMS Heritage participates in many state certification programs requiring blind sample (PE) analysis in addition to the EPA WP (Water Pollution) and WS (Water Supply) programs and a commercial service providing monthly blind samples (Analytical Products Group). In addition, EMS

Heritage-Indianapolis participates in the USEPA Contract Laboratory Program's Quarterly Blind (QB) program.

5. Quality Control Check Standards or Initial and Continuing Calibration Check Standards (ICV01, CCV) - An Initial Calibration Verification (ICV01) standard shall be analyzed at the beginning of each run to verify the standard curve (separate source than calibration standards, traceable to EPA or NBS if possible) and/or a Continuing Calibration Verification (CCV) standard shall be analyzed at a continuing frequency of 10% of the analytical samples in the analytical set (i.e. one every 10 analytical samples in a run).

6. Duplicate Samples (DUP02) or Matrix Spike Duplicates (DPS02) - At least one or 5%, whichever is greater, of all samples in a sample set with a similar matrix shall be selected and analyzed in duplicate. If a sample set contains samples from different matrices (e.g., effluent and drinking water), then duplicates or matrix spike duplicates should be analyzed for each matrix.

7. Additional QC Checks - may be included and will be used if specified by the approved method:

   a. Reagent purity checks

   b. Internal standards

   c. Surrogate spikes

   d. Method of Standard Additions (MSA, 3 Point or 1 Point)

11.3 Determination of Frequency of QC Measurements

The required frequency of analysis of certain QC sample types stated in this QAP may be given as a percentage (i.e., 5%) or translated into a numerical ration (i.e., 1 in 20). The term "analytical sample" is defined in Appendix D, Definitions and Acronyms. As the term is used, analytical sample includes all field samples, including Performance Evaluation samples, received from an external source, but it also includes all required QA/QC samples (matrix

spikes, analytical/post digestion spikes (1-point MSA), duplicates, serial dilutions, LCS, Interference Check Samples (ICS), CDL standards, preparation blanks (BLA02) and linear range analyses) except those directly related to instrument calibration or calibration verification. A "frequency of 10%" means once every 10 analytical samples.

The following Tables and Figures specify the QC Types and their frequency of analysis for different methods/regulatory programs.

Table # or Figure #	# Pages	Subject
Table 11.1	1	ICP Run Sequence
Table 11.2	1	FAA Run Sequence
Table 11.3	1	GFAA Run Sequence
Table 11.4	1	CLP-GFAA Run Sequence
Table 11.5	1	Analytical Run Requirements/Frequency
Figure 11.1	1	Metals Analysis Scheme For Spiking (SPI 01)
Figure 11.2	1	CLP-GFAA Analysis Scheme

11.4 Routine Methods Used to Assess Precision and Accuracy

The targets listed in Section 5.0 were derived where possible from data entered into the QCTS (Quality Control Tracking System). All sample analysis runs and all QC data points are entered into the QCTS. Certain of the QC types for a particular method are not applicable and/or not used to arrive at precision and accuracy statistics; those types can be identified from Table 11.5, Analytical Run Requirements/Frequency for a particular method.

The criteria listed in Table 5.1, Section 5.0 are derived from matrix specific QC. Control limits for Instrumental criteria (calibration) and method performance (LCS, ICV02) are found elsewhere in this document. EMS Heritage defines most QC Types (see Definitions) with either an "01" or "02" suffix. The "01" suffix denotes that the procedure did not include a preparation step and/or a preparation step is not possibly separated from the analytical procedures. An "02" suffix denotes that the procedure was taken

TABLE 11.1
ICP Run Sequence

TYPE	DESCRIPTION/FREQUENCY
BLA00	Instrument Blank*
CAL01	Calibration Standards (Single Point Calibration)*
ICV01	Initial Calibration Verification (EPA QC or equivalent; Mid-Range Std.)*
BLA01	Calibration Blank (Beginning, Initial Calibration Blank)*
CDL01**	Detection Limit Standard (2x CRDL, beginning, 2 times/8 hrs.)
ICS	Interference Check Sample(s) (Beginning, 2 times/8 hrs.)
LRA	Linear Range Analysis (Upper limit of linear range - quarterly)
LCS	Laboratory Control Sample (ICV02 or EPA supplied LCS, 1 per 20 or prep batch)
BLA02	Preparation Blank (1 per 20 or prep batch, whichever is more frequent)
SAMPLES	6 samples, including required SPI02's, DPS02's, DUP02's and SPI01's (MSA)***
CCV	Continuing Calibration Verification (May be same as ICV, 10% frequency or every 2 hours; mid-range std.)*
BLA01	Continuing Calibration Blank (10% frequency during run)*
SDA**	Serial Dilution Analysis (each matrix and/or each case)
SAMPLES	9 samples, including required SPI02's, DUP02's and SPI01's (MSA)***
CCV	Continuing Calibration Verification (May be same as ICV, 10% frequency or every 2 hours; Mid-range Std.)*
BLA01	Continuing Calibration Blank (end of run)*
	GO TO: SAMPLES OR CDL01
ICS	Interference Check Sample (End, 2 times/8 hrs)
CDL01**	Detection Limit Standard (2x CRDL, end, 2 times/8 hours)

*Does not count as an "analytical sample" for the 10% frequency requirement.

** Performed only for specific projects as required (contracts, etc.)

*** Single addition post digestion spike (1 point MSA) analysis is counted as an "analytical sample" for ICP; required immediately following unspiked analysis of that sample.

NOTE: Each full (3 point) MSA counts as two "analytical samples".

TABLE 11.2
FAA Run Sequence

TYPE	DESCRIPTION/FREQUENCY
BLA00	Instrument Blank*
CAL01	Calibration Standards (4+BLA00 Point Calibration)*
ICV01	Initial Calibration Verification (EPA QC or equivalent; Mid-Range Std.)*
BLA01	Calibration Blank (Beginning, Initial Calibration Blank)*
CDL01**	Detection Limit Standard (2x CRDL, beginning, 2 times/8 hrs.)
ICS	Interference Check Sample(s) (Beginning, 2 times/8 hrs.)
LCS	Laboratory Control Sample (ICV02 or EPA supplied LCS, 1 per 20 or prep batch)
BLA02	Preparation Blank (1 per 20 or prep batch, whichever is more frequent)
SAMPLES	7 samples, including required SPI02's, DUP02's and SPI01's (MSA)***
CCV	Continuing Calibration Verification (May be same as ICV, 10% frequency or every 2 hours; mid-range std.)*
BLA01	Continuing Calibration Blank (end of run)*
SAMPLES	10 samples, including required SPI02's, DPS02's, DUP02's and SPI01's (MSA)***
CCV	Continuing Calibration Verification (May be same as ICV, 10% frequency or every 2 hours; Mid-range Std.)*
BLA01	Continuing Calibration Blank (end of run)*
	GO TO: SAMPLES OR CDL01
CDL01**	Detection Limit Standard (2x CRDL, end, 2 times/8 hrs.)

* Does not count as an "analytical sample" for the 10% frequency requirement.

** Performed only for specific projects as required (contracts, etc.)

*** Single addition post digestion spike (1 point MSA) analysis is counted as an "analytical sample" for FAA; required immediately following unspiked analysis of that sample.

NOTE: Each full (3 point) MSA counts as two "analytical samples".

TABLE 11.3
GFAA Run Sequence

# INJECTIONS	TYPE	DESCRIPTION/FREQUENCY
1	BLA00	Instrument Blank*
5	CAL01	Calibration Standards (4+Blank Point Calibration)*
1	ICV01	Initial Calibration Verification (EPA QC or equiv.; Mid-range Std.)*
1	BLA01	Calibration Blank (Beginning, Initial Calibration Blank)*
1	CDL01***	Detection Limit Standard (2x CRDL, beginning, 2 times/8 hrs.)
1	LCS	Laboratory Control Sample (ICV02 or EPA supplied LCS, 1 per 20 or prep batch)
1	BLA02	Preparation Blank (1 per 20 or prep batch, whichever is more frequent)
7	SAMPLES	7 samples, including required SPI02's, DPS02's, DUP02's
7	SAMPLES-SP*	7 sample spikes (2x CRDL, post digestion spike, one per analytical sample except SPI02's, DPS02's)**
1	CCV	Continuing Calibration Verification (May be same as ICV, 10% frequency or every 2 hours; Mid-range Std.)*
1	BLA01	Continuing Calibration Blank (10% frequency during run)*
10	SAMPLES	10 samples, including required SPI02's, DPS02's, DUP02's
10	SAMPLES-SP*	10 sample spikes (2x CRDL, post digestion spike, one per analytical sample except SPI02's, DPS02's)**
1	CCV	Continuing Calibration Verfication (May be same as ICV, 10% frequency or every 2 hours; Mid-range Std.)*
1	BLA01	Continuing Calibration Blank (end of run)*
		GO TO: SAMPLES OR CDL01
1	CDL01***	Detection Limit Standard (2x CRDL), end, 2 times/8 hrs.)

* Does not count as an "analytical sample" for the 10% frequency requirement.

** Single addition post digestion spike (1 point MSA) required immediately following unspiked analysis of that sample.

*** Performed only for specific projects as required (contracts, etc.)

NOTE: Duplicate injections (burns) not performed; maximum of 20 injections between CCVs. Each full MSA (3-point) counts as 2 "analytical samples".

TABLE 11.4
CLP - GFAA Run Sequence

# INJECTIONS	TYPE	DESCRIPTION/FREQUENCY
1	BLA00	Instrument Blank*
5	CAL01	Calibration Standards (4+Blank Point Calibration)*
2	ICV01	Initial Calibration Verification (EPA QC or equiv.; Mid-range Std.)*
2	BLA01	Calibration Blank (Beginning, Initial Calibration Blank)*
2	CDL01	Detection Limit Standard (2x CRDL, beginning, 2 times/8 hrs.)
2	LCS	Laboratory Control Sample (ICV02 or EPA supplied LCS, 1 per 20 or prep batch)
2	LCS-SP	Laboratory Control Sample Spike (2x CRDL, post digestion spike, one per LCS)
2	BLA02	Preparation Blank (1 per 20 or prep batch, whichever is more frequent)
2	BLA02-SP	Preparation Blank (2x CRDL, post digestion spike, one per Prep Blank)
4	SAMPLES	2 samples, including required SPI02's, DPS02's, DUP02's
4	SAMPLES-SP	2 sample spikes (2x CRDL, post digestion spike, one per analytical sample except SPI02's, DPS02's)**
2	CCV	Continuing Calibration Verification (May be same as ICV, 10% frequency or every 2 hours; Mid-range Std.)*
2	BLA01	Continuing Calibration Blank (10% frequency during run)*
10	SAMPLES	5 samples, including required SPI02's, DPS02's, DUP02's
10	SAMPLES-SP*	5 sample spikes (2x CRDL, post digestion spike, one per analytical sample except SPI02's, DPS02's)**
2	CCV	Continuing Calibration Verfication (May be same as ICV, 10% frequency or every 2 hours; Mid-range Std.)*
2	BLA01	Continuing Calibration Blank (end of run)*
		GO TO: SAMPLES OR CDL01
2	CDL01	Detection Limit Standard (2x CRDL), end, 2 times/8 hrs.)

* Does not count as an "analytical sample" for the 10% frequency requirement.

** Single addition post digestion spike (1 point MSA) required immediately following unspiked analysis of that sampl (counts as an analytical sample).

NOTE: Duplicate injections (burns) are performed; maximum of 20 injections between CCVs. Each full MSA (counts as 2 "analytical samples"; for analytical runs containing only MSAs, single injections can be used for QC samples during that run.

Table 11.5
ANALYTICAL RUN REQUIREMENT/FREQUENCY

Test	Method Reference	Instrumental QC							Prep. QC							
		ICV01	BLA01	CCV[2]	CDL01	DPS01[3]	DUP01[3]	SP101 (or MSA)[3]	BLA02	(CLP) BLA02 SP101	ICV02 or LCS[4]	(CLP) LCS/ SP101	SP102[5]	DPS02[5]	DUP02[5]	DLCS
Acidity	EPA	R	5%	B,E 10%	-	-	R, 10%	-	NA	-	R	-	NA	NA	NA	-
Alkalinity	EPA	NA	5%	B,E 10%	-	10%	R, 10%	10%	NA	-	R	5%	NA	NA	NA	-
Ammonia - N	EPA	C	B,E 10%	B,E 10%	-	R, 10%	R, 10%	R, 10%	P	-	P	-	P, 10%	P, 10%	P, 10%	-
Asbestos	NIOSH	R	R	NA	-	-	R, 10%	-	NA	NA	R, 10%	-	NA	NA	NA	-
BOD	EPA/SM	R	R	-	-	-	R, 10%	-	NA	-	R, 5%	-	NA	NA	-	-
Boron Colorimetric	EPA	C	B,E 10%	B,E 10%	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Bromide	EPA/SM	R	R, 5%	-	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
COD	EPA/SM	C	R	R, 10%	-	-	R, 10%	-	NA	NA	R, 5%	-	NA	NA	NA	-
Chloride	EPA/SM	C	R, 5%	B,E 10%	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Chlorine, Total	ASTM	R	R	NA	B	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Coliform, Fecal	SM	NA	10%	NA	-	-	R, 10%	-	NA	NA	-	-	NA	NA	NA	
Coliform, Total	SM	NA	10%	NA	-	-	R, 10%	-	NA	NA	-	-	NA	NA	NA	-
Color	EPA	N	NA	B,E 10%	NA	-	R, 10%	NA	NA	NA	NA	-	NA	NA	NA	-
Cyanide, Amen.	EPA/SW	C	B,E 10%	B,E 10%	-	-	-	-	P, 5%	-	P, 5%	-	P, 10%	P, 10%	P, 10%	-
Cyanide, Total	EPA/SW	C	B,E 10%	B,E 10%	-	-	-	-	P, 5%	-	P, 5%	-	P, 10%	P, 10%	P, 10%	-
Cyanide, Total	CLP	C	B,E 10%	B,E 10%	B,E	-	-	-, N	P, 5%	-	P, 5%	-	R, 10%	-	R, 10%	-
Cyanide, T. Avail.	SW	C	B,E 10%	B,E 10%	B,E	P, 10%	P, 10%	P, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Dissolved Oxygen	EPA								NA	NA		-	NA	NA	NA	-

Table 11.5
ANALYTICAL RUN REQUIREMENT/FREQUENCY

Test	Method Reference	Instrumental QC							Prep. QC							
		ICV01	BLA01	CCV[2]	CDL01	DPS01[3]	DUP01[3]	SP101 (or MSA)	BLA02	(CLP) BLA02 SP101	ICV02 or LCS[4]	(CLP) LCS/ SP101	SP102[3]	DPS02[3]	DUP02[3]	DLCS
Dissolved Solids	EPA	R, 10%	R, 5%	NA	NA	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	NA	NA	NA	5%	-
ISE Fluoride	EPA	C	B,E 10%	B,E 10%	B	P, 5%	P, 5%	P, 5%	P, 5%	-	P, 5%	-	P, 5%	P, 5%	P, 5%	-
Formaldehyde	AOAC						R, 10%				, 5%					
Gross Alpha, Beta (Radioactivity)	EPA	NA	B,E 20%	B	-	-	R, 10%	-	NA	NA	-	-	NA	NA	NA	-
Titrimetric Hardness	EPA	R	B,E 10%	NA	-	-	R, 10%	-	NA	NA	R, 5%	-	NA	NA	NA	-
Hexavalent Chromium	SM	R	B,E 10%	B,E 10%	B	R, 10%	R, 10%	R, 10%	P, 10%	-	R, 5%	-	R, 10%	R, 10%	R, 10%	-
Hexavalent Cr	SW	R	B,E 10%	B,E 10%	B	R, 10%	R, 10%	R, 10%	P, 10%	-	R, 5%	-	R, 10%	R, 10%	R, 10%	-
Iodine	SM	C	B,E 10%	B,E 10%	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
TKN	EPA	C	B,E 10%	B,E 10%	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Nitrate-N (Brucine)	EPA	C	B,E 10%	B,E 10%	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Nitrate-N (Colorimetric)	EPA	C	B,E 10%	B,E 10%	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Nitrite-N	EPA	C	B,E 10%	B,E 10%	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Nitrate-Nitrite-N	EPA	C	B,E 10%	B,E 10%	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Nuisance Dust	NIOSH	R	R	B,E 10%	NA	NA	R, 10%	NA	NA	NA	NA	NA	NA	NA	NA	-
Oil & Grease	EPA413.1	R	R	NA	-	-	R, 10%	-	NA	NA	-	-	NA	NA	NA	-
Oil & Grease	SW 9071	R	R	NA	-	-	R, 10%	-	NA	NA	R, 5%	-	NA	NA	NA	-

Table 11.5
ANALYTICAL RUN REQUIREMENT/FREQUENCY

Test	Method Reference	Instrumental QC							Prep. QC							
		ICV01	BLA01	CCV[2]	CDL01	DPS01[3]	DUP01[3]	SP101 (or MSA)[7]	BLA02	(CLP) BLA02 SP101	ICV02 or LCS[4]	(CLP) LCS/ SP101	SP102[5]	DPS02[3]	DUP02[3]	DLCS
Paint Filter	SW	NA	NA	NA	NA	NA	R, 10%	NA	NA	NA	-	NA	NA	NA	NA	-
Percent Solids	SM	R	R	NR%	NA	NA	R, 10%	NA	NA	NA	R, 5%	NA	NA	NA	NA	-
Percent Solids	ASTM	R	R	NA	NA	NA	R, 10%	NA	NA	NA	R, 5%	NA	NA	NA	NA	-
pH	EPA/SW	C	NA	B,E 10%	NA	NA	R, 10%	NA	-	-	R, 5%	-	NA	NA	NA	-
Phenols	EPA/SW	C	B,E 10%	B,E 10%	B	R, 10%	R, 10%	R, 10%	P	-	P, 5%	-	P, 10%	P, 10%	P, 10%	-
Phosphorus	EPA	C	B,E 10%	B,E 10%	-	R, 10%	R, 10%	R, 10%	P	-	P, 5%	-	P, 10%	P, 10%	P, 10%	-
Radium	EPA	NA	B,E 5%	B	-	-	R, 10%	-	NA	NA	-	-	NA	NA	NA	-
Radium 226	EPA	NA	B,E 5%	B	-	-	R, 10%	-	NA	NA	-	-	NA	NA	NA	-
Residual Chlorine	EPA	R	B,E 10%	B,E 10%	-	R, 10%	R, 10%	R, 10%	NA	-	R, 5%	-	NA	NA	NA	-
Saturation Index	See individual methods for this calculation															
Settleable Matter	EPA		NA	NA	-	R, 10%	R, 10%	NA	NA	-	R, 5%	-	NA	NA	NA	-
Silica, Total	EPA	R	R	10%	-	R, 10%	R, 10%	-	NA	-	R, 5%	-	NA	NA	NA	-
S. Conductance	EPA/SW	R	R	B,E 10%	-	-	R, 10%	-	NA	NA	R, 5%	NA	NA	NA	NA	-
Sulfate	EPA/SW	R	R	B,E 10%	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Sulfide	EPA/SW	R		B,E 10%	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Sulfur	ASTM	R	R	10%	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Surfactants	EPA	R	R	10%	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Temperature	EPA	N	-	-	NA	NA	R, 10%	NA	NA	NA	-	NA	NA	NA	NA	-
Thiocyanate	EPA	R	R	B,E 10%	-	R, 10%	R, 10%	R, 10%			R, 5%	-				-

Table 11.5
ANALYTICAL RUN REQUIREMENT/FREQUENCY

Test	Method Reference	Instrumental QC							Prep. QC							
		ICV01	BLA01	CCV[2]	CDL01	DPS01[3]	DUP01[3]	SP101 (or MSA)[3]	BLA02	(CLP) BLA02 SP101	ICV02 or LCS[4]	(CLP) LCS/ SP101	SP102[5]	DPS02[5]	DUP02[5]	DLCS
Sulfide, T. Available	SW	R	R	B,E 10%	-	P, 10%	P, 10%	-	P, 10%	-	P, 5%	-	P, 10%	P, 10%	P, 10%	-
Sulfite	EPA	R	R	10%	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Total Halogen	ASTM	R	B,E 10%	NA	-	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
TOC	EPA/SW	R	B,E 10%	B,E 10%	B	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
T. Volatile Residue	EPA/SM /ASTM	-	R	-	-	NA	R, 10%	NA	NA	NA	R, 5%	-	NA	NA	NA	-
TOX	SW	R	B,E 10%	B,E 10%	B	R, 10%	R, 10%	R, 10%	NA	NA	R, 5%	-	NA	NA	NA	-
Total Recoverable Oil & Grease	SW	R	R	NA	-	-	R, 10%	-	NA	NA	R, 5%	-	NA	NA	NA	-
Total Solids	EPA	R	R, 5%	NA	-	-	R, 10%	-	NA	NA	R, 5%	-	NA	NA	NA	-
Total Suspended Solids	EPA	R	R, 5%	NA	-	-	R, 10%	-	NA	NA	R, 5%		NA	NA	NA	
Turbidity	EPA	R	R	B,E 10%	-	NA	R, 10%	NA	NA	NA	R, 5%	-	NA	NA	NA	-
Volatile Susp. Solids	EPA		R, 5%		-	NA	R, 10%	NA	NA	NA	R, 5%	-	NA	NA	NA	-
Metals-ICP	EPA	R	B,E 10%	B,E 10%	B,E,T	10%*	10%*	10%*	P, 10%	-	P, 10%	-	P, 10%	P, 10%	P, 10%	-
Metals-ICP	SW	R	B,E 10%	B,E 10%	B,E,T	NA	NA	NA	P, 10%	-	P, 10%	-	P, 10%	P, 10%	P, 10%	-
Metals-ICP	CLP	R	B,E 10%	B,E 10%	B,E,T	NA	NA	NA	P, 10%	-	P, 10%	-	P, 5%	-	P, 5%	-

*Only limited situations (samples not digested).

Table 11.5
ANALYTICAL RUN REQUIREMENT/FREQUENCY

Test	Method Reference	Instrumental QC							Prep. QC							
		ICV01	BLA01	CCV[2]	CDL01	DPS01[3]	DUP01[3]	SPI01 (or MSA)[4]	BLA02	(CLP) BLA02 SPI01	ICV02 or LCS[4]	(CLP) LCS/ SPI01	SPI02[3]	DPS02[3]	DUP02[3]	DLCS
Metals-FAA	EPA	R	B,E 10%	B,E 10%	B,E,T	NA	NA	NA	P, 10%	-	P, 10%	-	P, 10%	P, 10%	P, 10%	-
Metals-FAA	SW	R	B,E 10%	B, E 10%	B,E,T	NA	NA	NA	P, 10%	-	P, 10%	-	P, 10%	P, 10%	P, 10%	-
Metals-FAA	CLP	R	B,E 10%	B,E 10%	B,E,T	NA	NA	NA	P, 10%	-	P, 10%	-	P, 5%	-	P, 5%	-
Metals-GFAA	EPA	R	B,E 10%	B,E 10%	B,E,T	NA	NA	100%**	P, 10%	-	P, 10%	-	P, 10%	P, 10%	P, 10%	-
Metals-GFAA	SW	R	B,E 10%	B,E 10%	B,E,T	NA	NA	100%**	P, 10%	-	P, 10%	-	P, 10%	P, 10%	P, 10%	-
Metals-GFAA	CLP	R	B,E 10%	B,E 10%	B,E,T	NA	NA	100%**	P, 10%	P, 5%	P, 10%	P, 5%	P, 5%	-	P, 5%	-
Mercury, CVAA	EPA	R	B,E 10%	B,E 10%	B,E,T	NA	NA	NA	P, 10%	-	P, 10%	-	P, 10%	P, 10%	P, 10%	-
Mercury, CVAA	SW	R	B,E 10%	B,E 10%	B,E,T	NA	NA	NA	P, 10%	-	P, 10%	-	P, 10%	P, 10%	P, 10%	-
Mercury, CVAA	CLP	R	B,E 10%	B,E 10%	B,E,T	NA	NA	NA	P, 10%	-	P, 10%	-	P, 5%	-	P, 5%	-
2,3,7,8-TCDD	613 EPA	N	-	R,D	-	NA	NA	NA	P, 5%	-	10%	-	P, 10%	-	-	-
2,3,7,8-TCDD	CLP	N	-	12	-	NA	NA	NA	P, 5%	-	10%	-	P, 10%	P, 10%	-	-
PCDD's & PCDF's	8280 SW	N	-	12	-	NA	NA	NA	P, 5%	-	10%	-	P, 5%	P, 5%	-	-
Organochlorine Pests/PCBs	2/88 CLP	N	-	72 Hr. Seq.	-	NA	NA	NA	P, 5%	-	P, 5%	-	SDG, 5%	SDG, 5%	-	-
Organochlorine Pests/PCBs	OLM01 CLP	N	12	12	-	NA	NA	NA	P, 5%	-	P, 5%	-	SDG, 5%	SDG, 5%	-	-

**Single Point MSA

Table 11.5
ANALYTICAL RUN REQUIREMENT/FREQUENCY

Test	Method Reference	Instrumental QC							Prep. QC							
		ICV01	BLA01	CCV[2]	CDL01	DPS01[3]	DUP01[3]	SP101 (or MSA)[4]	BLA02	(CLP) BLA02 SP101	ICV02 or LCS[4]	(CLP) LCS/ SP101	SP102[3]	DPS02[3]	DUP02[3]	DLCS
Organochlorine Pests/PCBs	8080 SW	N	-	10%, 12	-	NA	NA	NA	P, 5%	-	P, 10%	-	P, 5%	P, 5%	-	-
Semi-volatiles GC/MS	2/88 CLP	N	-	12	-	NA	NA	NA	P, 5%	-	-	-	SDG, 5%	SDG, 5%	-	-
Semi-volatiles GC/MS	OLM01 CLP	N	-	12	-	NA	NA	NA	P, 5%	-	-	-	SDG, 5%	SDG, 5%	-	-
Semi-volatiles	625 EPA	N	-	R,D	-	NA	NA	-	P, 5%	-	R, 5%	-	P, 5%	P, 5%	-	N
Semi-volatiles	8270 SW	N	-	12	-	NA	NA	NA	P, 5%	-	N	-	P, 5%	P, 5%	-	N
Volatiles	2/88 CLP	N	12	12	-	SDG, 5%	-	SDG, 5%	NA	NA	-	-	NA	NA	NA	-
Volatiles	OLM01 CLP	N	12	12	-	SDG, 5%	-	SDG, 5%	NA	NA	-	-	NA	NA	NA	-
Volatiles	624 EPA	N	R,D	R,D	-	R, 5%	-	R, 5%	NA	NA	R, 5%	-	NA	NA	NA	-
Volatiles	8240/8260 SW	N	R, 12	12	-	R, 5%	-	R, 5%	NA	NA	R, 5%	-	NA	NA	NA	-
Organochlorine Pests/PCBS	608 EPA	N	-	R,D	-	NA	NA	NA	P, 5%	-	P, 10%	-	P, 10%	P, 10%	-	-
Purgeable Halocarbons	601 EPA	NA	R,D	NA	-	R, 10%	-	R, 10%	NA	NA	R, 10%	-	NA	NA	NA	-
Purgeable Halocarbons (Halogenated Volatiles)	8010 SW	N	R,D	10% R,D	-	R, 5%	-	R, 5%	NA	NA	R, 10%	-	NA	NA	NA	-
Purgeable Aromatics	602 EPA	NA	R,D	NA	-	R, 10%	-	R, 10%	NA	NA	R, 10%	-	NA	NA	NA	-
Purgeable Aromatics	8020 SW	N	R,D	10% R,D	-	R, 5%	-	R, 5%	NA	NA	R, 10%	-	NA	NA	NA	-
Halogenated & Aromatic Volatile Organics	601/602 EPA	NA	R,D	NA	-	R, 10%	-	R, 10%	NA	NA	R, 10%	-	NA	NA	NA	-

Table 11.5
ANALYTICAL RUN REQUIREMENT/FREQUENCY

Test	Method Reference	Instrumental QC							Prep. QC							
		ICV01	BLA01	CCV[2]	CDL01	DPS01[3]	DUP01[3]	SP101 (or MSA)[4]	BLA02	(CLP) BLA02 SP101	ICV02 or LCS[4]	(CLP) LCS/ SP001	SP102[5]	DPS02[5]	DUP02[5]	DLCS
Halogenated & Aromatic Volatile Organics	8021 SW	N	R,D	10% R,D	-	R, 5%	-	R, 5%	NA	NA	R,10%	-	NA	NA	NA	-
Acrolein, Acrylonitrile, Acetonitrile	8030 SW	N	R,D	10%, R,D	-	R, 5%	-	R, 5%	NA	NA	R, 10%	-	NA	NA	NA	-
Hydrocarbon Scan (FID)	8000 SW 8015-Mod	N	R,D	10% R,D	-	R, 5%	-	R, 5%	NA	NA	R, 10%	-	NA	NA	NA	-
RCRA Listed Solvents (FID)	8000 SW	N	R,D	10% R,D	-	R, 5%	-	R, 5%	NA	NA	R, 10%	-	NA	NA	NA	-
Alcohols (FID)	8015 SW	Q,N	R,D	10% R,D	-	R, 5%	-	R, 5%	NA	NA	R, 10%	-	NA	NA	NA	-
PCBs (ECD)	8080 SW	N	-	10% 12	-	NA	NA	NA	P, 10%	-	P, 10%	-	P, 5%	P, 5%	-	-
PNAs (FID)	8100 SW	N	-	R,D	-	NA	NA	NA	P, 10%	-	P, 10%	-	P, 5%	P, 5%	-	-
Chlorinated Hydrocarbons	8120 SW	N	-	10% R,D	-	NA	NA	NA	P, 10%	-	10%	-	P, 5%	P, 5%	-	-
Organophosphorus Pesticides	8141 SW	Q,N	-	10% R,D	-	NA	NA	NA	P, 10%	-	P, 10%	-	P, 5%	P, 5%	-	-
Chlorinated Herbicides	8150 SW	N	-	10% R,D	-	NA	NA	NA	P, 10%	-	P, 10%	-	P, 5%	P, 5%	-	-
PNAs (HPLC)	8310 SW	N	-	10% R,D	-	NA	NA	NA	P, 10%	-	P, 10%	-	P, 5%	P, 5%	-	-
T. Petroleum Hydrocarbons	418.1 EPA 503E SM	N	D	B,E 5%	-	R, 10%	-	R, 10%	NA	-	P, 10%	-	NA	NA	-	-
Volatiles (PID/ELCD)	502.2 EPA	N	R,D	R,D	-	-	R, 10%	-	NA	NA	R, 5%	-	NA	NA	NA	Q
EDB, DBCP	504 EPA	N,D	R,D	NA	Weekly	R, 5%	R, 5%	R, 5%	NA	NA	R, 10%	-	NA	NA	NA	Q
N & P Pesticides	507 EPA	Q,N	R,D	10% R,D	D	NA	NA	NA	P, 10%	-	P, 5%	-	P, 5%	P, 5%	-	Q

Table 11.5
ANALYTICAL RUN REQUIREMENT/FREQUENCY

Test	Method Reference	Instrumental QC							Prep. QC							
		ICV01	BLA01	CCV[2]	CDL01	DPS01[3]	DUP01[3]	SPI01 (or MSA)[3]	BLA02	(CLP) BLA02 SPI01	ICV02 or LCS[4]	(CLP) LCS/ SPI01	SPI02[3]	DPS02[3]	DUP02[3]	DLCS
Volatiles (GC/MS)	524.2 EPA	N	R, D	D, 8	-	-	R, 10%	-	NA	NA	R, 10%	-	NA	NA	NA	Q
PNAs (HPLC)	610 EPA	N	-	10% R,D	-	NA	NA	NA	P, 10%	-	P, 10%	-	P, 5%	P, 5%	-	-
Carbamates (HPLC)	531.1 EPA	Q,N	R,D	D,B,E	-	10%	-	10%	NA	NA	10%	-	NA	NA	NA	Q
Herbicides (ECD)	515.1 EPA	N	-	D,B,E 10%	N	NA	NA	NA	P, 10%	-	P, 10%	-	P, 10%	P, 10%	-	-
TCLP Regulated Analytes	SW	N	R,D	10% R,D	N	10%	10%	N	P, 10%	-	10%	-	10%	10%	10%	-
Semi-Volatiles GC/MS	525 EPA	N	NA	B	NA	NA	NA	NA	P	-	P, 5%	-	P, 5%	P, 5%	-	Q

Table Abbreviations:

B	=	Beginning of run	T	=	Twice per 8 hour shift	NA	=	Not applicable
C	=	Each calibration curve (ICV01)	SW	=	SW-846	-	=	Not routinely performed
D	=	Daily	N	=	As needed	SM	=	Standard Methods
E	=	End of run	SDG	=	Each sample delivery group	EPA	=	Methods for Chemical Analysis of Water and Wastes
P	=	Each prep batch	12	=	Once per 12 hours	AOAC	=	Association of Official Analytical Chemists
Q	=	Quarterly	8	=	Once per 8 hours	ASTM	=	American Society for Testing Materials
R	=	Each run						
S	=	2 times per 8 hour shift						

1. Number of Standards Run is 1, unless noted otherwise.

2. CCV may be the same as ICV.

3. Where preps are optional and not performed then "01" QC is used. Either MS/MSD or Spike and Dup used, not both. "01" QC will be used only when "02" QC is not applicable. An analytical spike (MSA) is not required on the predigestion spike sample (SPI02).

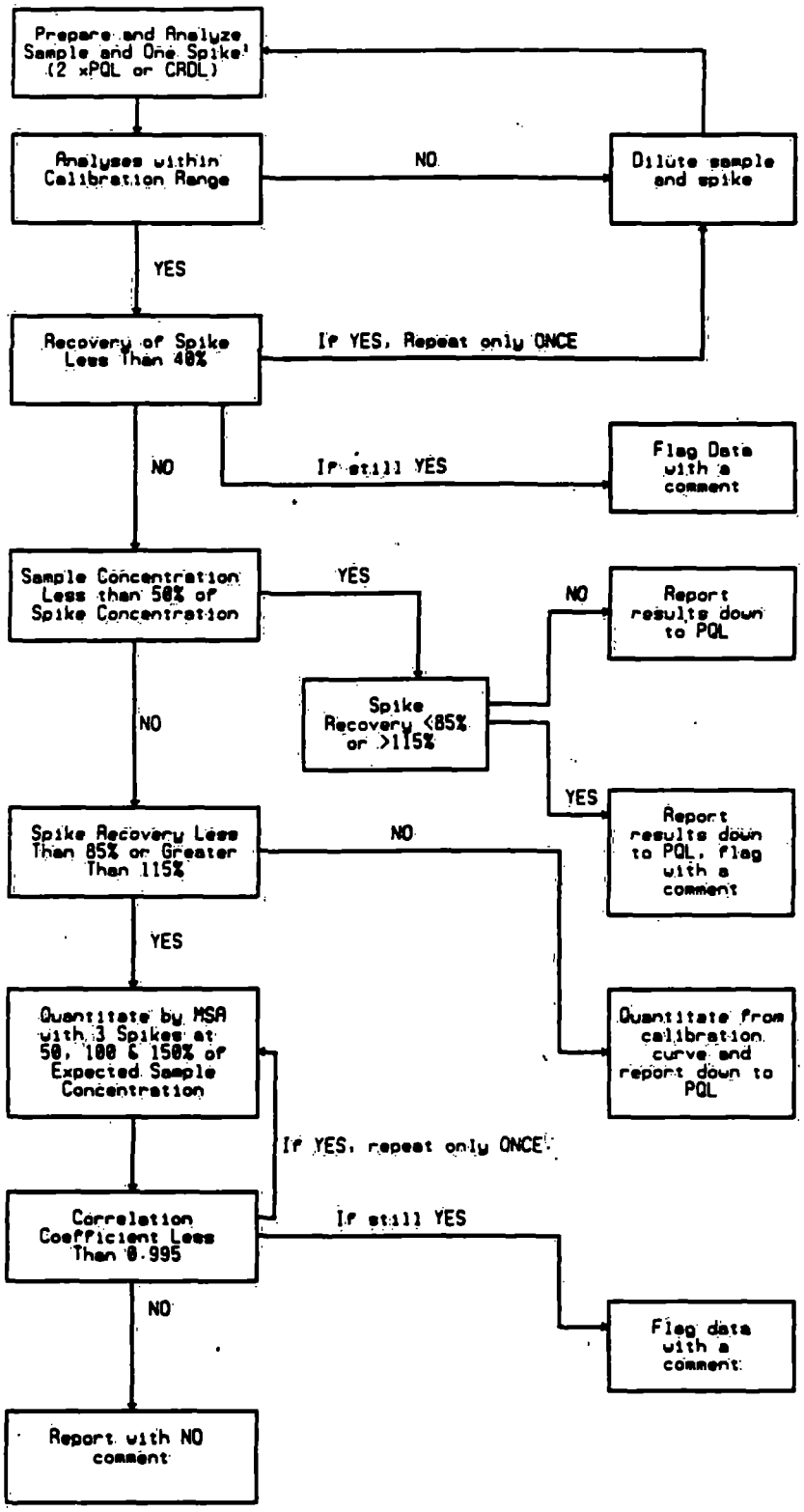
4. LCS can be "01" or "02".

Table 11.6
METHODS USED TO GENERATE PRECISION AND ACCURACY TARGETS

QC Type (Method)	Purpose	Concentration Level	Method References*
Duplicate Matrix Spikes (DPS01, DPS02)	Precision and Accuracy	Low Level	All EPA "500"Series (Drinking Water) Organic Methods EPA "600" Series Organic Methods: 601, 602, 624 EPA: 340.2, 350.1, 350.3, 351.2, 351.3, 375.4, 410.2, 415.1, 418.1 All Furnace Metals Methods SW-846: 9020, 9038, 9060; SM: 407A
		Mid Level	EPA "600" Series Organic Methods: 607, 608, 625 All SW-846 Organic Methods ("8000" Series) All EPA SOW (CLP) Organic Methods EPA: 325.1, 325.2, 335.1, 335.2, 365.2, 376.1, 376.2, 410.4, 420.1, 420.2 All ICP & FAA metals Methods SW-846: 7196, 9010, 9012, 9030, 9065, 9066; SM: 3128, 503E
Matrix Spikes (SPI01, SPI02, DPS01, DPS02)	Accuracy	Low Level	All EPA "500" Series (Drinking Water) Organic Methods EPA "600" Series Organic Methods: 601, 602, 624 EPA: 340.2, 350.1, 350.3, 351.2, 351.3, 375.4, 410.2, 415.1, 418.1 All Furnace Metals Methods SW-846: 9020, 9038, 9060; SM: 407A
		Mid Level	EPA "600" Series Organic Methods: 607, 608, 625 All SW-846 Organic Methods ("8000" Series) All EPA SOW (CLP) Organic Methods EPA: 325.1, 325.2, 335.1, 335.2, 365.2, 376.1, 376.2, 410.4, 420.1, 420.2 All ICP and FAA Metals Methods SW-846: 7196, 9010, 9012, 9030, 9065, 9066; SM: 312B, 503E
Sample Duplicates (DUP01, DUP02)	Precision	Mid Level	All Methods
		Low Level	All Methods (Maximum RPD=20)
Sample Duplicates (DPS01, DPS02)	Precision	Mid Level	See "Duplicate Matrix Spikes"
		Low Level	See "Duplicate Matrix Spikes"

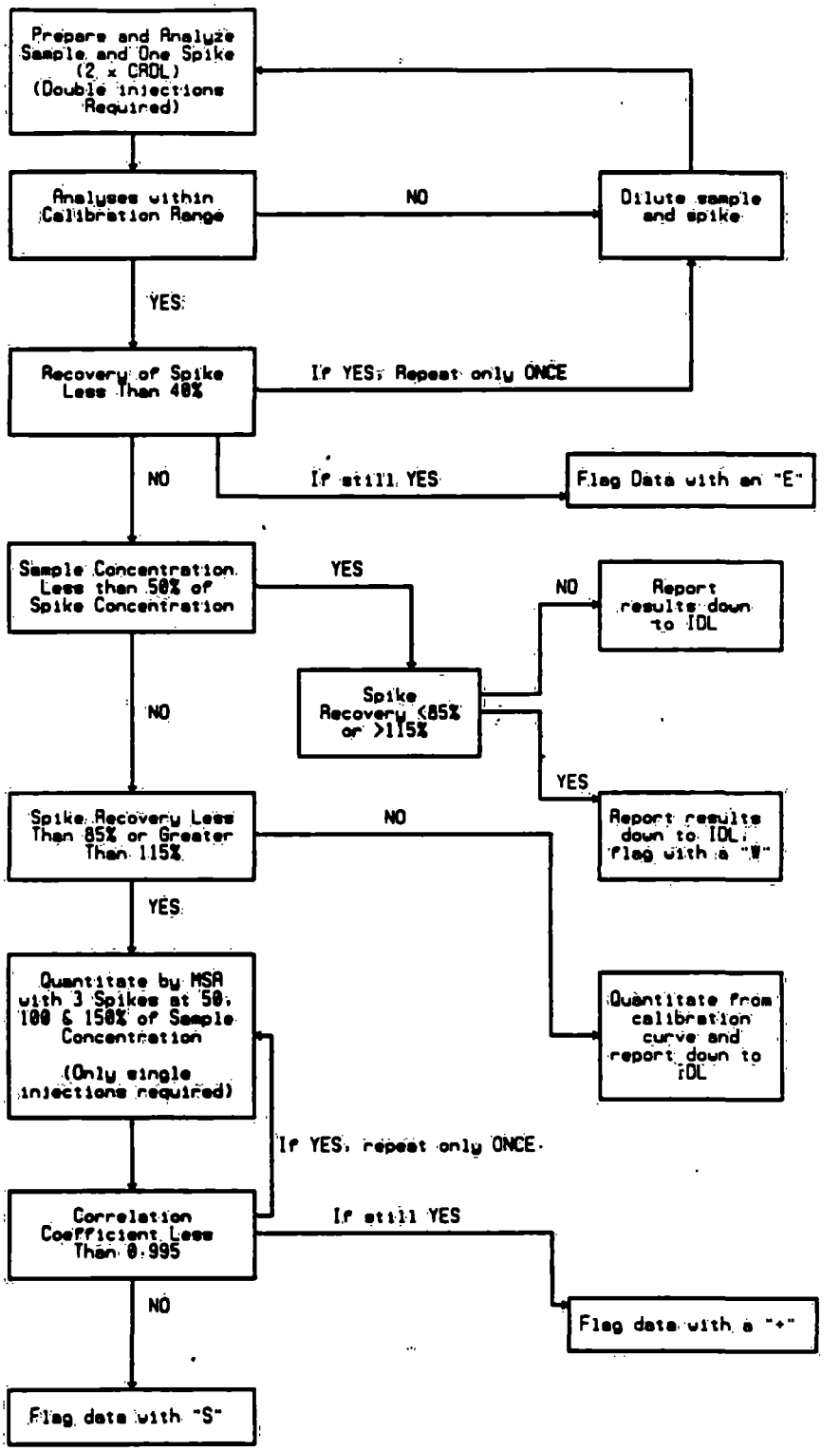
*See Table 11.5

FIGURE 11.1
METALS ANALYSIS SCHEME FOR SPIKING (SPI01)



[1] Spike required for all GFAA, optional for FAA/ICP except EPTOX or TCLP analyses.

FIGURE 11.2
CLP-GFAA ANALYSIS SCHEME



through the entire procedure, which includes a discreet or separate preparation (extraction, digestion, distillation, etc.) step.

All Table 5.1 control limits are computed from sample matrices processed through all analytical steps including any preparatory procedure ("02") if applicable.

11.4.1 Accuracy

Acceptance limits are calculated as follows, where x_i represents the individual values, $\bar{x}$ is the mean, n is the number of values and S is the Standard Deviation:

$$\begin{aligned}
\textit{Upper Control Limit (UCL)} &= \bar{x} + 3S \\
\textit{Upper Warning Limit (UWL)} &= \bar{x} + 2S \\
\textit{Center Line } (\bar{x}) &= \frac{\sum x_i}{n} \\
\textit{Lower Warning Limit (LWL)} &= \bar{x} - 2S \\
\textit{Lower Control Limit (LCL)} &= \bar{x} - 3S
\end{aligned}$$

11.4.2 Precision

Acceptance control limits are calculated as follows, where x_i represents the individual values, $\bar{x}$ is the mean, n is the number of values and S is the Standard Deviation:

$$\begin{aligned}
\textit{Upper Control Limit (UCL)} &= \bar{x} + 3S \\
\textit{Upper Warning Limit (UWL)} &= \bar{x} + 2S \\
\textit{Center Line } (\bar{x}) &= \frac{\sum x_i}{n}
\end{aligned}$$

11.4.3 Identification of Outliers

Outliers are excluded from the data used to calculate acceptance (control) limits. The procedure is described in ASTM E178-80, Section 4.

Outliers may be determined by any of the procedures referenced in ASTM E178-80 applicable, however, as a general rule the inorganic precision limits will be tested for outliers using the coefficient of kurtosis test at the 1 Percent Significance Levels (this is equivalent to a test for normality). The kurtosis formula is recommended for "two-

sided" tests (changes in level to higher and lower values) and also for changes in scale (variance). Outliers in the data sets for determining accuracy control limits in all tests and precision control limits in organic testing (from MS/MSD determinations) may use the simpler test criterion, T_n at the 1 percent significance level as follows:

$$T_n = (x_n - \bar{x})/S$$

Where:

$\bar{x}$ = arithmetic average of all n values, and
S = estimate of the population standard deviation based on the sample data
x_n = the doubtful value

11.5 Methods Used to Generate Precision and Accuracy Targets

The concentration levels used to make control limit determinations are as follows:

1. Low level - defined as concentrations from the minimum detection limit to a level 5 times the MDL or PQL.

2. Mid level - defined as the mean level between the minimum detection level and the upper end of the linear range.

3. High level - defined as the concentration at the upper end of the linear range.

Refer to Table 11.6, Methods Used to Generate Precision and Accuracy Targets for further information.

11.5.1 The following procedures/equations are to be used to assess data:

1. Accuracy

$$\%Recovery\ of\ Standard = \frac{A}{B} \times 100\%$$

Where: A = Value Measured (Observed)
B = True Value (Reference)

$$\%Recovery\ of\ Spike = \frac{(SSR - SR)}{SA} \times 100\%$$

Where: SSR = Spiked Sample Result
SR = Sample Result, 0.0 if < MDL
SA = Spike Added

2. Precision - Replicability expressed as Relative Percent Difference (RPD)

The following formula will be used when sample precision is evaluated utilizing matrix spikes (MS) and matrix spike duplicates (MSD):

$$RPD = \frac{2|MSR - MSDR|}{(MSR + MSDR)} \times 100$$

Where: MSR = Matrix Spike Recovery (%R)
MSDR = Matrix Spike Duplicate Recovery (%R)

The following formula will be used when sample precision is evaluated from duplicate (un-spiked) sample results:

$$RPD = \frac{2|S - D|}{(S + D)} \times 100$$

Where: S = Sample Original Measured Value
D = Duplicate Sample Measured Value

3. Standard Deviation (S)

The following formula will be used for calculations by computer programs:

$$S = \sqrt{\frac{\sum_{i=1}^{n} (C_i - \bar{C})^2}{n - 1}}$$

Where: C_i = Each individual data point
$\bar{C}$ = Average value for all readings

The following form may be used when S is calculated with a calculator:

$$S = \sqrt{\frac{\sum C_i^2 - \frac{(\sum C_i)^2}{n}}{n-1}}$$

4. Relative Standard Deviation (RSD)

Relative Standard Deviation is the ratio of the standard deviation S of a set of numbers to their mean ($\bar{X}$) expressed as percent. It relates standard deviation (or precision) of a set of data to the size of the numbers; sometimes referred to as the coefficient of variation (CV).

$$CV = RSD(percent) = \frac{S}{\bar{X}} \times 100\%$$

5. Percent Difference (%D)

Instrument calibration methods require this calculation to compare initial and continuing calibration response factors.

$$\%Difference = \frac{\overline{RRF_i} - RRF_c}{\overline{RRF_i}} \times 100$$

Where: $\overline{RRF_i}$ = Average relative response factor from initial calibration

RRF_c = Relative response factor from continuing calibration standard

11.6 Significant Figures

The following rule will be used for the number of significant figures to use in calculations: For all mathematical operations (addition, subtraction, multiplication, division and exponentiation) retain the equivalent of two more places of figures than present in the single observed value. No rounding of calculated values or intermediate results should be done until the final values are obtained. No rule can be given for the number of significant places to be

retained in final values, however, most tests will be reported with two significant figures. Percent recovery (%R) data will be rounded and reported to include the first decimal place. Relative percent difference (RPD) calculations will be performed using the above rounded %R result when hand calculated, or will use all digits carried by a computer when calculated by computer. The RPD result will be reported to 2 significant figures. The rules to be used for significant figure reporting of %R and RPD are as follows:

<u>% Recovery</u>

# Significant Figures Reported	Magnitude of Value (x)
4	$x \geq 100$
3	$100 > x \geq 10$
2	$10 > x \geq 1$
1	$x < 1$

<u>RPD</u>

# Significant Figures Reported	Magnitude of Value (x)
2	$x \geq 1$
1	$x < 1$

11.6.1 The rounding procedure to be followed is:

1. 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, 11.444 is rounded off to 11.44.

2. 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.

3. If the figure following those to be retained is 5, and if there are no figures other than zeroes 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.

11.6.2 Calculations using Percent Recovery (%R of spikes, etc.) or observed result from the RPD calculation will use the rounded (reported) value in the calculation, so that reported %R and final results used in calculations (vs. using un-rounded numbers not found on final reports) will arrive at the same result.

Organic testing (GC, GC/MS, etc.) requires reporting of %RSD and Percent Difference (%D) to at least one decimal place.

11.7 Control Charts

In addition to the Quality Control Tracking System (QCTS) which establishes control limits quarterly for all QC types (in a tabular format), certain QC types will be evaluated using graphical quality control charts at the bench level.

Control charts are graphical methods for monitoring and improving analytical quality over time. They are process-control tools that can be applied to spiked sample or reference material recoveries (ICVO1, LCS) or other QC test results. They can be used to document data quality, detect the existence of quality problems (special causes, motivate better performance and improve the analytical process.

Graphical quality control charts will include at a minimum:

1. ICV01
2. LCS
3. BLA02

Any other graphical control charting required by method or contract will be performed as required.

Graphical quality control charts and their associated control and warning limits will be updated with each analytical run at the bench.

Refer to Section 11.4 and Appendix A, Selected References, for additional guidance.

11.8 Instrument Detection Limits (IDLs) and Method Detection Limits (MDLs)

Instrument Detection Limits (IDLs) and Method Detection Limits (MDLs) are a quantitative measure of capability. Determination of the IDLs and/or MDLs are mandatory at EMS Heritage Laboratories.

All operating instruments in the laboratory have documented IDLs on file with the QA unit. All newly acquired instruments will have IDLs determined and reported to the QA Unit for approval, before any samples are analyzed. Any significant manipulations/modification to any instrument will require a new determination of the IDLs, which shall be submitted to the QA Unit for approval, before any samples are analyzed. The frequency for determination of IDLs, in the absence of any major instrument manipulations/modifications, shall be determined by the QA unit. Refer to Appendix D, Definitions, under Detection Limits, for the definition of an IDL. See Figure 11.3 for the

IDL/MDL reporting form. Copies of the IDL/MDL form will be sent to the Corporate Quality Assurance Officer for formal test code location approval.

11.8.1 All analytical methods used in the laboratory will have MDLs determined and reported to the QA Unit (not required when an MDL is equivalent to an IDL) for approval, before any samples are analyzed and reported. At a minimum, MDLs may be determined on only 1 instrument of several equivalent instruments having essentially equivalent IDLs, however, they must be determined on the instrument of least sensitivity (highest IDLs). Methods requiring individual analysts' demonstration of ability may be an exception to this rule. At a minimum, the MDLs will be determined in a reagent water matrix and will represent the best achievable detection limit. These reagent water MDLs will be determined by using the procedure outlined in 40 CFR Part 136, Appendix B. This procedure is designed for applicability to a wide variety of sample types ranging from reagent (blank) water containing analyte to wastewater containing analyte. Client or regulatory program specific requirements may call for the determination of client matrix specific MDLs, in which case the lab may opt to use the MDL procedure specified in the Third Edition of SW-846 for all non Clean Water Act (CWA) testing programs (those not requiring 40 CFR Part 136).

11.8.2 <u>MDL Determination as Outlined in 40 CFR Part 136 App. B</u>

A summary of the procedure, as used by EMS Heritage, follows:

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

   a. The concentration value that corresponds to an instrument signal/noise in the range of 2.5 to 5.

   b. The concentration equivalent of three times the standard deviation of replicate instrumental measurements of the analyte in reagent water.

Figure 11.3
DETECTION LIMIT STUDY

DATE:_____

INSTRUMENT:_____ ANALYST:_____

ANALYTE:_____ Std. Conc. Used:_____

METHOD:_____

PREP METHOD:_____

SAMPLE MATRIX:_____

CURVE DEVELOPMENT

	Conc.	Units
1.		
2.		
3.		
4.		
5.		

6. ICV01_____ TV=_____ Obsv.=_____ %R=_____

MEASURED CONCENTRATION

	Conc.	Units
8.		
9.		
10.		
11.		
12.		
13.		
14.		

15. ICV01_____ TV=_____ Obsv.=_____ %R=_____

16. BLA01_____

Mean (%) of #'s 8 through 14 values =_____

Standard Deviation (SD) =_____ x 3.143 = _____

IDL/MDL =_____

95% LCL = IDL/MDL_____ x 0.64 =_____

95% UCL = IDL/MDL_____ x 2.20 =_____

c. That region of the standard curve where there is a significant change in sensitivity, i.e. a break in the slope of the standard curve.

d. Instrumental limitations.

2. Prepare reagent (blank) water that is as free of analyte as possible. This reagent water must not contain analyte or interferant at concentrations at or above the MDL.

3. a. MDLs determined in reagent water will contain analyte concentrations which are at least equal to or in the same concentration range as the estimated MDL. The standard concentration will not exceed 10 times the actual MDL. EMS Heritage will set the standard concentration between 1 and 5 times the estimated detection limit.

b. MDLs required to be determined in sample matrices must first be analyzed for the background concentration. Depending on the level of analyte present in the sample a known amount of analyte may be added to bring the level of analyte between one and five times the estimated detection limit. If the level of analyte is greater than the estimated detection limit, then the option of choosing another sample with a lower analyte level or the option using that sample (if analyte does not exceed 10 times the reagent water MDL) may be chosen.

4. a. Seven aliquots of the sample will be used to calculate the MDL. All samples will be processed through the entire analytical method. If a blank measurement is required to calculate the measured level of analyte, obtain a separate blank measurement for each sample aliquot analyzed. The average blank measurement is subtracted from the respective sample measurements.

b. EMS Heritage may opt to take two aliquots of the sample to be used to calculate the MDL and process each entirely. If these measurements indicate that the sample is in the desirable range, then five additional aliquots will be analyzed, combined with the two aliquots

for a total of 7 measurements. If the sample is not in the correct range, the MDL will be re-estimated and the process repeated.

5. The variance (S^2) and standard deviation (S) of the replicate measurements will be calculated as given in the referenced procedure. The standard deviation of the 7 replicate measurements will be multiplied by 3.143 and rounded to three significant figures.

6. The 95% confidence interval estimates for the MDL will be calculated as follows:

   LCL = 0.64 MDL

   UCL = 2.20 MDL

7. EMS Heritage will generally not use the optional iterative procedure for MDL determinations.

   Where EMS Heritage opts to use the SW 846 procedure for determining the MDL, the same procedure as 40 CFR, Part 136, Appendix B will be used except for the following points:

   a. Triplicate analyses will be utilized instead of seven analyses.

   b. The standard deviation from the triplicate analyses will be multiplied by 7 to obtain the MDL.

11.8.3 EMS Heritage will report a practical quantitation limit (PQL) in place of the actual MDL where allowed. Exceptions will be made to Practical Quantitation Limit (PQL) reporting where regulatory or client DQO's push the limits of reporting close to the MDL. In no case will EMS Heritage report data lower than the MDL without the "estimated" qualifier on the result.

The PQL will be 10 times the standard deviation (S_{pooled}) that is derived from the procedures used to determine the MDL. It will be calculated to two significant figures in most cases. Alternatives to the PQL calculated in this manner will be action levels or other criteria used as the reporting detection limit as long as the reported limit is

equal to or greater than the actual MDL. The QA Officer will make the final determination for all reporting detection limits.

EMS Heritage recognizes the definition of PQL as stated in John Taylor's book Principles of Quality Assurance of Chemical Measurements, 1987, p. 79-82.

SECTION 12.0

12.0 Data Reduction, Validation and Reporting

12.1 Introduction

The laboratory analyst holds the key to the successful completion of valid and documentable analytical testing. Analysts must be provided with proper training, equipment and supervision so that they know and follow proper analytical procedures. It is management's responsibility to make available at the bench level, this QA Plan and it is the analysts' responsibility to know and to follow its' requirements. In addition to the QA Plan, pertinent EMS Heritage SOPs, EMS Heritage written methods and published (EPA, etc.) methods, the analysts must be fully aware and have easy access to any specific contract requirements and DQO's. Data validation will never result in acceptable data if the proper QC types are not analyzed as dictated by the specific project or contract.

12.2 Data Reduction

This section outlines how the raw data are reduced (calculated) into reportable values. Refer to Appendix E, Job Descriptions, for the responsibilities and specific duties of the analyst.

12.2.1 All lab analysts share some portion of the responsibility for maintaining documentation of the testing being performed. In addition to the various bound notebooks which are maintained documenting standard preparations, instrument maintenance, instrument performance, logbook of logbooks, etc., analysts must maintain some combination of bound notebooks and/or original raw data printouts with bench sheets indicating the analytical run contents, sequence and results. Some documentation requirements under various testing programs may make the use of loose bench sheets in lieu of bound sequentially numbered notebooks an unacceptable procedure, in which case bound notebooks will be utilized exclusively. Exclusive use of bound notebooks may necessitate the use of loose sheets for data entry of results and associated information into the LIMS system.

12.2.2 All analytical run notebooks must contain the following information at a minimum:

1. Analyst identification

2. Date of analysis

3. Instrument identification

4. Analytical method (Edition or Version) used and any deviations

5. Date of initial calibration

6. Computer file name if applicable

7. Concentration and source identification of all standards and spikes

8. EMS sample I.D. number

9. Reference to prep performed

10. Any comments pertinent to the analysis or sample conditions (homogeneity)

11. Any dilutions, concentrations, sample manipulations (initial and final weights/volumes, etc.)

Calculation of results from raw data if not contained in the bound lab notebook, will be maintained and filed along with the original hard copy of instrument printouts.

12.2.3 When data entry of results into LIMS is required (direct data file transfer not available), it will be necessary to summarize the final results and all information needed for data entry. A combination of the analytical run notebook, the instrument printouts/chromatograms, calculation work sheets, prep bench sheets/notebooks and summary of final results will be sufficient to re-construct the sample analysis. This simple final result summary will include at a minimum:

1. Analyst identification

2. Date of analysis

3. Instrument identification

4. Analytical method used

5. Computer file names

6. EMS sample I.D. number

7. Comment to appear on the final report

8. Any dilutions or concentrations involved

9. Final results with proper units and detection limits

10. Reviewer initials and date of review

11. Data entry operator and date of data entry

12.2.4 All instrument printouts/chromatograms must contain the following at a minimum:

1. Analysts' initials and date of review of hard copy

2. Sample or standard identification (and conc.)

3. Computer file numbers

4. Dilutions or concentrations

5. Date and time of injection or analysis

6. Units (µg/L, mg/L, mg/kg, etc.)

7. Identification of samples that are spiked or duplicated (in addition to computer assigned "Q" numbers).

8. Peaks chosen for quantitation and their identification.

12.2.5 Some testing will generate only bench sheets when no instrument printout is possible or practical and no bound notebook is maintained. The following tests are <u>directly read</u> from instruments:

1. pH and ISE methods

2. Manual spectrophotometric methods

3. Gravimetric methods

4. Coliform bacteria

5. Heat of combustion

6. Total organic halides

7. Temperature tests (i.e. Flash Point, Boiling Point)

8. Titrations

9. Turbidity

10. Biochemical oxygen demand (BOD)

11. Specific conductance

In those cases this bench sheet must contain all information required in the analytical run notebook previously discussed and the following at a minimum:

1. Reviewer initials and date of review

2. Data entry operator initials and date of entry

3. Page numbers

4. Calculated final results, %R of spikes, RPD of duplicates, etc.

5. Any raw data used to arrive at the final result

6. Results of the calibration curve (linear regression, log transforms, etc.)

12.2.6 All calibration curves conforming to a linear equation will be fitted by the least squares linear regression technique. This procedure will also be used for calibration curves that require log transforms or similar transforms. The formula for calculation of the regression line is as follows:

Where: $Y = mX + b$
Y = Point on the y axis
m = Slope of line
X = Point on the x axis
b = y intercept

The least squares estimate of b and m uses the following equations:

$$m = \frac{\sum XY - \frac{\sum X \sum Y}{n}}{\sum X^2 - \frac{(\sum X)^2}{n}}$$

$$b = \bar{Y} - m\bar{X}$$

Other scientifically sound procedures/data reduction techniques may be used as permitted by the Chief Chemist and the QA Officer.

12.2.7 When using the <u>external standard</u> calibration technique the average calibration factor (CF) can be used in place of a calibration curve (non-linear) when the %RSD is less than 20% over the working range and linearity through the origin can be assumed. The calibration factor (CF) is calculated as follows:

$$CF = \frac{\textit{Total Area of Peak*}}{\textit{Mass Injected (in nanograms)}}$$

or $$RF(\textit{Response Factor}) = \frac{\textit{Mass injected (in nanograms)}}{\textit{Total Area of Peak*}}$$

*For multi-response pesticides/PCBs, gasoline, diesel, etc., use the total area of all peaks used for quantitation.

The concentration of each analyte in the sample may be determined by calculating the amount of standard purged or injected, from the peak response, using the calibration curve or the calibration factor (CF) above. The concentration of a specific analyte is calculated as follows:

<u>Aqueous samples:</u>

$$\text{Concentration (ug/L)} = [(A_x)(A)(V_i)(D)]/[(A_s)(V_i)(V_s)]$$

where:

A_x = Response for the analyte in the sample, units may be in the area counts or peak height.

A = Amount of standard injected or purged, ng.

A_s = Response for the external standard, units same as for A_x.

V_i = Volume of extract injected, μL. For purge-and-trap analysis, V_i is not applicable and therefore = 1.

D = Dilution factor, if dilution was made on the sample prior to analysis. If no dilution was made, D = 1, dimensionless.

V_t = Volume of total extract, μL. For purge-and-trap analysis, V_t is not applicable and therefore = 1.

V_s = Volume of sample extracted or purged, mL.

By inspection of the above formula one observes that the concentration in the extract is:

$$(A_x)(RF)$$

where: $$RF(Response\ Factor)^{*} = \frac{A}{A_s}$$

*RF is the inverse of CF.

<u>Nonaqueous samples</u>:

$$\text{Concentration (ng/g)} = [(A_x)(A)(V_t)(D)]/[(A_s)(V_i)(W)]$$

where:

W = Weight of sample extracted or purged, g. The wet weight or dry weight may be used, depending upon the specific applications of the data.

A_x, A_s, A_i, V_t, D, and V_i have the same definition as for aqueous samples.

12.2.8 When using the internal standard technique (all GC/MS analyses) the average response factor (RF) can be used in place of a calibration curve (non-linear) when the %RSD is less than 20% over the working range and linearity through the origin can be assumed. The response factor (RF)* is calculated as follows:

$$RF = (A_s C_{is})/(A_{is} C_s)$$

where:

A_s = Response for the analyte to be measured.

A_{is} = Response for the internal standard.

C_{is} = Concentration of the internal standard, μg/L.

C_s = Concentration of the analyte to be measured, μg/L.

*Also known as "Relative Response Factor" or RRF

The concentration of a specific analyte is calculated as follows:

<u>Aqueous samples</u>:

$$\text{Concentration } (\mu g/L) = [(A_x)(C_{is})(D)]/[(A_{is})(RF)(V_s)]$$

where:

A_x = Response of the analyte being measured, units may be in area counts or peak height.

C_{is} = Amount of internal standard added to extract or volume purged, ng.

D = Dilution factor, if a dilution was made on the sample prior to analysis. If no dilution was made, D = 1, dimensionless.

A_{is} = Response of the internal standard, units same as A_x.

RF = Response factor for analyte.

V_s = Volume of water extracted or purged, mL.

Nonaqueous samples:

Concentration (μg/kg) = $[(A_s)(C_{is})(D)]/[(A_{is})(RF)(W_s)]$

where:

W_s = Weight of sample extracted, g. Either a dry weight or wet weight may be used, depending upon the specific application of the data.

A_s, C_{is}, D, A_{is}, and RF have the same definition as for aqueous samples.

The RF from the daily standard (CCV) analysis is used to calculate the concentration in the sample unless specific methods dictate otherwise.

12.2.9 Temperature variations for pH are negated by simply allowing solutions to warm-up to room temperature or using an automatic temperature compensation probe. When testing for specific conductance, the operator may use the standard solution and the table to check accuracy of the cell's constant or to determine an unknown constant. The formula is:

$$K = \frac{k_1 + k_2}{\frac{1}{R}}$$

where,
K = cell constant in c.g.s. metric units (cm^{-1})
k1 = conductivity from Table 12.6
k2 = blank conductivity
1/R = measured conductance of KCl standard on meter

TABLE 12.6
TEMPERATURE vs CONDUCTIVITY
0.01N KC1 SOLUTION

TEMPERATURE (°C)	CONDUCTIVITY (ABSOLUTE MICROMHOS/CM)
15	1141.5
16	1167.5
17	1193.6
18	1219.9
19	1246.4
20	1273.0
21	1299.7
22	1326.6
23	1353.6
24	1380.8
25	1408.1
26	1435.6
27	1463.2
28	1490.9
29	1518.7
30	1546.7

1/R, k_1 and k_2 must either be determined at the same temperature, or corrected to the same temperature to make the equation valid.

To calculate sample value, use the following equation:

$$\frac{\textit{Conductivity of Sample x Cell Constant}}{1 + 0.0191\ (t-25)}$$

Table 12.7 lists denominator values (1+0.0191 [t-25]) for temperatures ranging from 17°C to 28°C.

12.2.10 Manual data entry is the responsibility of the Data Entry Supervisor who will assure that data entry staff have knowledge of the system in order that complete analytical information is entered accurately, in the correct format and labeled consistently. Data entry staff will not perform any calculations; all data entry items will be summarized and submitted on standard forms which have been reviewed by the responsible group leader for acceptability, accuracy and completeness.

All analyses in the data system are based on the "analytical run" concept. All data (prep or analytical, is grouped in the computer, exactly in the order analyzed (as it also appears on a benchsheet). All QC is included in the analytical sequence.

Automated data transfer is the responsibility of each respective Group Leader.

12.3 Data Validation - During Collection

The principal criteria to be used to validate data integrity during collection will be the following:

1. Calibration Criteria (Linearity, RF etc.)
2. Internal Standard Areas (organics)
3. Calibration Blank Value (CAL01)
4. Method Prep Blank Value (BLA02)
5. Reagent Blank Value (BLA01)

TABLE 12.7

TEMPERATURE	Km (C) (Denominator of Sample equ.)
17°C	0.8472
18°C	0.8663
19°C	0.8854
20°C	0.9045
21°C	0.9236
22°C	0.9427
23°C	0.9618
24°C	0.9809
25°C	1.00
26°C	1.0191
27°C	1.0382
28°C	1.0573

6. Result of calibration verification standard used to verify calibration (ICV01).

7. Results of (matrix) spiked non QC samples (DPS01, SPI01, SPI02, DPS02).

8. Results of surrogate recoveries (organics).

9. Results of replicate measurements (DUP01, DUP02, DPS02).

10. Results of Continuing Calibration Verification standard (CCV).

11. Results of Laboratory Fortified Blanks and Laboratory Control Samples or QC Check Samples (LCS, DLCS, ICV02).

12.3.1 These measurements are to be made by the analyst who, using specific acceptance criteria, will either proceed with analyses or take corrective action. All QC data must be reviewed by the Group Leader to insure that all QC types have been completed and meet acceptance criteria. Group Leaders must also:

1. Check raw data entries and calculations.

2. Check extraction logs and benchsheets.

3. Check Calibration integrity.

4. Check Instrument/analytical logbooks.

The Group Leaders are responsible for assuring that all bench sheets submitted for data entry are accurate and adequate to allow for the rapid and error free recording of data into LIMS.

12.3.2 Group Leaders and the Sample Custodian are also responsible for checking and assuring that all internal chain of custody requirements and documentation of such are met.

12.3.3 In summary, Group Leaders will review all bench sheets or release computer files to LIMS after review. In addition 20% of all raw data will be reviewed by the Group Leaders to insure that the method was in-control during the analytical run. Group Leaders are responsible for initialing and submitting data for data entry upon completion of

their review. This completes the first step in review of the data integrity and data validity.

12.4 Data Validation - Post Completion

Subsequent to data entry, the Quality Assurance Unit is responsible for comparing bench sheets with actual data entered into LIMS. Such review will occur for 2-5% of all data entered. This activity will be documented and retained on file.

Refer to Figure 12.1, Data Review Protocol for the procedures used at EMS Heritage for data review and validation. The QA Officer and/or the QA Unit must also:

1. Confirm that the goals for precision and accuracy on duplicate and spiked compounds are sufficient to achieve the goal of 99% completeness.

2. Confirm that all analytical QC precision and accuracy (the measurement system, not sample (matrix) related) is 100% acceptable or that the run has been rejected and corrective action taken.

3. Confirm that all client specific or contract specific QC requirements have been met.

4. Examine at least 5% of the raw data (e.g. chromatograms, AAS recorder outputs, burn records) on a periodic basis to verify adequacy of documentation, confirm peak shape and resolution, and to assure that the instrument system is sufficiently sensitive and responsive.

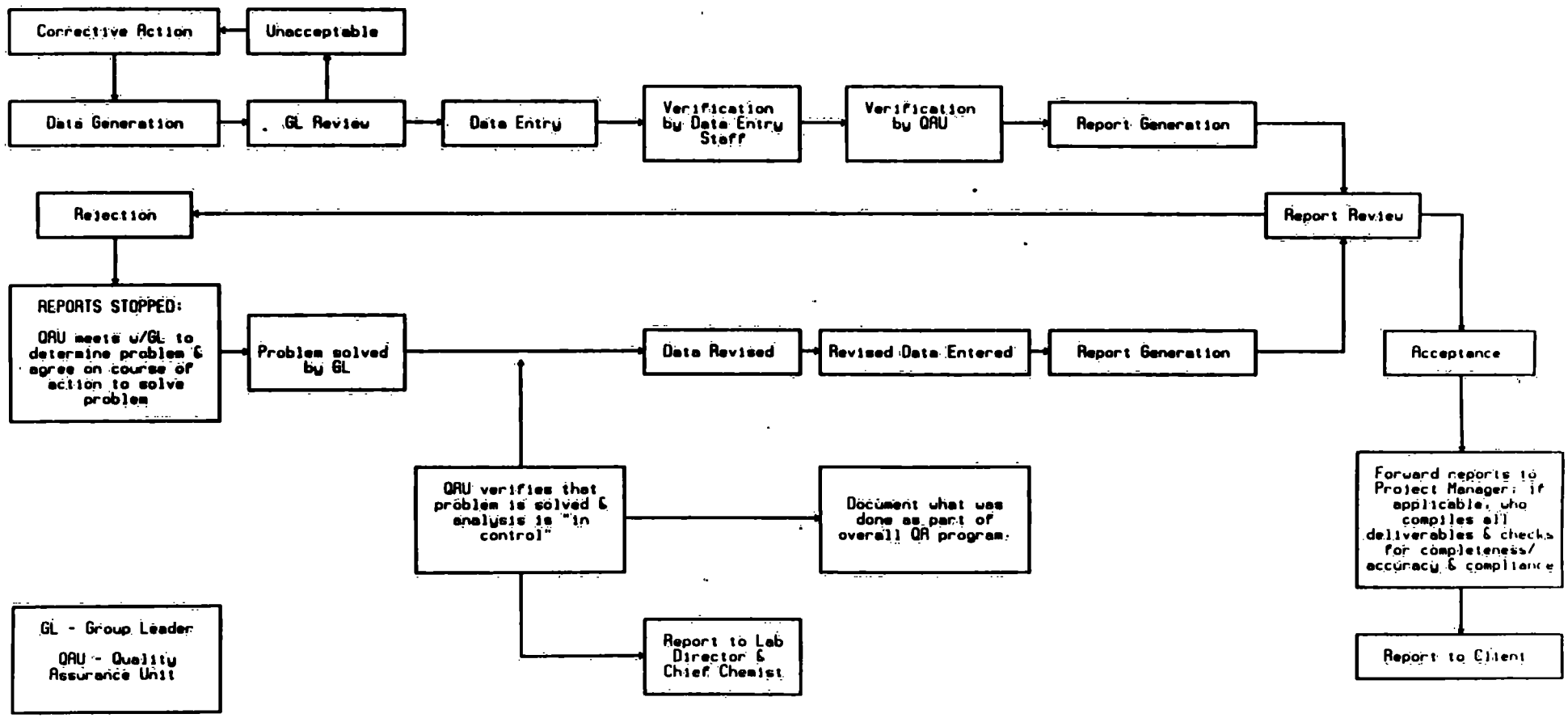
12.4.1 Internal and External Assessments

External assessment of the adherence to the QA/QC policy and procedures is the responsibility of the Quality Assurance Officer. Audit forms have been developed in the QAP and are used at all EMS Heritage Laboratories to evaluate their adherence to QA/QC Procedures. External assessments are also accomplished via third party audits.

Internal assessment of the compliance to company QA/QC policies and procedures is conducted by the Laboratory Director and the Quality Assurance Unit or their designee. Review of documentation, use of blind duplicates and standards and monthly reference materials shall be used to evaluate the performance of each laboratory. Refer

FIGURE 12.1
EMS LABORATORIES

DATA REVIEW PROTOCOL



to Section 14.0, Performance and Systems Audits for the details of internal and external assessments.

12.4.2 Quality Control Policy and Procedures

The EMS Heritage Laboratories, Inc. QAP is mandatory at all laboratories. Specific procedures are required and regular quality control audits are performed to assure compliance to company policy. Quarterly quality control reports are required from the QA Units submitted through the QA Officer. The overall quality of analysis shall be compiled and summarized by the QA Officer, who will report this summary to the President of EMS Heritage. Acceptable levels of performance are presented and monitored by the QA Officer. Refer to Section 15.0, Quality Assurance Reports for further details.

12.5 Laboratory Quality Control Checks

The types and frequency of laboratory QC Checks are presented in Table 11.5, Analytical Run Requirements/Frequency. This table presents basically three categories of QC:

1. Instrument Calibration QC

2. Instrumental Method QC (tests w/no prep. or analyzed w/o prep)

3. Analytical samples QC - processed through all steps (prepped QC).

Instrument Calibration criteria must be met before any analyses are allowed to proceed; those criteria are given in Table 9.5, Instrument Calibration. Internal QC checks not related to calibration are discussed below.

12.5.1 Preparation or Method Blanks

Blanks are identified at EMS Heritage as either BLA01 or BLA02 (calibration blanks are treated as a calibration data point, CAL01). Those methods that do not differentiate a prep from the analysis, i.e. purge and trap volatile analyses, are labeled as BLA01, which is equivalent to a BLA02 for tests that do have a separable prep and analysis. The following control limits apply for all method blanks (BLA02) and reagent blanks (BLA01):

If sample results are greater than 10 times the method blank value or the sample results are below the detectable level, the analysis is acceptable. Otherwise, the following criteria will apply.

1. Organic Analytes: Less than the Reporting Detection level (PQL)

   Exceptions to the rule will be for common lab solvents not to exceed 5 times the PQL, including but not limited to the following:

   1. Acetone
   2. Methylene Chloride
   3. Toluene
   4. Methyl Ethyl Ketone (MEK)
   5. Methyl Isobutyl Ketone (MIBK)
   6. Freon(s)
   7. Phthalates

2. Inorganic Analytes: Less than the Reporting Detection Level (PQL)

   Exceptions to the rule will be for the following metals - not to exceed 3 times the PQL:

   1. Iron
   2. Nickel
   3. Zinc
   4. Copper

12.5.2 Any target compounds in the blank will be reported. Any sample containing a similar amount of the compound outside the acceptable range will be re-analyzed when the source of the contamination is identified and removed.

Target compounds found to be BDL (Below Detection Limit) in the blank will be entered into the data base at 0.4 times the MDL.

12.5.3 Matrix Spikes

Matrix spikes are included as a routine protocol according to the frequency given Table 11.5, Analytical Run Requirements/Frequency. Matrix spikes serve only to show that an individual sample does or does not exhibit matrix interferences using the prescribed method; they do not definitively demonstrate that a given analytical method is out of control. Other QC types will be utilized to demonstrate that an analytical method is in control (QC check sample, LCS, etc.).

12.5.3.1 There are basically two types of spikes utilized and they are as follows:

1. Pre-digestion/extraction spikes

2. Post digestion spikes

Pre-digestion/extraction spikes are performed for all applicable analyses at the required (Table 11.5) frequency. The goals for accuracy are listed in Table 5.1, QA Targets for Precision, Accuracy and Method Detection Limits. Those control limits are determined from actual data entered into the QCTS when a sufficient number of observations (minimum of 7) are available to determine meaningful statistical limits.

Accuracy will be a function of the spiking level chosen. Many methods and testing programs specify the spiking levels to be used; EMS Heritage will use those spiking levels where specified. As a general rule, spiking will be performed at approximately 10 to 20 times the MDL unless other factors preclude that choice.

Several methods have established multi-laboratory performance based control limits for spike recovery of specific matrices (water and soil) through the USEPA. While Table 5.1 contains actual EMS Heritage developed control limits, the control limits used will be those determined by the USEPA for those equivalent analyses (assumes similar spiking levels used). Surrogate

matrix spikes will be treated in the same manner for organic analyses. Refer to the specific methods for further explanation.

12.5.3.2 The spike (%R) recovery QC Acceptance Criteria for those organic methods providing specific limits are as found in Table 12.1, Organic Spike Recovery Criteria:

12.5.3.3 The spike recovery (%R) QC Acceptance Criteria for those inorganic methods providing specific limits are given in Table 12.2, Inorganic Spiking Levels and Control Limits. Those criteria are the minimum acceptable criteria, stricter limits may be set by contractual requirements and/or QA Units. Analytes not listed in Table 12.2 will utilize the control limits established in Section 5.0, Table 5.1 where a sufficient number of observations exist, otherwise the control limit of 75-125% Matrix Spike Recovery will apply.

12.5.3.4 Post-digestion spikes (SPI01) are primarily used in metals analyses and are also referred to as the Method of Standard Additions (MSA). Two versions of this MSA are referenced in SW-846, Third Edition. The full method of standard additions generates a 4 point curve from which final results can be calculated. Another version of MSA is the Single-Point MSA, which essentially is a sample and matrix specific spike recovery. Section 11.0, Figures 11.1, Metals Analysis Scheme For Spiking and 11.2, CLP-GFAA Analysis Scheme define the criteria used to determine the application of those techniques.

The spike recovery criteria for a post-digestion spike is as follows:

SPI01 Criteria: 85-115% *Recovery*

Those analytical samples not meeting the above criteria will follow the procedures outlined in either Figure 11.1 and/or Figure 11.2.

TABLE 12.1
ORGANIC SPIKE RECOVERY CRITERIA

Volatile Methods: SW-846-8240, CLP-VOA			
Parameter	Water, Range %R	Soil, Range %R	Spike Amount
Benzene	76-127	66-142	50 µg/L
Chlorobenzene	75-130	60-133	50 µg/L
1,1-Dichloroethene	61-145	59-172	50 µg/L
Toluene	76-125	59-139	50 µg/L
Trichloroethene	71-120	62-137	50 µg/L

Volatile Methods: SW-846 8240*, EPA 624	
Parameter	Water, Range %R
Benzene*	37-151
Bromodichloromethane	35-155
Bromoform	45-169
Bromomethane	D-242
Carbon tetrachloride	70-140
Chlorobenzene*	37-160
Chloroethane	14-230
2-Chloroethylvinyl ether	D-305
Chloroform	51-138
Chloromethane	D-273
Dibromochloromethane	53-149
1,2-Dichlorobenzene	18-190
1,3-Dichlorobenzene	59-156
1,4-Dichlorobenzene	18-190
1,1-Dichloroethane	59-155
1,2-Dichloroethane	49-155
1,1-Dichloroethene*	D-234
trans-1,2-Dichloroethene	54-156
1,2-Dichloropropane	D-210

TABLE 12.1
ORGANIC SPIKE RECOVERY CRITERIA

Volatile Methods: SW-846 8240*, EPA 624	
cis-1,3-Dichloropropene	D-227
trans-1,3-Dichloropropene	17-183
Ethyl Benzene	37-162
Methylene chloride	D-221
1,1,2,2-Tetrachloroethane	46-157
Tetrachloroethene	64-148
Toluene*	47-150
1,1,1-Trichloroethane	52-162
1,1,2-Trichloroethane	52-150
Trichloroethene*	71-157
Trichlorofluoromethane	17-181
Vinyl chloride	D-251

D = Detected
*These analytes for method 8240 and CLP will use tighter limits established by RCRA and CLP: see previous limits.

Volatile Methods: EPA 601, 602; SW-846 8010, 8020	
Parameter	Water, Range %R
Bromodichloromethane	42-172
Bromoform	13-159
Bromomethane	D-144
Carbon tetrachloride	43-143
Chlorobenzene	38-150
Chloroethane	46-137
2-Chloroethylvinyl ether	14-186
Chloroform	49-133
Chloromethane	D-193
Dibromochloromethane	24-191
1,2-Dichlorobenzene	D-208

TABLE 12.1
ORGANIC SPIKE RECOVERY CRITERIA

Volatile Methods: EPA 601, 602; SW-846 8010, 8020	
Parameter	Water, Range %R
1,3-Dichlorobenzene	7-187
1,4-Dichlorobenzene	42-143
1,1-Dichloroethane	47-132
1,2-Dichloroethane	51-147
1,1-Dichloroethene	26-167
trans-1,2-Dichloroethene	38-155
1,2-Dichloropropane	44-156
cis-1,3-Dichloropropene	22-178
trans-1,3-Dichloropropene	22-178
Methylene chloride	25-162
1,1,2,2-Tetrachloroethane	8-184
Tetrachloroethene	26-162
1,1,1-Trichloroethane	41-138
1,1,2-Trichloroethane	39-136
Trichloroethene	35-146
Trichlorofluoromethane	21-156
Vinyl chloride	28-163
Benzene	39-150
Ethylbenzene	32-160
Toluene	46-148
Chlorobenzene	55-136
1,2-Dichlorobenzene	37-154
1,3-Dichlorobenzene	50-141
1,4-Dichlorobenzene	42-143

D = Detected

TABLE 12.1
ORGANIC SPIKE RECOVERY CRITERIA

Semi-Volatile Methods: SW-846 8270, CLP-SVOA		
Parameter	Water, Range %R	Soil, Range %R
Phenol	12-89	26-90
2-Chlorophenol	27-123	25-102
1,4-Dichlorobenzene	36-97	28-104
N-nitroso-di-n-propylamine	41-116	41-126
1,2,4-Trichlorobenzene	39-98	38-107
4-Chloro-3-methylphenol	23-97	26-103
Acenaphthene	46-118	31-137
4-Nitrophenol	10-80	11-114
2,4-Dinitrotoluene	24-96	28-89
Pentachlorophenol	9-103	17-109
Pyrene	26-127	35-142

Semi-Volatile Methods: SW-846 8270*, 625	
Parameter	Water, Range %R
Acenaphthene	47-145*
Acenaphthylene	33-145
Aldrin	D-166
Anthracene	27-133
Benzo(a)anthracene	33-143
Benzo(b)fluoranthene	24-159
Benzo(k)fluoranthene	11-162
Benzo(a)pyrene	17-163
Benzo(ghi)perylene	D-219
Benzyl butyl phthalate	D-152
δ-BHC	24-149
γ-BHC	D-110
Bis(2-chloroethyl)ether	12-158

TABLE 12.1
ORGANIC SPIKE RECOVERY CRITERIA

Semi-Volatile Methods: SW-846 8270*, 625	
Parameter	Water, Range %R
Bis(2-chloroethoxy)methane	33-184
Bis(2-chloroisopropyl)ether	36-166
Bis(2-ethylhexyl)phthalate	8-158
4-Bromophenyl phenyl ether	53-127
2-Chloronaphthalene	60-118
4-Chlorophenyl phenyl ether	25-158
Chrysene	17-168
4,4'-DDD	D-145
4,4'-DDE	4-136
4,4'-DDT	D-203
Dibenzo(a,h)anthracene	D-227
Di-n-butyl phthalate	1-118
1,2-Dichlorobenzene	32-129
1,3-Dichlorobenzene	D-172
1,4,-Dichlorobenzene	20-124*
3,3'-Dichlorobenzidine	D-262
Dieldrin	29-136
Diethyl phthalate	D-114
Dimethyl phthalate	D-112
2,4-Dinitrotoluene	39-139
2,6-Dinitrotoluene	50-158
Di-n-octylphthalate	4-146
Endosulfan sulfate	D-107
Endrin aldehyde	D-209
Fluoranthene	26-137
Fluorene	59-121
Heptachlor	D-192

TABLE 12.1
ORGANIC SPIKE RECOVERY CRITERIA

Semi-Volatile Methods: SW-846 8270*, 625	
Parameter	Water, Range %R
Heptachlor epoxide	26-155
Hexachlorobenzene	D-152
Hexachlorobutadiene	24-116
Hexachloroethane	40-113
Indeno(1,2,3-cd)pyrene	D-171
Isophorone	21-196
Naphthalene	21-133
Nitrobenzene	35-180
N-nitrosodi-n-propylamine	D-230*
PCB-1260	D-164
Phenanthrene	54-120
Pyrene	52-115*
1,2,4-Trichlorobenzene	44-142*
4-Chloro-3-methylphenol	22-147*
2-Chlorophenol	23-134*
2,4-Dichlorophenol	39-135
2,4-Dimethylphenol	32-119
2,4-Dinitrophenol	D-191*
2-Methyl-4,6-dinitrophenol	D-181
2-Nitrophenol	29-182
4-Nitrophenol	D-132*
Pentachlorophenol	14-176*
Phenol	5-112*
2,4,6-Trichlorophenol	37-144

D = Detected
*These analytes for method 8240 & CLP will use tighter limits established by RCRA, CLP-see previous list limits

TABLE 12.1
ORGANIC SPIKE RECOVERY CRITERIA

Organochlorine Pesticides/PCBs: SW-846 8080, CLP-Pest		
Parameter	Water, Range %R	Soil, Range %R
gamma-BHC (Lindane)	56-123	46-127
Heptachlor	40-131	35-130
Aldrin	40-120	34-132
Dieldrin	52-126	31-134
Endrin	56-121	42-139
4,4'-DDT	38-127	23-134

Organochlorine Pesticides/PCBs: EPA 608; SW-846 8080	
Parameter	Water, Range %R
Aldrin	42-122*
α-BHC	37-134
β-BHC	17-147
δ-BHC	19-140
γ-BHC	32-127*
Chlordane	45-119
4,4'-DDD	31-141
4,4'-DDE	30-145
4,4'-DDT	25-160*
Dieldrin	36-146*
Endosulfan I	45-153
Endosulfan II	D-202
Endosulfan Sulfate	26-144
Endrin	30-147*
Heptachlor	34-111*
Heptachlor epoxide	37-142
Toxaphene	41-126

TABLE 12.1
ORGANIC SPIKE RECOVERY CRITERIA

Organochlorine Pesticides/PCBs: EPA 608; SW-846 8080	
Parameter	Water, Range %R
PCB-1016	50-114
PCB-122	15-178
PCB-1232	10-215
PCB-1242	39-150
PCB-1248	38-158
PCB-1254	29-131
PCB-1260	8-127

D = Detected
*These analytes for method 8240 & CLP will use tighter limits established by RCRA, CLP-see previous list limits

TABLE 12.2
INORGANIC SPIKING LEVELS AND CONTROL LIMITS

Element	For ICP/AA				For Furnace AA				Other[1] (ug/L)	Control Limits % Recovery
	Water (ug/L)	Soil[2] (mg/kg)	Soil[3] (mg/kg)	Soil[4] (mg/kg)	Water (ug/L)	Soil[2] (mg/kg)	Soil[3] (mg/kg)	Soil[4] (mg/kg)		
Aluminum	2,000	400*	400*	200*						75-125%R
Antimony[5]	500	100	100	50	100	20	20	10		75-125%R
Arsenic	2,000	400	400	200	40	8	8	4		75-125%R
Barium	2,000	400	400	200						75-125%R
Beryllium	50	10	10	5						75-125%R
Cadmium	50	10	10	5	2	0.40	0.40	0.20		75-125%R
Calcium	100,000*	20,000*	20,000*	10,000*						75-125%R
Chromium	200	40	40	20	20					75-125%R
Cobalt	500	100	100	50						75-125%R
Copper	250	50	50	25	20					75-125%R
Iron	1,000	200*	200*	100						75-125%R
Lead	500	100	100	50	20	4	4	2		75-125%R
Magnesium	100,000*	20,000*	20,000*	10,000*						75-125%R
Manganese	500	100	100	50						75-125%R
Mercury									1/1/1/1=0.25	75-125%R
Nickel	500	100	100	50						75-125%R
Potassium	100,000*	20,000*	20,000*	10,000*						75-125%R
Selenium	2,000	400	400	200	10	2	2	1		75-125%R
Silver	50	10	10	5						75-125%R
Sodium	100,000*	20,000*	20,000*	10,000*						75-125%R

TABLE 12.2
INORGANIC SPIKING LEVELS AND CONTROL LIMITS

Element	For ICP/AA				For Furnace AA				Other[1] (ug/L)	Control Limits % Recovery
	Water (ug/L)	Soil[2] (mg/kg)	Soil[3] (mg/kg)	Soil[4] (mg/kg)	Water (ug/L)	Soil[2] (mg/kg)	Soil[3] (mg/kg)	Soil[4] (mg/kg)		
Thallium	3,000	600	600	300	50	10	10	5		75-125%R
Vanadium	500	100	100	50						75-125%R
Zinc	500	100	100	50						75-125%R
Cyanide									100[5]	

*No spike required. NOTE: Elements without spike levels and not designated with an asterisk, must be spiked at appropriate levels.

[1]Cyanide spiking level reported is for both water and soil/sediment matrices.

[2]Used for USEPA CLP ILM01. The levels shown indicate concentrations in the final digestate of the spiked sample (100 mL for mercury and 200 mL for all other metals when the wet weight of 1 gram (for ICP, Furnace, and Flame AA), or 0.40 grams (for mercury) of sample is taken for analysis. Adjustment must be made to maintain these spiking levels when the weight of sample taken deviates by more than 10% of these values. Appropriate adjustment must be made for microwave digestion procedure where 0.5 grams of sample or 50.0 mL (45.0 mL of sample plus 5.0 mL of acid) of aqueous sample are required for analysis.

[3]Used for USEPA CLP SOW 7/88 or equivalent. The levels shown indicate concentrations in the final digestate of the spiked sample (100 mL for mercury and 200 mL for all other metals) when the wet weight of 1 gram (for ICP, Furnace and Flame AA), or 0.40 grams (for mercury) of sample is taken for analysis.

[4]Used for non-CLP analyses. The levels shown indicate concentrations in the final digestate of the spiked sample (100 mL for mercury and 100 mL for all other metals) when the wet weight of 1 gram (for ICP, Furnace, and Flame AA), or 0.40 grams (for mercury) of samples is taken for analysis.

[5]The level shown indicates the amount of cyanide that must be added to the original (undistilled) sample. for instance, 100 ug must be added per each Liter of aqueous sample. If the sample volume is 500 mL, then 50 ug of cyanide must be added. If the volume if 50 mL, then 5 ug of cyanide must be added.

For soil samples, 25 ug of cyanide must be added per each gram of solid sample taken for analysis. The spiking level is dependent on the weight of the sample taken and the final distillate volume. If one gram of sample is taken for analysis, and the final distillate volume is 250 mL, then the distillate must contain cyanide at a concentration of 100 ug/L. If five grams of sample are taken, then the distillate must contain cyanide at a concentration of 500 ug/L. Assuming a sample of one gram, the manual and semi-automated colorimetric methods call for a cyanide concentration of 25 ug per the 500 mL mixture of the sample, reagents and water before distillation. The final distillate, in this case, contains cyanide at a concentration of 100 ut/L. Fo the midi-distillation method, a cyanide concentration of 25 ug must be added into the 50 mL mixture of sample reagents, and water before distillation. This yields a cyanide concentration of 500 ug/L in the final distillate of 50 mL.

12.5.4 Duplicate Matrix Spikes (DPS01, DPS02)

Duplicate matrix spikes measure both accuracy (see previous section for matrix spikes) and precision. As with matrix spikes, USEPA has established control limits for precision of specified methods for waters and soils. Those control limits are given as Relative Percent Difference (RPD) and will be used as control limits by EMS Heritage when applicable. When the methods do not specify RPD control limits, Table 5.1 of this QAP will be utilized when a sufficient number of observations allow for usable statistical limits. Any method not falling into the above two categories will be allowed a maximum of 50 percent RPD for organic testing and 20 percent RPD for inorganic testing. RPD's exceeding these limits may be considered as out-of-control for Duplicate Matrix Spike analyses.

Methods Without Established Control Criteria:
RPD Inorganic Criteria: 0-20
RPD Organic Criteria: 0-50

12.5.4.1 The Precision Control Limits for those organic methods providing specific limits are given in Table 12.3, Organic Precision Control Limits.

12.5.5 Reagent Water or Reagent Matrix Spikes (LCS, DLCS)

Reagent water or reagent matrix spikes will be used as additional QC checks to monitor the effectiveness of the method. These QC types will utilize either reagent water spiked w/analyte (also known as Laboratory Fortified Blank) or a blank matrix (water, soil, sand, oil) which is known to exhibit minimal or no matrix interferences. EMS Heritage uses the acronyms of LCS (Laboratory Control Sample), DLCS (Duplicate Laboratory Control Sample) and/or ICV02 (Initial Calibration Verification - Prepped Standard) to identify the variations of these check samples. Analysis of this QC type will demonstrate that the method is in control when the Matrix Spike/Matrix Spike Duplicate (MS/MSD) recoveries are out-of-control. These QC types must be extracted/digested (if applicable) in the same preparation batch as the samples failing to meet QC criteria. Analysis may be optional for some organic tests when QC criteria for MS/MSD samples are met.

12.5.5.1 The reagent water or reagent matrix spikes (Laboratory Control Sample) are entered into the QCTS in LIMS as are all QC types. In addition, these QC samples are kept on control charts at the bench level. The minimum

TABLE 12.3
ORGANIC PRECISION CONTROL LIMITS

Volatile Methods: SW-846 8240, CLP-VOA		
Parameter	RPD, Water	RPD, Soil
Benzene	11	21
Chlorobenzene	13	21
1,1-Dichloroethene	14	22
Toluene	13	21
Trichloroethene	14	24

Semi-Volatile Methods: SW-846 8270, CLP-SVOA		
Parameter	RPD, Water	RPD, Soil
Phenol	42	35
2-Chlorophenol	40	50
1,4-Dichlorobenzene	28	27
N-Nitroso-di-n-propylamine	38	38
1,2,4-Trichlorobenzene	28	23
4-Chloro-3-methylphenol	42	33
Acenapthene	31	19
4-Nitrophenol	50	50
2,4-Dinitrotoluene	38	47
Pentachlorophenol	50	47
Pyrene	31	36

TABLE 12.3
ORGANIC PRECISION CONTROL LIMITS

Organochlorine Pesticides/PCBs: SW-846 8080, CLP-Pest		
Parameter	RPD, Water	RPD, Soil
gamma-BHC (Lindane)	15	50
Heptachlor	20	31
Aldrin	22	43
Dieldrin	18	38
Endrin	21	45
4,4'-DDT	27	50

QC criteria to be utilized for these QC types will be the same criteria as found in Table 5.1 for matrix specific precision and accuracy. More stringent criteria will be utilized where available. As a general rule the following criteria will apply for the Laboratory Control sample:

(LSC, DLCS, ICV02): 80-120% *Recovery (Accuracy)*
DLCS: 20% *RPD*

Some tests, particularly extractable organic analyses cannot meet this criteria, see Table 5.1.

12.5.6 Quality Control Check Samples - Performance Evaluation Samples (P.E. Samples)

Acceptance criteria for P.E. samples are set by the organization running the study (EPA, commercial vendors). All results of P.E. samples are summarized to management.

12.5.7 Quality Control Check Standards or Initial and Continuing Calibration Check Standards (ICV01, CCV)

Refer to Section 9.0, Table 9.5, Instrument Calibration for the acceptance criteria of the ICV01 and the CCV.

12.5.8 Duplicate Samples (DUP01, DUP02)

Control limits for duplicate samples are identical to those set for duplicate matrix spike samples (see section 12.6.4, Table 5.1 and Table 12.3) with one exception. Since duplicate precision is measured from analyte already present in the sample (no spike added) the level may not be detectable or may be very close to the detection limit. Concentrations of analyte less than 10 times the reporting detection limit (MDL, PQL, etc.) present in non-spiked (duplicate) samples will not be considered as out-of-control based on the QCTS data, but will be allowed a maximum RPD of 20 percent for inorganic analyses and 50 percent for organic analyses.

12.5.9 Methods Utilizing Internal Standards

The criteria which must be met for internal standard areas (when used) are found in Table 12.4, Internal Standard Area Criteria.

TABLE 12.4
INTERNAL STANDARD AREA CRITERIA

Instrument	Method	Criteria, χ = Absolute Area of Daily CCV
GC/MS	EPA 524.2	$-30\% > \chi < +50\%$
GC/MS	EPA 525	$-30\% > \chi < +50\%$
GC/PID/ELCD	EPA502.2	±3 SD from CAL Standards
GC/NPD	EPA 507	30% Difference from daily CCV
GC/ECD	EPA 508	30% Difference from daily CCV
GC/ECD	EPA 515.1	30% Difference from daily CCV
HPLC	EPA 531.1	30% Difference from daily CCV
GC/MS	SW-846 8240	$-50\% > \chi < +100\%$
GC/MS	SW-846 8260	$-50\% > \chi < +100\%$
GC/MS	SW-846 8270	$-50\% > \chi < +100\%$
GC/MS	CLP-VOA	$-50\% > \chi < +100\%$
GC/MS	CLP-SVOA	$-50\% > \chi < +100\%$
GC/MS	EPA 624*	$-50\% > \chi < +100\%$
GC/MS	EPA 625*	$-50\% > \chi < +100\%$
GC/ECD	SW-846 8080**	$-50\% > \chi < +100\%$

*No method criteria, EMS Heritage has adopted these criteria.
**Any correction of areas using Internal Standards will not exceed this criteria.

12.5.10 Surrogate Recovery Criteria

Control limit criteria for methods which do not specify specific control limits will be developed from in-house data. EMS Heritage will not adopt criteria less stringent than the published method criteria. "Advisory" criteria will not require corrective action. Refer to Table 12.5, Surrogate Recovery Criteria for method specific control criteria.

12.6 Review of Project Data

Project Managers are responsible for review of the overall project data before submission to the client. All laboratory "Certificates of Analysis" (Reports)and QA Summaries are reviewed and approved only by the QA Unit (see Reporting) prior to delivery to the Project Manager.

Project Managers are responsible for the following review prior to releasing the data report package to clients:

1. Review of supporting documentation including, but not limited to:

    a. Chain of Custody.

    b. Laboratory Analysis Request or Task Order Forms.

2. Review of all contract or project deliverables for completeness and accuracy including but not limited to:

    a. Reporting forms.

    b. Selected Raw data including chromatograms/ printouts.

    c. Adherence to specific DQO's.

    d. Analysis of all required QC Types at the required frequency.

3. Review of data for any obvious anomalous values, specifically those areas requiring knowledge of special project conditions possibly unknown to the QA Unit during review. Review large sets of data for comparability from one analytical batch or case

TABLE 12.5
SURROGATE RECOVERY CRITERIA

Volatiles: SW-846 8240, CLP-VOA			
Parameter	Water, Range %R	Soil, Range %R	Spike Amount
4-Bromofluorobenzene	86-115	74-113	50 µg
1,2-Dichloroethane-d_4	76-114	70-121	50 µg
Toluene-d_8	88-110	84-117	50 µg

Semi-Volatiles: SW-846 8270, CLP-SVOA			
Parameter	Water, Range %R	Soil, Range %R	Spike Amount
Nitrobenzene-d_5	35-114	23-120	50 µg
2-Fluorobiphenyl	43-116	30-115	50 µg
p-Terphenyl-d_{14}	33-141	18-137	50 µg
Phenol-d_6	10-94	24-113	100 µg
2-Fluorophenol	21-100	25-121	100 µg
2,4,6-Tribromophenol	10-123	19-122	100 µg
2-Chlorophenol-d_4	33-110 (advisory)	20-130 (advisory)	150 µg
1,2-Dichlorobenzene-d_4	16-110 (advisory)	20-130 (advisory)	100 µg

Organochlorine Pesticide/PCBs: SW-846 8080, CLP-Pest		
Parameter	Water, Range, %R	Soil, Range %R
Dibutylchlorendate (DBC)[1]	24-154 (advisory)	20-150 (advisory)
Tetrachloro-m-xylene (TCX)	60-150 (advisory)	60-150 (advisory)
Decachlorobiphenyl (DCB)	60-150 (advisory)	60-150 (advisory)

[1]DBC has been replaced by TCX & DCB for CLP-Pest OLMØ1.

to another in the project (QA Unit does not generally review an entire case at one time).

4. Adherence to reporting deadlines and shipment/delivery of report packages by the best means available to meet those deadlines.

12.7 Data Reporting

The Data Entry Supervisor is responsible for supervision of all data entry operators. The Data Entry (D.E.) Supervisor (or designee other than the original data entry operator) will verify 5 percent of all data entered into LIMS. Locations having only one D.E. person will not check data in this manner; this responsibility will fall solely upon the QA Unit of that location.

Validation of data entry is performed for all data at a 2-5 percent frequency and is the responsibility of the QA Unit. The QA Unit may delegate this task to the QA Assistant or other staff person trained to perform that function.

The QA Unit is responsible for reviewing all final reports prior to release to clients. Reports are to be reviewed for:

1. Completeness - All parameters, detection limits, units, dates, descriptions, etc. must be complete and correct.

2. Consistency - All parameters must be internally consistent (CrVI ≤ Cr Total; TKN ≥ NH_3 - N, TS ≥ TDS, etc.)

3. Comparability - All parameters and units must be reported in such a way that data sets can be evaluated relative to each other as necessary.

12.7.1 All modifications to samples in the LIMS system must be documented on the Sample Modification Form, Figure 12.2. Original entries or additions (comments, etc.) to original entries will not utilize this form unless the sample is a "status 8" (released) category. All modifications to test codes must be approved by the Project Manager or the QA Unit. Modifications to samples that are completed and released (LIMS status 8) are possible only by the QA Unit staff. Any report that has been sent to a client and subsequently modified in any way by the QA Unit must be identified as an "amended report" and the date of amendment and the initials of the person making the amendment will be given on the certificate of analysis.

FIGURE 12.2

REQUEST FROM:_____ DATE_____

SAMPLE STATUS:_____

SAMPLE NUMBERS:_____

_____

CLIENT:_____

TEST CODE ADDED/CANCELLED:_____

TEST CODE CHANGED FROM _____ TO _____

RESULTS MODIFICATIONS:_____

_____

_____

_____

REASON FOR ADDITION OR CHANGE:_____

_____

_____

_____

MODIFIED BY:_____ DATE _____

PROJECT MANAGER'S APPROVAL INITIALS:_____ DATE _____

ACCOUNT MANAGER'S APPROVAL INITIALS:_____ DATE _____

OLD PRICE:_____ NEW PRICE:_____

12.7.2 Samples of final reports and computer (LIMS) QC summaries are contained in Appendix F, Final Report Examples.

12.7.3 Special Reporting Requirements

Sample analysis failing QC criteria due to matrix related interferences or samples requiring dilutions, etc. may have been analyzed 2 or more times. EMS Heritage will report a maximum of two analyses in those cases, or each analysis if client desires.

If a re-analysis of the sample fails the same criteria a second time and all other instrument criteria are in control, a matrix interference is assumed and both analyses may be reported. If only the reanalysis is in control, only the reanalysis will be reported.

Exceptions to this policy will be made for contract requirements and/or different client DQO's.

12.8 Data Storage

The following data is maintained for long term storage.

- bench sheets
- strip charts
- chromatograms, print-outs
- magnetic media used to store results
- invoices and financial statements
- project files
- customer data
- various raw data
- lab related periodicals

12.8.1 The records, hard copy and magnetic media, are kept on site for a period of six months to a year. As necessary, records may be transferred to an off-site records storage facility. The records storage

facility must provide secure, access controlled and environmentally controlled storage of records. For all GLP (40 CFR, part 160) projects, records will be kept on-site.

After the completion of the requested work, records of the raw data, quality assurance data and reports will be kept by EMS for at least five (5) years unless otherwise required by law or regulations. Magnetic tapes are maintained, however, magnetic tapes have a storage life expectancy of less than ten (10) years.

12.8.2 The following is an overview of how records are stored and retrieved at EMS Heritage.

12.8.2.1 Storing Records

To send a box off site to a records storage facility the following three steps will be followed.

1. A box is filled with material of a related nature. The box is then marked to show the contents and the related service group and destruction date.

2. The box is then taken to the off-site storage coordinator where the box is given a unique number. The unique number, the contents, the associated service group, and the date stored are recorded in a ledger. Once the box is entered into the ledger it is scheduled to be picked up or delivered to the off-site records storage facility.

3. The off-site records storage facility stores the box and gives it a unique location code. Once the location code is assigned off-site records storage facility contacts the off-site storage coordinator, who enters the location code into the box's ledger entry. This allows for the recall of individual boxes.

12.8.2.2 Recalling Records

To recall records from off-site storage requires the EMS box number and the records storage facility location code, both of which are kept in a records storage ledger.

A copy of the ledger is kept by the off-site storage coordinator, who can also recall the box from storage.

12.8.3 The LIMS system located in Indianapolis is backed up on a three cycle program. Every week a backup of the system is done. Weekly backup tape sets are rotated every week. So, if the computer is backed-up with tapes set "A" this week tape set "B" is used the next week. The tape sets are rotated back and forth every other week, except the last week of the month. For the last week of the month tape set "C" is used. By using this method it is possible to restore the computer from as far back as one month. The tape sets are held at off-site storage, except when called back to do the backup. EMS Heritage also maintains over a month of "redo's" on tape that are backed up each day. "Redo's" are copies of the transactions needed to apply to an old backup of the database to bring it up to date. EMS Heritage also maintains a two week rotation of backups for the software. The software is backed up each day as well.

12.8.4 Data is not stored or organized per specific project unless contract or other client requirements dictate such. If storage by project is required, all raw data and final reports are copied and stored in a "central project file".

All original raw data and benchsheets are organized and stored in folders chronologically according to analytical batch and date of analysis.

SECTION 13.0

13.0 Corrective Action

13.1 Introduction

Criteria levels which designate in or out of control status are specified in the applicable sections of this QA Plan. The corrective actions recommended, that will return the analysis to an "in control" status, are summarized in Table 13.1, Corrective Actions.

Corrective action must be undertaken whenever any number of unacceptable conditions exist.

13.2 Warning Limits

A first condition requiring corrective action occurs when external standards or otherwise specified quality control check samples are analyzed and results found to be outside established warning limits, upper or lower (UWL, LWL). Data may be acquired if the upper and lower control limits (UCL, LCL) are not exceeded in this condition, but corrective action must be undertaken. See Trends Analysis, Section 13.4.

Two successive readings outside of warning limits (but inside of control limits) are considered out of control. The analysis must be stopped and immediate corrective action is undertaken (see all Trends Analysis, below).

13.3 Control Limits

Another condition is one in which either of the control limits have been violated. In this case, all analyses stop and immediate corrective action is undertaken.

13.4 Trends Analysis

Analyses are out of control whenever any of the following occurs:

- 1 point is outside the control limit
- 2 consecutive points are outside the warning limits
- 7 consecutive points are on one side of the center line
- 7 consecutive points increase or decrease
- An obvious trend is observed in the distribution of points

13.5 Notification

In both of the above conditions, the determination is to be made by the analyst if the procedure is in control. If it is in control, analyses proceed; if it is out of control, all analyses are stopped and the following information is compiled immediately and in writing.

1. Test which is out of control.
2. Analyst.
3. Instrument.
4. A brief description of the problem.

At a minimum the problems will be written on the runs (bench sheets) and the QA Unit will be notified and consulted. When the seriousness of the problem warrants a more formal report, the following information will be supplied on the form in Figure 13.1.

The report is given immediately to the Group Leader, Lab Director and Quality Assurance Unit, The goal at this point is to return the analysis status to IN-CONTROL as soon as possible.

The Group Leader is responsible for returning the analysis status to in control and he or she may draw upon any or all of the resources at EMS Heritage to accomplish this in a timely fashion.

13.6 Specific Corrective Actions

The nature of the corrective actions which may be required at the bench are too numerous to document within a manual such as this one. However, there are some common procedures which are generally appropriate to a number of trouble-shooting protocols including:

1. Review of analytical history: Is there a sudden problem or has an analysis slowly "drifted" out of control?
2. Prepare fresh standards: Have the standard or stock or working solutions expired or degraded?
3. Prepare fresh reagents: Have any reagents expired or degraded?

4. Review the method - ask for assistance: Has an analyst introduced an un-noticed, methodical error into the procedure?

Refer to Table 13.1, Corrective Actions for detailed procedures.

EMS will subscribe to any reasonable corrective action deemed necessary by regulatory personnel. Corrective actions will also be initiated as needed as a result of systems or performance audits, split samples or data validation reviews. Exceptions to this policy must be approved by the President of the laboratory or the QAO for the purpose of negotiating a corrective action.

Following corrective action, any sample analyzed during the out of control period must be reanalyzed.

13.7 Corrective Action Documentation

Upon returning the analysis to an "in-control" status, the Group Leader is responsible for filing the following information in the method file:

1. Test which was out of control.
2. Analyst/Date.
3. Instrument I.D.
4. Brief description of the problem.
5. Corrective actions taken.
6. Current Status.
7. Date analysis returned to "in-control" status.
8. Person responsible for remedy.

Figure 13.1, Analytical Control Notification is the form that will be used for out of control and return to "in control" status reports.

FIGURE 13.1
ANALYTICAL CONTROL NOTIFICATION

1. Test _____

2. Analyst _____

   Date _____

3. Instrument _____

4. Brief Description of Problem _____

   _____

   _____

   _____

5. Corrective Actions Taken _____

   _____

   _____

   _____

   _____

6. Current Status _____

   _____

   _____

   _____

7. Date Returned to In-Control _____

   _____

8. Persons Responsible For Remedy _____

   _____

   _____

TABLE 13.1
CORRECTIVE ACTIONS

QC Type	Recommended Corrective Actions
Instrument Blanks	Prepare another blank, if same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc. Re-analyze any samples associated with unacceptable blanks.
Calibration Standards	Reanalyze standards. If still unacceptable, then remake standards. If still unacceptable try an alternate source or prepare from neat standards.
Continuing Calibration Standards	Reanalyze standard. If still unacceptable, then recalibrate and rerun samples from the last unacceptable CCV standard.
Internal Standards	Inspect the chromatographic system for malfunctions and make corrections as required. Reanalyze affected samples. If reanalysis does not solve the problem and the system is not malfunctioning, report both analyses with comments, as required by some clients. Report only 1 analysis with comments for those clients not requiring replicate reporting.
Surrogates	Check for errors in calculations, formulation of spiking solution, internal standard responses and instrument performance. Reanalyze the samples if none of the above reveals a problem. If an undiluted analysis with acceptable surrogate recoveries is being reported, do not reanalyze diluted samples if the surrogates are outside limits. MS/MSDs outside of control limits for surrogates are never reanalyzed except for specific contractual or DQO requirements. If the sample and its associated MS/MSD show the same surrogate recovery pattern, document this in a case narrative or analysis comments. If reanalysis does not solve the problem and the system is not malfunctioning, report both analyses with comments, as required by some clients. Report only 1 analysis with comments for those clients not requiring replicate reporting. Corrective actions are not required for advisory surrogate limits. For procedures involving extraction, when surrogates are outside the limits and require corrective actions reanalyze the extract first, to determine if the problem was with the analysis. If reanalysis does not solve the problem then re-extract and analyze the second extract. If surrogate recoveries in an extracted blank do not meet specifications upon re-analysis, re-extract and reanalyze all samples and a blank. Specifically for GC/MS semi-volatile analysis, if two base/neutral or two acid surrogates are out of limits <u>or</u> if recovery of any <u>one</u> base/neutral or acid surrogate is below 10% corrective actions are required as described herein.

TABLE 13.1
CORRECTIVE ACTIONS

Method Blanks	Reanalyze blank. If still positive, determine source of contamination. If sample results are greater than 10 times the method blank value or the sample results are below the detectable level, the analysis is acceptable. If necessary, reprocess (i.e. digest or extract) the sample set.
Initial Calibration Verification Standards (ICV)	Reanalyze ICV standards. If still unacceptable, then remake ICV standards and reanalyze. If still unacceptable, then recalibrate and reanalyze ICV. If still unacceptable evaluate source and validity of all standards as appropriate.
Post Digestion/Extraction Spike (MSA)	Check for error. Refer to Figures 11.1 or 11.2 for actions regarding the Method of Standard Additions for Metals analysis. For all other post digestion spikes, reanalyze. If reanalysis does not meet the criteria, flag the results with a comment and include in the case narrative.
Pre Digestion/Extraction Matrix Spike (MS/MSD)	For %R criteria only: Check for error. If extracted standard (LCS, lab Fortified Blank, QC check sample, etc.) meets criteria, then poor recovery is considered to be a matrix interference. Extracted standard or check standard must be prepared in same prep batch where applicable. Report results with a comment and include in the case narrative. If extracted standard fails, reprep and reanalyze all affected samples. CLP protocol testing will not require reanalysis for organics testing unless a trend develops for poor accuracy.
Extracted Standards	Check for errors in preparation and analysis. Reanalyze and reprep all affected samples.
Duplicates and Duplicate Spikes	For RPD criteria only: Check for error. If extracted standard (DLCS) meets criteria, then report the result. Poor precision may be due to sample inhomogeneity; check sample appearance. If obvious sample inhomogeneity is the problem, do not enter the outlier into the QCTS, but report results with a comment and include in the case narrative. Sample RPD's exceeding 20 percent for inorganic analyses or 50 percent for organic analyses or the method specific criteria (RCRA, CLP) with no obvious sample inhomogeneity problem must be reprepped and reanalyzed for all affected samples. CLP protocol testing will not require reanalysis unless a trend develops for poor precision.

SECTION 14.0

14.0 Performance and Systems Audits

14.1 Performance Audits

A performance audit is an independent check to evaluate the data produced by a laboratory's analytical system, and may be categorized as a quantitative appraisal of quality. There are several ways that this is done:

1. Worksheet review
2. Oral worksheet review
3. On-site analyst work review
4. Independent or check sample review
5. Intra and interlaboratory check sample, or proficiency test (performance evaluation) sample analysis review

14.1.1 Internal Performance Audits

Internal performance audit worksheet reviews are conducted by the QA Officer and/or the QA Unit. These reviews must be conducted at a frequency necessary to assure the accuracy of either the total measurement system or its component parts. Worksheet reviews by the QAO and/or QAU will be on-going but will occur at a minimum frequency of semi-annually for selected tests. This will be in addition to (or will be a more in-depth review of all data records) the 2-5 percent frequency of data entry validation performed by the QAU.

Internal performance audit worksheet reviews will consist of evaluations of all data and related supporting documentation to assure that all required QC checks are being made and evaluation criteria followed. Reports relating to internal performance audit worksheet reviews are confidential and will be released only upon approval from the President of EMS Heritage.

14.1.2 Performance Audit-Proficiency Test Samples

Performance Audits at EMS Heritage also consist of analysis of independent or commercial check samples and participation in performance evaluation sample programs.

Refer to Table 14.1, Reference Materials and Performance Evaluation Participation for the sources of reference materials used and the on-going performance audit participation.

All information generated from Performance Evaluation (P.E.) sample programs will be made available during systems audits or upon request. Blind samples and split samples may be submitted as deemed necessary by the QAO or the QAU.

14.2 Systems Audits

A systems audit is an on-site inspection and review of a laboratory's quality control system and may be categorized as a qualitative appraisal of quality. It will cover any or all of the operational quality control elements of the quality assurance program. Systems audits include but are not limited to the following:

1. Sample handling: receiving, custody, log-in, storage
2. Sample analysis: written SOPs and analytical methods, protocols
3. Records control
4. Documentation: bound notebooks where required; records of all sample handling and analytical procedures
5. Preventative maintenance: adequate records, procedures.
6. Proficiency testing
7. Personnel practices
8. Training
9. Workload
10. Instrumentation and facilities

14.2.1 External Systems Audits

Systems audits are performed frequently at EMS Heritage by State and Federal agencies as part of the participation in sample analyses for governmental organizations. In addition, many of our commercial clients perform routine audits of EMS Heritage. Evaluation by other appropriate

outside experts is to be performed in the event that regulatory personnel are not available. At a minimum, systems audits will occur annually. EMS Heritage Laboratories will welcome any external audit from an organization which currently or proposes to submit samples for analysis.

14.2.2 Internal Systems Audits

In order to verify that each laboratory division is performing according to the standards established by EMS Heritage Laboratories, Inc., an internal audit system has been established. Internal systems audits will be conducted no less frequently than annually. The auditor will be appointed by and directly responsible to the President of the corporation.

The President may appoint for any given audit the following staff:

1. Quality Assurance Officer
2. Quality Assurance Unit
3. Outside (Contracted) Auditor

EMS Heritage also encourages the individual groups at each division to perform a self-audit at periodic intervals to assess their overall operation.

These audits will be scheduled by the auditor and each laboratory director. All reports relating to internal systems audits will be treated as an internal document only; release to any outside entity will be only upon approval of the President of EMS Heritage.

To facilitate the procedure and make it consistent from division to division, a set of audit procedures and protocols has been developed and will be used consistently throughout the corporation. These forms will be used as a guideline and a tool for documentation of problems and to assure that all important areas are covered. The forms are not an end in themselves and will be subject to change/improvement by the QAO at his discretion in order to facilitate and improve the auditing process. Refer to Appendix G, Internal Systems Audit Forms.

14.2.3 Internal Systems Audits - Procedures and Protocols

Not all areas (service groups) will necessarily be audited during each visit. During each audit, at least one analytical run will be randomly selected from the service group(s) chosen. This run will be thoroughly checked using the audit checklist forms and any other pertinent audit questions.

Upon completion of the audit, the auditor will conduct an exit interview with the QA Unit and the Laboratory Director and any other personnel deemed appropriate. A copy of the completed audit forms as well as any supporting narrative will be given to the QA Unit and the Laboratory Director at that time or immediately upon completion. A copy of all of these materials will also be sent to the President, Vice President of Operations, Quality Assurance Officer and all QA Units of all EMS Divisions. This sharing of audit information with all divisions is to provide not only a report of findings but will also serve to point out potential deficiencies which may exist at the respective divisions not audited. The auditor will retain a copy of the materials to use in the next audit. The QAO will confer with the President to prioritize items for the next audit.

Generally the audit will consist of the auditor reviewing with the group leader and the analyst all the steps involved in generating a run of reportable data. It will also include an overview of the entire lab, address issues relevant to the operation as a whole (i.e. cooler logs, log-in procedures, oven logs, etc.) Any deficiencies will be noted on the forms. Deficiencies will be discussed at the time they are noted and the auditor will explain what will be required to correct this deficiency.

Form 1 will always be completed. It addresses general laboratory practices. Form 2 will be completed during each audit for each service group audited. Forms 3-5 will be used on a service group specific basis only.

TABLE 14.1
REFERENCE MATERIALS AND
PERFORMANCE EVALUATION PARTICIPATION

Source	Type	Frequency	Parameters	Division
APG	Unknowns	Monthly	All	All
EPA-WP	Unknowns	Semi-Annually	All	All
EPA-WS	Unknowns	Semi-Annually	All	All
North Carolina-Wastewater	Unknowns	Semi-Annually	Metals, General Chemistries	Charlotte
State of New York	Unknown	Quarterly	All	Indianapolis
State of New Jersey	Unknown	Semi-Annually	All	Indianapolis
EPA Reference	Known	On-Going	All	All
APG	Known	On-Going	All	All
NIST	Known	On-Going		All
EPA QB-Inorganics	Unknown	Quarterly	Metals	Indianapolis
EPA QB-Organics	Unknown	Quarterly	Organics	Indianapolis
Chemical Waste Management	Unknown	Quarterly	All	Indianapolis, Chicago
State of Illinois	Unknown	Yearly	All	Chicago

15.0 Quality Assurance Reports

For each division, by the last day of the month following the completion of each fiscal quarter the Quality Assurance Unit (QAU) will provide information as required to the Quality Assurance Officer (QAO), who will, in turn, compile and summarize the information to the President, the Vice President of Operations and the Laboratory Directors. QA reports will consist of but not be limited to the following points:

15.1 QCTS Review

A statement that the QAO has reviewed the precision, accuracy and method detection limits data for the previous quarter in the QCTS data base. Included in this statement will be:

1. A listing of outliers - Parameters for which data quality objectives have not been met. Parameters for which MDLs must be evaluated.

2. A brief narrative discussing the course of action to be taken to correct deficiencies identified above.

15.2 Correction of Deficiencies

A statement that the laboratory has corrected or has begun to correct deficiencies identified in the previous quarter's QA report. Included in this statement will be:

1. A brief narrative describing what was done.

2. A brief narrative describing what is yet to be done.

15.3 Performance and Systems Audits Summary

In addition, on a monthly basis the President, Vice President of Operations and the Lab Directors will be supplied with the results of all performance and systems audits most recently completed. Results of EPA WS and WP series samples will be provided to the President, the Vice-President of Operations and Lab Directors as they are received. The forms in Figures 15.1 and 15.2 to this part will be used.

15.4 Significant Problems and Solutions

Significant QA/QC problems and recommended solutions will be reported to the President on a timely basis.

15.5 Outside Reporting

Whenever regulatory authorities require submission of QA reports, such reports will be submitted to the appropriate QA officers of those agencies at a frequency prescribed by those agencies (e.g. quarterly).

FIGURE 15.1
APG RESULTS SUMMARY

Month _____

Year _____

Deviation from Means of Reporting Labs	Chemistries	General	Metals	GC	GC/MS
0 - 1.0Σ					
1.01 - 2.00					
2.01 - 3.00					
>3.00					
Total					

Values with deviation > 2.00							
Analyte	Value Rptd.	True Val.	% Recovery	Analyte	Value Rptd.	True Val.	% Recovery

N = _____

Deviation	N	%	Prev. Mo %	This Mo %
0 - 1.00				
1.01 - 2.00				
2.01 - 3.00				
3.01 - Outlier				

# of Outliers

FIGURE 15.2
EPA PERFORMANCE EVALUATION SUMMARY

Study # _____

Date Performed _____

Date Reported _____

% Acceptance/Group	Metals	General	GC/MS	GC
% Analytes Correct				
% Test Results Correct				
Number of Analytes				
Number of Tests				

List Unacceptable Results:

Analyte	Reported Value	True Value	% Recovery

SECTION 16.0

KEY RESUMES

List of Key Resumes

Name	Page #
[redacted]	7
	7
	5
	4
	14
	13
	2
	6
	8
	18
	16
	5
	1
	21
	21
	8
	23
	19
	4
	23
	3
	6
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	16
	3
	24
	13
	24
	1

FOIA Exemption 4

FOIA Exemption 4

[redacted]

FOIA Exemption 4

[redacted]

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FOIA Exemption 4

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FOIA Exemption 4

[redacted]

RESERVED

APPENDIX A

APPENDIX A
Selected References

Quality Control/Quality Assurance

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APPENDIX B

APPENDIX C

APPENDIX C
SAFETY ISSUES

MANDATORY SAFETY PROCEDURES & PRACTICES

This section is not meant as a comprehensive manual of safety practices, but only as a indicator of some of the important ones and how they are specifically applied at EMS. The Safety Officer is responsible for responding to any questions concerning safety procedures and policies.

SAFETY GLASSES

Approved protective eyewear must be worn by all EMS Heritage Personnel at all times in all laboratory areas. Laboratory areas include all areas with quarry tile flooring and all working areas in front of fume hoods and lab benches. Non-prescription safety glasses and goggles are available free of charge to all employees. Contact lenses are not recommended for use in the laboratory and are not considered protective. All visitors should be advised to wear eye protection and should be offered a pair of safety glasses to use during their tour of designated lab areas.

Failure of an individual to wear protective eye wear in a designated area will result in the forfeiture of the next payable QA bonus to that individual.

INSPECTIONS

Periodic inspections of all laboratory areas will be performed by the Safety Officer. Inspections will assess current operating procedures and practices. Recommendations for improvement may be made or immediate remedial action may be necessary. Results of these inspections will be discussed with the Group Leaders, the Chief Chemist and the personnel directly involved with the area of inspection.

SMOKING

No smoking is allowed in any marked laboratory area, the loading dock, common hallways or the restrooms. Smoking is permitted only in the conference room, in the breakroom at designated tables, and in a private office or office area. This policy applies to visitors as well. Any individual observed smoking in a restricted area will forfeit their next payable QC bonus.

FUME HOODS

Fume hoods must be used for all procedures involving concentrated acids, bases, and solvents. Fume hoods are maintained to deliver a face velocity of 100 fpm. When an individual is not working at the hood, the face glass should be closed. The glass curtain

should be raised only to the extent necessary for easy access. Protective eye wear must be used when working at or near a fume hood. Each hood is marked to indicate a maximum sash level for safe operation.

PROTECTIVE CLOTHING

Lab coats, gloves, and shoe covers are available for use by all EMS employees. Protective clothing should not be worn into non-laboratory areas since it may transfer hazardous material onto surfaces otherwise assumed to be clean.

It is recommended that a lab coat be worn in all laboratory areas to protect not only the individual but their clothing. Shoe covers are also recommended for procedures where splashing hazardous samples, or chemicals is probable.

Protective gloves should be used for procedures involving: handling hazardous waste samples; handling hot or cold materials; handling acids, solvents, or bases. Gloves should be made of a material which is impervious to the hazardous nature of the substance being handled.

General Lab Work - Natural Latex (Surgeons) Gloves.
Hot/Cold Work - Zetex, Leather or other non-flammable insulating material.
Acids - Nitrile, Neoprene
Bases - Neoprene, Nitrile
Solvents - Neoprene, Nitrile, Viton
Alcohol - Neoprene, Nitrile

Long hair must be tied back to avoid hazards such as fire and chemical contact.

FIRE/FIRE EXTINGUISHERS

Fire extinguishers are highly visible and located at all EMS Heritage locations. All extinguishers are type ABC or Halon. ABC extinguishers may be used on paper trash and wood, burning liquids, and electrical equipment. It is recommended however, that Halon be used on electrical fires particularly in computers or instruments. A commercial safety service checks and maintains the fire extinguishers. Powder for extinguishing flammable metal fires is available in the safety cabinet. (See Evacuation Memo)

CLEANLINESS

A very important part of safety is good housekeeping. This includes:

1. Maintaining an organized work area.
2. Cleaning up every spill immediately, even water.

3. Keeping small objects off the floor and large objects out of traffic paths, particularly exit ways.
4. Returning unused chemicals, glassware, or equipment to its proper storage area.
5. Disposing of waste (chemicals, napkins, tongue blades, pipets) in the proper container.
6. Disposing of broken glassware immediately in the proper containers.
7. Do not place contaminated chemical transfer utensils on the bare countertop.

SPILL CLEANUP

Spills must be cleaned up immediately after they happen. Even a water spill should be removed. Special kits are available for neutralizing and absorbing various liquid spills for disposal. These kits are located in the safety cabinet. If in doubt as to the type of spill, inform the Safety Officer; always assume the worst. Ask the Safety Officer when in doubt as to the proper method for cleanup or disposal. Chemicals should never be reused following a spill. Dry chemicals should be treated with as much caution as liquids. Many times, special equipment may be necessary (i.e. respirators, splash suit, caution signs, etc.) and should be used. If in doubt as to the safety equipment required for a particular spill, consult the Safety Officer.

REPORTING ACCIDENTS

All accidents no matter how small must be reported to the Safety Officer and the Group Leader. In some cases a form may need to be filled out describing the situation and result. If medical attention is indicated, the Safety Officer may direct the individual to the emergency care center or to a hospital.

COMPRESSED GASES

All gas cylinders must be affixed to an immobile surface when in use. All cylinders must be transported with the protective valve cap in place. Cylinders in storage must be chained to the wall or placed in the protective cage. Empty cylinders should be segregated from full cylinders for easy access during exchange. Flammable gases must be segregated from oxidizers and non-flammable gases (this includes 'empty' tanks). Empty cylinders should be marked as such.

COMMON PROCEDURES

1. Always add acid to water, never water to acid.
2. Never pipet by mouth, use a suction bulb.

3. Never store food or drink in a sample cooler
4. Never eat in the laboratory, use the breakroom.
5. Always lubricate glass tubing before inserting in stopper.
6. Always dispose of waste properly, consider the janitor.
7. Keep balance and balance area clean.
8. Always read the label and MSDS.
9. Always report accidents to the Safety Officer.
10. When in doubt about an element of Safety - ASK QUESTIONS
11. All sample and chemical containers are to be closed overnight.

SAFETY SHOWERS/EYE WASH

Safety showers should always be used in instances of gross contamination of clothing or skin. The eye wash should always be used when foreign matter is introduced into or around the eye. The safety shower and eye wash stations are periodically checked and maintained. Operation of the safety shower includes disrobing from the contaminated clothing and rinsing for at least 15 minutes. The eye wash should be used at least 15 minutes and contact lenses should be removed as soon as possible.

CHEMICAL HANDLING/STORAGE

Read the label and MSDS on each and every chemical used. The safety related item which should be understood are: Fire Hazard, Health Hazard, Reactivity Hazard, Protective Equipment, Disposal, Storage, and First Aid. If the chemical is used in making a stock solution, clearly label the new container with the date, analysts initials, expiration date, contents and any other pertinent information. Never use anything from an unlabeled container. Follow the storage recommendations. Flammables always go in an approved container and storage cabinet. Acids always go in an acid storage cabinet. Incompatible chemicals should not be stored together. Large quantities of chemicals should not be 'pigeon holed' at work locations. Properly dispose of and reorder chemicals found to be past their expiration date. Transport chemicals in protective containers if breakage is a possibility. Keep chemical containers clean with tight fitting lids and readable labels. In disposing of chemicals, samples, damaged equipment or expendable materials consider the potentialities of the action (eg. incompatible waste, exposure to the janitor).

FIRST AID

First aid kits are maintained by a commercial first aid company. Any of the materials in these kits may be used to self treat minor accidents or common ailments. All accidents, no matter how small, must be reported to the Group Leader and the Safety Officer. The instructions and labels on all medications and materials should be read and understood by the user prior to application or use. A Red Cross first aid manual is available for reference in the safety cabinet.

SAFETY CABINET

All safety related supplies are maintained in a dedicated cabinet centrally located in the laboratory. The contents includes; fire extinguishers; respirators; spill clean up kits; gloves; splash suits; shoe covers; safety manuals; and material safety data sheets (MSDS).

These items are regularly inventoried, however, all destructive uses of these items should come to the attention of the Safety Officer. All items should be replaced after use and not stored elsewhere in the laboratory. Any items routinely necessary for specific procedures should be obtained and stored separately near the area in which they are used.

EATING/DRINKING IN LAB

No eating is allowed in any laboratory area. Drinking is not recommended. Never store food or beverages in a cooler/refrigerator used for incubation, chemical or sample storage.

ALCOHOL/DRUG USE

No person under the influence of alcohol or drugs will be allowed to work in any laboratory area. Such an individual may be subject to disciplinary action which may include termination. Any individual who is required to take a prescribed medication which might affect his/her judgement should inform the Safety Officer so that non-laboratory work can be assigned.

VISITOR AREAS

We want to show off the lab in a safe and efficient manner. In general, visitors should be restricted to the hallways and non-quarry tile areas. Viewing windows are available and should be used. Anyone wishing to tour inside the lab should make prior arrangements with the Chief Chemist or the Safety Officer. Visitors should always be supplied with safety glasses/goggles. Visitors must be accompanied on tours, not only for their safety but to maintain confidentiality.

EVACUATION PROCEDURES

In case evacuation of the building is necessary, because of fire, chemical spill, or other emergency, the person discovering the accident should page "70" and inform all occupants to evacuate the building and the source or location of the accident. The Chief Chemist or designee will make an accounting of all personnel outside while the Safety Officer or designee will assure the proper authorities are notified.

MATERIAL SAFETY DATA SHEETS

Material safety data sheets are maintained for each chemical used in the lab. These sheets provide information on handling, disposal, spill cleanup, health hazards, physical/chemical data and safety measures. The MSDS should be consulted by the analyst prior to using any new or unfamiliar chemical. Each analyst should be familiar with the major hazards of each

chemical they work with (flash point, contact hazard, etc.) The MSDS manual is kept in the safety cabinet and should be returned after each use. Each chemical supplier is required to provide a MSDS with each chemical shipped.

WORKING AFTER HOURS

Employees working after business hours or on weekends must inform their Group Leaders of when and for how long they will work. Procedures requiring the use of concentrated acids, bases or solvents should be avoided by individuals working alone.

CONTAMINATION CONTROL

All sample and chemical containers must be closed using screw top lids, ground glass stoppers, or a similar device and not allowed to stand open overnight. Before disposal all materials (rags, towels, etc.) used to clean up volatile solvent spills should be kept in an open container in a working fume hood until all traces of the solvent have evaporated. All utensils (spoons, spatulas, pipets, etc.) used to transfer materials should be cleaned weekly or as needed. All reasonable measures should be taken to avoid environmental contamination.

Soiled lab coats should be exchanged for clean coats frequently and once used should not leave the laboratory area. Soiled lab coats should be stored in the proper hamper. Personal items (coats, etc.) should not be taken into the lab areas.

APPENDIX D

APPENDIX D
DEFINITIONS AND ACRONYMS

ABSORBANCE - a measure of the decrease in incident light passing through a sample into the detector. It is defined mathematically as:

$$A = \frac{I(solvent)}{I(solution)} = \log\frac{Io}{I}$$

Where, I = radiation intensity

ACCURACY - The closeness of agreement between an observed value and an accepted reference value. When applied to a set of observed values, accuracy will be a combination of a random component and of a common systematic error (or bias) component.

ALIQUOT - a measured portion of a field sample taken for analysis.

ANALYSIS - a specific test applied to a specific sample.

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), preparation blank (PB) and linear range analysis sample (LRS).

ANALYTICAL SET - the basic unit for analytical quality control. Also known as sample set or analytical batch. The analytical set is defined as samples which are analyzed (or sampled together) with the same method sequence, the same lots of reagents and with the same treatment common to all samples. The samples must have been analyzed (or collected) within the same specified time period or in continuous sequential time periods. Samples in each set should be of similar composition (same matrix).

ANALYTICAL SPIKE - a post-digestion spike. The addition of a known amount of standard after digestion/extraction.

AUDITS - A systematic check to determine the quality of the operation of some function or activity.

> Performance Audits: Quantitative data are independently obtained for comparison with routinely obtained data in a measurement system. Examples of these audits are EPA performance evaluation programs, commercial performance evaluation programs, split sampling program involving at least two laboratories, blind spike samples.
> Systems Audit: These are qualitative in nature and consist of an on-site review and evaluation of a laboratory or field operations quality assurance system and physical facilities for sampling calibration and measurements.

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.

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 which behave similarly with respect to the procedures being employed and which are processed as a unit from a specific client that are submitted on the same day and are of the same matrix. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch. Also known as a "case".

BIAS - the deviation due to matrix effects of the measured value (x_s - x_u) from a known spiked amount. Bias can be assessed by comparing a measured value to an accepted reference value in a sample of known concentration or by determining the recovery of a known amount of contaminant spiked into a sample (matrix spike). Thus, the bias (B) due to matrix effects based on a matrix spike is calculated as:

$$B = (x_s - x_u) - K$$

where:

x_s = measured value for spiked sample
x_u = measured value for unspiked sample, and
K = known value of the spike in the sample.

Using the following equations yields the percent recovery (%R). The value of %R may be used to correct the measured values for that batch of data. Thus,

$$\%R = 100\ (x_s - x_u) / K$$

and

$$x_c = 100\ (x_u / \%R)$$

where x_c = corrected value.

Correction for bias may be applicable <u>except</u> when the recovery of the analyte is between 80% to 120%, when using bias correcting methods (e.g. isotope dilution), or when recovery is greater than 100%. In some cases, when the uncorrected concentration is above a regulatory threshold bias correction is not needed. The measured value will be considered the minimum amount present. In all other cases correction for bias may be used. Bias correction will only be applied when required by regulation.

BLANKS - an artificial sample of an analytical matrix designed to monitor the introduction of artifacts into the system.

a. <u>Field Quality Control Blanks</u>

1. <u>Field Blanks</u>: Blanks of analyte free water that are prepared <u>on-site</u> by filling appropriate sample containers with the water, adding appropriate preservatives, sealing the containers, and completing the appropriate documentation. These blanks should be prepared during the middle to end of a sampling event by filling sample containers with water from the equipment decontamination water transport containers. They are to be treated, stored, transported, and analyzed in a same manner as the sample group for which it was intended. These blanks may be submitted for all water parameter groups.

2. <u>Equipment Blank</u>: Blanks of analyte-free water that are prepared <u>on-site</u> by pouring the equipment decontamination water through decontaminated field equipment. Appropriate sample containers, for each analyte group must

be used, preservatives added, if required, and appropriate documentation must be completed. These blanks are to be stored, transported and analyzed with the intended parameter groups. At least one equipment blank is required for each water and solid matrix analytical group, and must be collected at the beginning of the sampling episode. If field decontamination is performed on-site, additional equipment blanks must be submitted for all water and solid matrix analytical groups.

3. Trip Blank: These blanks are required only for water samples for VOCs. Blanks of volatile organic free water are prepared by the organization that is providing the sample containers. These are transported to the site with the empty VOC sample containers, and shipped to the analyzing laboratory in the same containers as the VOC samples. They remain unopened for the entire trip. Proper labeling and documentation must be completed. A trip blank must be submitted for each cooler that transports VOC samples.

b. Laboratory

1. Method Blank: A blank of an appropriate analyte-free matrix that is processed (digested, extracted, etc.) and analyzed with a specified sample set (See BLA02, BLA01).

2. Reagent Blank: An aliquot of analyte-free water or solvent that is analyzed with a sample set. (See BLA01).

CALIBRATION - process by which the correlation between instrument response and actual value of a measured parameter is determined.

a. Calibration Curve: a curve which plots the concentration of known analyte standards against the instrument response to the analyte. Also known as a Standard Curve.

b. Calibration Standard: Solutions or dilutions of a substance or material with a verifiable accuracy which are used to evaluate the sample property of an unknown sample. In analytical terms, these standards are used to establish a calibration curve or standard instrument response factors.

c. Continuing Calibration Standard: Standards that are analyzed during an analytical set to verify the accuracy of the calibration curve.

d. Internal Standard: a compound having similar chemical characteristics to the compounds of interest but which is not normally found in the environment or does not interfere with the compounds of interest. A known and specified concentration

of the standard is added to each sample prior to analyses. The concentration in the sample is based on the response of the internal standard relative to that of the calibration standard and the compound in the standard.

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.

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act ("Superfund").

CLP - Contract Laboratory Program (USEPA).

CHARACTERIZATION - a determination of the approximate concentration range of compounds of interest used to choose the appropriate analytical protocol.

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, if performed or the client's designation.

CONTINUING CALIBRATION - analytical standard run at a specified frequency to verify the 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 a contract Statement of Work. Equivalent to Contract Required Quantitation Limit (CRQL).

CONTROL LIMITS - a range within 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.

CONTROL SAMPLE - a QC sample introduced into a process to monitor the performance of the system.

CONFIDENCE LEVEL - the statistical probability associated with an interval of precision (or accuracy) values in a QC chart. The values of confidence intervals are generally expressed as percent probability. It is a commonly accepted convention that the result being tested is significant if the calculated probability is greater than 90 percent, and is highly significant if the probability is greater than 99 percent.

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.

CWA - Clean Water Act.

DATA QUALITY - the totality of features and characteristics of data that bears on its ability to satisfy a given purpose. The characteristics of major importance are accuracy, precision, completeness, representativeness, and comparability. These characteristics are defined as follows:

a. Accuracy - the degree of agreement of a measurement (or an average of measurements of the same thing), X, with an accepted reference or true value, T, usually expressed as the difference between the two values, X-5, or the difference as a percentage of the reference or true value, 100 (X-T)/T, and sometimes expressed as a ratio, X/T. Accuracy is a measure of the bias in a system.

b. Precision - a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation. Various measures of precision exist depending upon the "prescribed similar conditions."

c. Representativeness - expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

d. Comparability - expresses the confidence with which one data set can be compared to another.

DATA QUALITY OBJECTIVES - a set of specifications that the environmental data must meet in order to be acceptable for its intended use in a program area. DQOs are commonly established for limits of detection and quality of data (precision, accuracy, representativeness and comparability).

DETECTION LIMITS - The smallest concentration/amount of an analyte of interest that can be measured with a stated probability of significance. Detection limits must be further defined as:

a. Method Detection Limit - the smallest concentration of an analyte of interest that can be measured and reported with 99 percent confidence that the concentration is greater than zero. The MDLs are determined from the analysis of a sample in a given matrix containing the analyte at a specified level. Determination of MDLs must be done by procedures determined in Appendix B of 40 CFR, part 136. Equivalent procedures to determine MDLs must be approved by the applicable regulatory agencies. Note: Reporting results at the MDL may result in a relative uncertainty of the result of greater than ± 100%.

b. Practical Quantitation Limit - the smallest concentration of an analyte of interest that can be reported with a specific degree of confidence. PQLs shall be determined in the same way as MDLs by using the procedures outlined in Appendix B of 40 CFR, Part 136. The standard deviation (sd) derived from the procedures will be used to calculate the PQL: PQL = 10 sd which corresponds to an uncertainty of ± 30 percent in the measured value at the 99 percent confidence level. Also known as the "Reporting Detection Limit" or the Limit of Quantitation (LOQ).

INSTRUMENT DETECTION LIMIT - the smallest amount of an analyte of interest that generates an instrument response (signal) under prescribed conditions such that the magnitude of the signal is larger than the absolute uncertainty (error) associated with it. IDLs are determined by multiplying by 3.143 (3.0 for CLP) the average standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of 3x-5x the estimate of the IDL on three nonconsecutive days with seven consecutive measurements per day (compute the standard deviation for each day, then average the standard deviations).

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.

$$\textit{Dry Weight} = \textit{Wet Weight Basis} \times \frac{100}{D}$$

$$\textit{Where } D = \textit{Total Solids, \%.}$$

DUPLICATE (LAB) - a second aliquot of a sample that is treated the same as the original sample in order to determine the precision of the method. Also known as a laboratory

replicate (See DUP01 and DUP02, Replicate Sample, Matrix Spike Duplicate, Field Duplicate).

ENVIRONMENTAL SAMPLE - any sample from a natural source or sources that reasonably may be expected to contribute pollution to or receive pollution from ground waters or surface waters. This includes, but is not limited to: receiving waters; waters used to define natural background conditions; soils; sediments; industrial, domestic or municipal discharge effluents; chemical storage or handling facilities; waste disposal facilities or areas; industrial or agricultural chemical handling or application areas; surface water run-off; and facilities for handling or applying of chemicals for weed or insect control.

EPA - Environmental Protection Agency (USEPA)

EQUIPMENT BLANK - see Equipment Rinsate.

EQUIPMENT RINSATE - a sample of the media which has been used to rinse the sampling equipment. The media used for rinsing is acceptable if the concentration of any analyte of concern in the media is no higher than the highest of either:

a. the detection limit, or

b. five percent of the regulatory limit for that

c. five percent of the measured concentration in that

It is collected after completion of decontamination and prior to sampling. This blank is useful in documenting adequate decontamination of sampling equipment.

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 DUPLICATES - independent samples which are collected as close as possible to the same point in space and time. They are two separate samples taken from the same source, stored in separate containers, and analyzed independently. These duplicates are useful in documenting the precision of the sampling process.

FIFRA - Federal Insecticide, Fungicide, and Rodenticide Act.

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.

HOMOGENEITY - the degree to which a property or substance is randomly distributed throughout a material. Homogeneity depends on the size of the units under consideration. Thus, a mixture of two minerals may be inhomogeneous at the molecular or atomic level, but homogeneous at the particulate level.

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 an EMS Heritage laboratory 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 instrument 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.

INTERFERENTS - substances which affect the analysis for the element of interest.

INTERNAL STANDARDS - in-house compounds added at a known concentration.

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 inventory's facility, as recorded on the shipper's delivery receipt and sample Traffic Report. Also referred to as VTSR (validated time of sample receipt).

LABORATORY SAMPLE - a sample, intended for testing or analysis, prepared from a gross sample or otherwise obtained. The laboratory sample must retain the composition of the gross sample. Often reduction in particle size is necessary in the course of reducing the quantity.

LINEAR RANGE, LINEAR DYNAMIC RANGE - the concentration range over which the analytical curve remains linear.

LOT - a quantity of bulk material of similar composition whose properties are under study.

MATRIX - the predominant material of which the sample to be analyzed is composed. Matrix is not synonymous with phase (liquid or solid).

MATRIX DUPLICATE - an intralaboratory split sample which is used to document the precision of a method in a given sample matrix.

MATRIX MODIFIER - salts used in AA to lessen the effects of chemical interferents, viscosity, and surface tension.

MATRIX SPIKE - an aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

MATRIX SPIKE DUPLICATES - Intralaboratory split samples spiked with identical concentrations of target analyte(s). The spiking occurs prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.

MCL - Maximum Contaminant Level (regulatory level).

METHOD BLANK (previously termed reagent blank) - an analytical control consisting of all reagents, internal standards and surrogate standards, that is carried through the entire analytical procedure. The method blank is used to define the level of laboratory background and reagent contamination.

METHOD DETECTION LIMIT (MDL) - The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte. See Detection Limits.

For operational purposes, when it is necessary to determine the MDL in the matrix, the MDL shall be determined by multiplying the appropriate one-sided 99% t-statistic by the standard deviation obtained from a minimum of three analyses of a matrix spike containing the analyte of interest at a concentration three to five times the estimated MDL, where the t-statistic is obtained from standard references or the table below.

No. of samples:	t-statistic
3	6.96
4	4.54
5	3.75
6	3.36
7	3.14
8	3.00
9	2.90
10	2.82

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 spectral effects. Also referred to as Full Method of Standard Additions (3-Point MSA).

METHOD OF STANDARD ADDITIONS, SINGLE ADDITIONS - the simplest version of MSA is the single-addition method, in which two identical aliquots of the sample solution, each of Volume V_x, are taken. To the first (labeled A) is added a small volume V_s of a standard analyte solution of concentration c_s. To the second (labeled B) is added the same volume V_s of the solvent. The analytical signals of A and B are measured and corrected for nonanalyte signals. The unknown sample concentration c_x may be calculated as follows:

$$c_x = \frac{S_B V_s c_s}{(S_A - S_B)\ V_x}$$

where S_A and S_B are the analytical signals (corrected for the blank) of solutions A and B, respectively. V_s and c_s should be chosen so that S_A is roughly twice S_B on the average. It is best if V_s is made much less than V_x, and thus c_s is much greater than c_x, to avoid excess dilution of the sample matrix. If a separation or concentration step is used, the additions are best made first and carried through the entire procedure.

m/z - Mass to charge ratio, synonymous with "m/e", used in mass spectrometry

NARRATIVE (SDG Case Narrative) - a portion of a 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.

NPDES - National Pollutant Discharge Elimination System (regulated under the CWA).

ORGANIC-FREE REAGENT WATER - For volatiles, all references to water in the methods refer to water in which an interferant is not observed at the method detection limit of the compounds of inters. Organic-free reagent water can be generated by passing tap water through a carbon filter bed containing about 1 pound of activated carbon. A water purification system may be used to generate organic-free deionized water. Organic-free reagent water may also be prepared by boiling water for 15 minutes and, subsequently, while maintaining the temperature at 90°C, bubbling a contaminant-free inert gas through the water for 1 hour.

For semivolatiles and nonvolatiles, all references to water in the methods refer to water in which an interferant is not observed at the method detection limit of the compounds of interest. Organic-free reagent water can be generated by passing tap water through a carbon filter bed containing about 1 pound of activated carbon. A water purification system may be used to generate organic-free deionized water.

PARAMETER GROUP - Is defined as a group of samples that have been preserved in the same manner, prepared by similar protocols and analyzed using instruments of similar technology (also known as analyte group). Examples of parameter groups are:

Volatiles (EPA methods 601, 602, and 624)
Pesticides (EPA methods 608, 614, 622)
Trace Metals (All metals except mercury)
Nutrients (Total Kjeldahl Nitrogen, Nitrate ± Nitrite, Total Phosphorous)

PERCENT SOLIDS - the proportion of solid in a sample determined by drying an aliquot of the sample.

PERCENT DIFFERENCE (%D) - As used in this QAP and elsewhere 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 below).

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.

PERFORMANCE EVALUATION SAMPLES - A sample submitted for analysis whose composition and concentration are known to the submitter but unknown to the analyst. Also known as a Blind Sample.

PRECISION - the agreement among a set of replicate measurements without assumption of knowledge of the true value. Precision is estimated by means of duplicate/replicate analyses. These samples should contain concentrations of analyte above the MDL, and may involve the use of matrix spikes. The most commonly used estimates of precision are the relative standard deviation (RSD) or the coefficient of variation (CV),

$$RSD = CV = 100\ S/\bar{x},$$

where $\bar{x}$ = the arithmetic mean of the x_i measurements, and s = variance; and the relative percent difference (RPD) when only two samples are available.

$$RPD = 100\ [(x_1 - x_2)/(s_1 + x_2)/2].$$

PREPARATION BLANK (regent blank, method blank) - an analytical control that contains distilled, deionized water and reagents, which is carried through the entire analytical procedure (digested 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.

PROJECT - single or multiple data collection activities that are related through the same planning sequence.

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.

QUALITY ASSURANCE - a system of activities whose purpose is to provide the producer or user of environmental data the assurance that it meets defined standards of quality with a stated level of confidence.

QUALITY ASSURANCE PLANS (QAP) - an orderly assembly of detailed and specific procedures which delineates how data of a known and accepted quality is produced.

a. Comprehensive Quality Assurance Plan (CompQAP) - a QA plan that outlines all the capabilities of the specified organization, the routinely used quality control measures, the routine QA targets for precision and accuracy, and all documentation, calibration and maintenance activities that are necessary to produce data of a known and acceptable quality.

b. Quality Assurance Project Plans (QAPP) - a QA plan that is written for a specific project outlining specific QA targets and data quality objectives as well as all protocols and QC measures needed to meet the project specific objectives.

c. Research Quality Assurance Plans (RQAP) - a special type of Quality Assurance Project Plan that is generally written as a requirement of a direct contract with the Florida DER for research activities. The specific activities are defined in section 6.0 of the guidelines. The content and format requirements are different from those of any other QAP.

QUALITY CONTROL - the overall system of activities whose purpose is to document and control the quality of environmental data so that it meets the needs of the users.

A. Quality Control Checks - standards of samples from an independent source that are analyzed at a specified frequency.

1. Quality Control Check Standards - standard solutions from a source other than normal calibration standards that are certified and traceable. These standards are used to check the accuracy of a calibration curve.

2. Quality Control Check Sample (also known as Reference Materials) - samples obtained from an independent source for which the level(s) of analytes have been validated. These samples are prepared and analyzed with a sample set of similar matrix. If these samples have been obtained from the National Institute of Standards and Testing (formerly National Bureau of Standards), these are referred to as Standard Reference Materials.

B. OCTS - Quality Control Tracking System - the computerized system at EMS Heritage Laboratories, Inc. utilized to contain, compile and report quality control data.

1. Quality Control Types

a. BLA01 - Reagent blank, calibration blank.

An aliquot of de-ionized (DI) water containing the same reagents as the sample but is NOT taken through preparation. This sample is used as the calibration zero concentration for initial calibration purposes. The BLA01 is analyzed as a sample as frequently as required in the QAP. The BLA01 can be used to re-zero only after it has been analyzed as a sample. Instrument response is entered on bench sheets. If the instrument response is above the Control Limit when the BLA01 is run as a sample and calculated as a concentration, the samples back to the last acceptable BLA01 must be re-analyzed. If BLA01 is 0.5-0.99 of IDL, the concentration may be entered into the data base. Otherwise, enter less than 0.4X IDL. Entries into the data base MUST BE CONSISTENT, e.g., either instrument response OR concentration NOT both, and must have units reported.

b. BLA02 - Method Blank or Preparation Blank.

Same as above but is carried through the complete steps of analysis from digestion/extraction/etc. in the exact same manner (e.g., same glassware, reagents, storage bottle) as the sample. BLA02 is matrix specific and must be run with each matrix and each prep run. A prep run consists of only 1 analyst on 1 day, utilizing the same reagents and glassware. Subtraction of the method blank is addressed by each method. A general rule applies to the BLA02: If the BLA02 is equal to or exceeds the method detection limit (MDL), samples in that group must be re-prepped. Therefore a BLA02 must be run with each sample set. Instrument response is recorded on bench sheets, but concentration is entered into the QC data base in all cases. If BDL, entered <0.4X IDL into the QC data base.

c. CAL01 - Calibration Standard.

Calibration standards (the number and frequency of which are specified in each method) are used to establish an analytical curve for that analyte based on absorbance, emission intensity, area or other type of measurable response for known standards. CAL01, CAL02, CAL03, etc., are prepared using exactly the same reagents used in the analysis of the sample. Note that some methods require a CDL standard be included as a CAL standard.

d. CCV - Continuing Calibration Verifications.

Analytical standard that is run with a frequency specified in the QAP - at a minimum frequency of 10% BUT may be alternated with ICV01

to meet the frequency requirements. The CCV may be from the same source as calibration standards or a different source depending on the method used. All runs must culminate with this sample's analysis except for GC/MS.

e. CDL01 - Contract Detection Limit Standard.

A reagent sample to verify analytes are quantifiable at the detection limit stated. The amount of analyte in this sample may be specified by a method, project, or client. In general, twice the analyte concentration of the regulatory detection line or CRDL is a good CDL01 amount. (Required weekly for drinking water organic analyses). Some methods mandate use of this standard for inclusion into the calibration curve.

f. DLCS - Duplicate Laboratory Control Sample (ICV02 or EPA supplied LCS).

Duplicate control sample of known analyte concentration and source analyzed by exactly the same method as the samples. DLCS must be of the same matrix as the samples but must be from a different source than the calibration standards (EPA or NIST traceable when possible). Results are expressed as % recovery and RPD. Also known as a "Laboratory Fortified Blank" when analytes are spiked into reagent water.

g. DLCS1 - Duplicate Laboratory Control Sample (ICV01 or EPA supplied LCS).

Duplicate control sample of known analyte concentration and source analyzed by exactly the same method as the samples. DLCS must be of the same matrix as the samples but must be from a different source than the calibration standards (EPA or NIST traceable when possible). Results are expressed as % recovery and RPD. Also known as a "Laboratory Fortified Blank" when analytes are spiked into reagent water. This "1" designation is a programming device used to indicate that no separable prep exists for the method.

h. DPS01 - Reagent Duplicate, Matrix Spike.

An aliquot of sample (water, oil, S/S/S) spiked with a known quantity of the analyte of interest - but added after preparation or if no preparation is involved in analysis of sample. The sample is split and

spiked with exactly the same amount of analyte. Results are expressed as Relative Percent Difference (RPD) or as required.

i. DPS02 - Duplicate Spike (Prepped).

Same as DPS01 but the sample is split in as representative a way as possible, spiked with equal amounts of the analyte, and carried through the preparation step(s). Results are expressed as RPD or as required.

j. DUP01 - Duplicate Sample Analysis (Non-prepped).

For samples not requiring digestion/extraction/etc., a homogeneous, representative aliquot (water, oil, S/S/S) is split and carried through the analytical steps to quantitation. Results are expressed as RPD.

k. DUP02 - Duplicate Sample Analysis (Prepped).

Same as DUP01 but split before any required preparation and carried through to quantitation exactly as its counterpart. Results are expressed as RPD.

l. ICV01 - Initial Calibration Verification.

This standard verifies the calibration curve, and this analyte must be from a different source as the calibration standards (EPA or NIST traceable when possible).

m. ICV02 - Initial Calibration Verification.

Same as ICV01 but added to the sample before any required preparation. May be equivalent to an LCS when reagent water is utilized as the spiking medium.

n. LCS - Laboratory Control Sample (ICV02 or EPA supplied LCS).

Control sample of known analyte concentration and source analyzed by exactly the same method as the samples. LCS should be of same matrix as samples (must utilize the same procedures) but must be from a different source that the calibration standards (EPA or NIST

traceable when possible). The LCS may be called a "QC Check Sample" or is also known as "Laboratory Fortified Blank" when analytes are spiked into reagent water.

o. LCS01 - Laboratory Control Sample (ICV01 or EPA supplied LCS).

Control sample of known analyte concentration and source analyzed by exactly the same method as the samples. LCS should be of the same matrix as samples (must utilize the same procedures) but must be from a different source than the calibration standards (EPA or NIST traceable when possible). Also known as a "Laboratory Fortified Blank" when analytes are spiked into reagent water. This "01" designation is a programming device used to indicate that no separable prep exists for the method.

p. SPI01 - Matrix Spike (Standard Addition).

A post digestion/extraction spike, or a method with no separable prep. An aliquot of homogeneous sample (water, oil, S/S/S) fortified (spiked) with a known quantity of specific compound(s) and carried through the analysis and quantitation steps. At least one spike per matrix and concentration must be analyzed per run or frequency specified by QAP or SOW.

q. SPI02 - Matrix Spike (Pre-digestion/extraction; prepped).

Same as a SPI01 but is used when preparations are required. Calculate as a percent recovery, unless a method or client specifies differently.

r. SUR01 - Surrogate Spike (Organic analyses only).

Surrogate standards are added to every blank, sample, LCS, MS, MSD, and standard to evaluate analytical efficiency by measuring percent recovery (unless specified to report recoveries differently). A representative sample is taken, surrogates added, analyzed, and quantitated. A SUR01 would not require preparation, or no separable prep exists for the method.

s. SUR02 - Surrogate Spike (Organic analyses only).

Same as SUR01 but surrogates are added before any preparation. Surrogates are unique compounds not normally detected in environmental samples.

RCRA - the Resource Conservation and Recovery Act.

REAGENT BLANK - see Method Blank.

REAGENT GRADE - analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER - water that has been generated by any method which would achieve the performance specifications for ASTM Type II water, and in which an interferant 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 QAP 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:

$$RRF = \frac{A_x}{A_{is}} \times \frac{C_{is}}{C_x}$$

Where

A = area of the characteristic ion measured

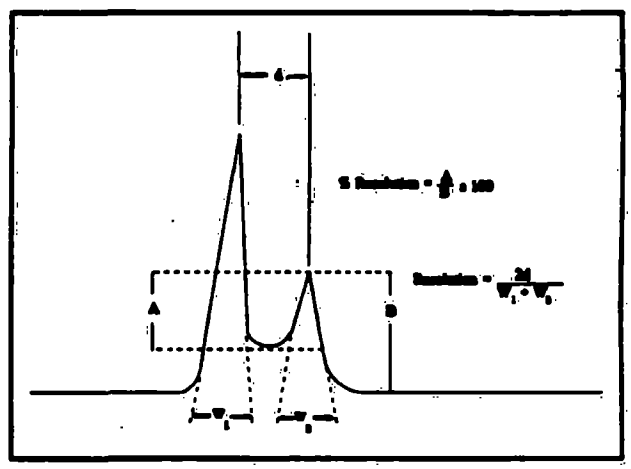
C = concentration

is = internal standard

x = analyte of interest

REPLICATE SAMPLE - samples that have been collected at the same time from the same source (field replicates) or aliquots of the same sample that are prepared and analyzed at the same time (laboratory replicates). Duplicate samples are one type of replicate sample. The analytical results from replicates are used to determine the precision of a system. If the concentration of analytes in the sample are below detectable limits, Duplicate Spike Samples may be used to determine precision. Blind Replicates (Duplicates) are replicates that have been collected (field replicate) or prepared (laboratory replicate) and are submitted and analyzed as separate samples (analyst does not know they are replicates).

RESOLUTION - percent resolution is 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 is determine taking 2 times the difference in elution times between two peaks and dividing that by the sum of the baseline peak widths of the two peaks.



RUN - a continuous analytical sequence consisting of prepared samples and all associated quality assurance measurements as required by the QAP.

SAMPLE - a portion of material to be analyzed that is contained in single or multiple containers and identified by a unique sample number.

a. Sample Custody - all records and documentation that is required to trace a sample from point of origin through disposal after analysis. These records must include, but are not limited to:

1. Field notebooks;

2. Field sample ID tags;

3. Laboratory transmittal forms (if applicable);

4. Laboratory sample receipt logs;

5. Sample extraction/preparation logs or worksheets;

6. Analytical (instrument) logs or worksheets;

7. Calibration and quality control data associated with a sample set;

8. Instrument maintenance logs;

9. Sample disposition logs; and

10. Final reports.

b. Legal Chain of Custody - is a special type of sample custody in which all events associated with a specific sample must be documented in writing. In addition to the records described above, chain of custody records must include the follows:

1. Sample transmittal forms or tags that have adequate spaces for the dated, original signatures of all individuals who handle the sample (or cleaned the sample containers if obtained from a contracted laboratory) from time of collection (or container receipt) through laboratory delivery.

2. Laboratory sample storage logs that identify date, time, and individuals who remove samples from storage.

3. Secure, limited access storage areas.

SAMPLE DELIVERY GROUP (SDG) - a unit within a sample Case that is used to identify a group of samples for delivery. An SDG is a group of 20 or fewer samples within a Case, received over a period of up to 14 calendar days. Data from all samples in an SDG are due concurrently. A Sample Delivery Group is defined by one of the following, whichever occurs first:

a. Case; or

b. Each 20 samples within a Case; or

c. 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 MATRIX - means that characteristic of an environmental or laboratory sample, associated with its physical and chemical properties, which defines how such a sample is handled when subjected to the intended analytical process. The following samples matrices (major matrix groups), as defined below, should be used in QA plans whenever specifying data quality objectives:

a. Reagent Water: A sample of water which conforms to ASTM grades II, III or IV.

b. Drinking Water: Includes finished (treated) or raw source water designated as potable water. Such sources may be from surface or groundwater.

c. Surface Water: Includes fresh or saline waters from streams, canals, rivers, lakes, ponds, bays and estuaries (natural or manmade).

d. Groundwater: Includes all waters found below ground in confined or unconfined aquifers.

e. Wastewater: Includes any influent or effluent associated with domestic or industrial waste treatment facilities.

f. Chemical Waste: Includes sludges and residuals from domestic or industrial wastewater processing, and liquid or solid chemicals that are no longer used for its intended purpose.

g. Soil/Sediment: Surface or subsurface soils and sediments of fresh or salt water origin.

h. Biological Tissue: Includes tissues of plant or animal origin. The most common of these are shellfish, finfish and aquatic plants.

i. Oils: Includes any oily matrix.

j. Solvents: Includes waste solvents.

SAMPLE NUMBER (Client Sample Number) - a unique identification number designated by the client for each sample. The Sample Number appears on the sample Chain of Custody which documents information on that sample.

SDWA - Safe Drinking Water Act.

SEMIVOLATILE COMPOUNDS - compounds amenable to analysis by extraction of the sample with an organic solvent. Used synonymously with Base/Neutral/Acid (BNA) compounds.

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.

SPLIT SAMPLES - aliquots of sample taken from the same container and analyzed independently. In cases where aliquots of samples are impossible to obtain, field duplicate samples must be taken for the matrix duplicate analysis. These are usually taken after mixing or compositing and are used to document intra-or interlaboratory precision, recognizing their limitations.

SPIKED SAMPLES - samples fortified to a known and validated concentration of analyte. Percent recoveries are calculated for each compound in the spike.

a. Field: An environmental sample fortified to a known and validated concentration in the field. These may be submitted as blind spike (laboratory does not know they are spiked) or as identified field spikes. The use of this QC check is not recommended.

b. Laboratory:

1. Reagent Spikes: Samples of an appropriate analyte-free matrix (deionized water, sand, soil, etc.) that are fortified to a known and validated concentration of analyte(s) before sample preparation (See LCS).

2. Sample (Matrix Spikes): Environmental sample selected from a set (not blanks) that are fortified to a known and validated concentration of analyte(s) before sample preparation. The concentration of each analyte in the spiking solution should be approximately 3-5 times the level expected in the sample (see SPI02, DPS02).

3. Surrogate Spikes: A compound having similar chemical characteristics to the compounds of interest, but which is not normally found in environmental samples. Known concentrations of these compounds are added to all samples in the set before sample preparation (see SUR01, SUR02).

STANDARD ADDITION - the practice of adding a known amount of an analyte to a sample immediately prior to analysis. It is typically used to evaluate interferences. See Method of Standard Additions.

STANDARD ANALYSIS - an analytical determination made with known quantities of target compounds; used to determine response factors.

STANDARD CURVE - a plot of concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by successively diluting a standard solution to produce working standards which cover the working range of the instrument. Standards should be prepared at the frequency specified in the appropriate section. The calibration standards must be prepared using the same type of acid or solvent and at the same concentration as will result in the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

STOCK SOLUTION - a standard solution which can be diluted to derive other standards.

SUBSAMPLE - a portion taken from a sample. A laboratory sample may be a subsample of a gross sample; similarly, a test portion may be a subsample of a laboratory SVOA sample.

SURROGATES (Surrogate Standard) - for semivolatiles 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 labelled compounds not expected to be detected in environmental media (see SUR01, SUR02).

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. Could also be known as surrogates.

TARGET COMPOUND LIST (TCL) - a list of compounds designated at the primary targets 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.

TEST PORTION (also called specimen, test specimen, test unit, aliquot) - that quantity of a material of proper size for measurement of the property of interest. Test portions may be taken from the gross sample directly, but often preliminary operations, such as mixing or further reduction in particle size, are necessary.

TIME - when required to record time on any deliverable item, time shall be expressed as Military Time, i.e., a 24-hour clock.

TRAFFIC REPORT (TR) - an EPA sample identification form filled out by the sampler, which accompanies the sample during shipment to the laboratory and which is used for documenting sample condition and receipt by the laboratory.

TRIP BLANK - a sample of media taken from the laboratory to the sampling site and returned to the laboratory unopened. The media used for the trip blank is acceptable if the concentration of any analyte of concern in the media is no higher than the highest of either:

a. The detection limit, or

b. Five percent of the regulatory limit for that analyte, or

c. Five percent of the measured concentration in the sample.

A trip blank is used to document contamination attributable to shipping and field handling procedures. This type of blank is useful in documenting contamination of volatile organics samples.

TWELVE-HOUR TIME PERIOD - the twelve (12) hour time period (when applicable) 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.

VALIDATED TIME OF SAMPLE RECEIPT (VTSR) - the date on which a sample is received at the Contractor's facility, as recorded on the shipper's delivery receipt and Sample Traffic Report.

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 0.32mm. Columns with lesser diameters are classified as narrow bore capillaries.

COMMON LABORATORY ACRONYMS AND ABBREVIATIONS

AA	Atomic Absorption
BDL	Below Detection Limit
BED	Below Estimated Limit of Detection
BTU	British Thermal Unit
CCC	Calibration Check Compound
CVAA	Cold Vapor Atomic Absorption
DL	Detection Limit
ECD	Electron Capture Detector (GC)
ELCD	Electrolytic Conductivity Detector
EP	Extraction Procedure
FAA	Flame Atomic Absorption
FID	Flame Ionization Detector (GC)
FPD	Flame Photometric Detector
FTIR	Fourier Transform Infra-Red
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
GFAA	Graphite Furnace Atomic Absorption
HOC	Halogenated Organic Compounds (Appendix III of 40 CFR Part 268)
ICP	Inductively Couple Plasma Atomic Emission Spectroscopy
IDL	Instrument Detection Limit
LIMS	Laboratory Information Management System
MDL	Method Detection Limit
mg/kg	Milligrams per Kilogram (ppm)
mg/L	Milligrams per Liter (ppm)
ND	Not Detected
NPD	Nitrogen Phosphorus Detector
OVA	Organic Vapor Analyzer
PCB	Polychlorinated Biphenyls
PID	Photoionization Detector
ppb	Parts per Billion
ppm	Parts per Million
PQL	Practical Quantitation Limits
QA/QC	Quality Assurance/Quality Control
SPCC	System Performance Check Compound
S/S/S	Soil/Sediment/Sludge

SVOC	Semivolatile Organic Compound
SVOA	Semivolatile Organic Analysis
SW-846	"Test Methods for Evaluating Solid Waste: Physical/Chemical Methods"
TCLP	Toxicity Characteristic Leaching Procedure
TOC	Total Organic Carbon
TOX	Total Organic Halogen
TSS	Total Suspended Solids
TTO	Total Toxic Organics
TX	Total Halogen
ug/kg	Micrograms per Kilogram (ppb)
ug/L	Micrograms per Liter (ppb)
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound

APPENDIX E

Job Description

PRESIDENT

QUALIFICATIONS

Position	Education	Experience
President	BS/BA Science	10 years

Other experience, advanced education and/or proven aptitude and performance may count for education or experience. Experience may include laboratory, regulatory or other related environmental or management experience.

DUTIES/RESPONSIBILITIES

Designate a Laboratory Director at each facility and replace as necessary.

Designate a Quality Assurance Officer and replace as necessary.

Assure that the VPO, QAO and Lab Directors clearly understand their functions and responsibilities.

Establish and revise company policies and operating procedures as necessary.

Approve the Quality Assurance Program (QAP) and the Chemical Hygiene Plan (CHP).

Job Description

VICE PRESIDENT OPERATIONS

Position	Education	Experience
VP Operations	BS/BA Science	7 years

DUTIES/RESPONSIBILITIES

Coordinate resources among locations to assure that personnel, facilities, equipment, and materials are known and available as required to produce data on time according to methods, SOP's, the QAP and client data quality objectives.

Coordinate resources among locations to assure that methods, SOP's, the QAP and the CHP are approved and followed. Assure that corrective action is taken in response to deviations when necessary.

Coordinate resources among locations to assure that appropriate and adequate training is provided and that training records are maintained.

Coordinate resources among locations to assure that laboratory waste is properly disposed.

Assure that all Laboratory Directors know, understand, and carry out their responsibilities. Communicate any deviations from policy to the President and assure any required corrective actions are taken.

Perform other duties as required or as needed.

LAB DIRECTOR/ASSISTANT LAB DIRECTOR

QUALIFICATIONS

Position	Education	Experience
Lab Director	BS/BA Science	7 years
Asst. Lab Director	BS/BA Science	5 years

Other experience, advanced education and/or proven aptitude and performance may count for education or experience. Experience may include laboratory, regulatory or other related environmental or management experience.

DUTIES/RESPONSIBILITIES

Assure that personnel, resources, facilities, equipment, and materials are known and available as required to produce data on time according to methods, SOP's, the QAP and client data quality objectives.

Assure that methods, SOP's, the QAP and the CHP are approved and followed. Assure that corrective action is taken in response to deviations when necessary.

Assure that analytical methods are as specified in the work plan. Maintain working knowledge of local, state and federal regulations as they relate to services performed by the lab.

Assure that appropriate and adequate training is provided and that training records are maintained.

Assure that raw data is appropriately archived.

Assure that laboratory waste is properly disposed.

Nominate a Quality Assurance Unit Director for approval by the QAO and the President.

Assure that the Quality Assurance Unit clearly understands their duties.

Assure that all laboratory personnel know, understand, and carry out their responsibilities.

Perform other duties as required or as needed.

Job Description

QUALITY ASSURANCE OFFICER

QUALIFICATIONS

Position	Education	Experience
QA Officer	BS/BA Science	7 years

Other experience, advanced eduction and/or proven aptitude and performance may count for eduction or experience. Experience may include laboratory, regulatory or other related environmental or management experience.

DUTIES/RESPONSIBILITIES

Assure the inspection of systems and operations for conformance to methods, SOP's, the QAP, regulations and client data quality objectives at all locations. Document and report the results of the inspections and any deviations from methods, SOP's, and the QAP quarterly to the President along with corrective actions taken.

Perform follow-up inspections, etc. to assure that corrective actions have been taken. Coordinate development and revision of the Quality Assurance Plan (QAP) as required.

Coordinate and document certifications by local, state, and federal regulatory authorities at all locations.

Provide technical support and training to Quality Assurance Units and staff on methods, SOP's, regulations and the QAP. Maintain working knowledge of local, state and federal regulations and quality technology as they relate to services performed by the lab and quality control.

Coordinate and supervise all Quality Assurance Units. Assure that the Quality Assurance Units know and understand their responsibilities at each location.

Assure that all QAP, method and SOP requirements are met prior to initiation of a new procedure.

Final authority to terminate or alter any incorrect or improper analytical or measurement procedure in order to conform to requirements of the QA Plan.

QUALITY ASSURANCE OFFICER (continued)

Assure coordination and documentation of internal and external audits and performance evaluation programs. Assure the coordination of responses to external QA audits or performance evaluations. Assure the development of responses to other QA questions.

Advise purchasing on the quality of materials, supplies and equipment.

Perform other duties as required or as needed.

Job Description

QUALITY ASSURANCE UNIT

QUALIFICATIONS

Position	Education	Experience
QA Unit	BS/BA Science	4 years

Other experience, advanced education and/or proven aptitude and performance may count for education or experience. Experience may include laboratory, regulatory or other related environmental or management experience.

DUTIES/RESPONSIBILITIES

Inspect systems and operations adequately and perform performance evaluation studies to assure conformance to methods, SOP's, the QAP, regulations and client data quality objectives. Audit data entry and other data management systems to assure accuracy and completeness.

Document and report to the Quality Assurance Officer and Lab Director results of inspections and any deviations from methods, SOP's, and the QAP along with suggested corrective action.

Review and accept or reject client specific QAP's. Maintain documentation trail of all methods, SOP's and QAP's.

Provide technical support and training to staff on methods, SOP's and the QAP. Maintain working knowledge of local, state and federal regulations and quality technology as they relate to services performed by the lab and the related quality assurance issues.

Document that all QAP, method and SOP requirements are met prior to initiation of a new procedure. Maintain records of detection limit studies.

Review the Certificate of Analysis and other data deliverables for conformance with methods, SOP's, client data quality objectives and the QAP. Respond to QA questions on Certificate of Analysis and other deliverables.

Coordinate and document internal and external audits and performance evaluation programs. Host and respond to QA audits or external performance evaluation studies.

Advise purchasing on the quality of materials, supplies and equipment.

QUALITY ASSURANCE UNIT (continued)

Function as QA Unit for GLP projects.

Perform other duties as required or as needed.

Job Description

CHIEF CHEMIST/SENIOR SCIENTIST

QUALIFICATIONS

Position	Education	Experience
Chief Chemist	BS/BA Science	5 years
Senior Chemist	BS/BA Science	3 years

Other experience, advanced education and/or proven aptitude and performance may count for education or experience. Experience may include laboratory, regulatory or other related environmental or management experience.

DUTIES/RESPONSIBILITIES

Provide technical support and training on instruments, methodologies, regulations and the QAP to staff. Assist in troubleshooting analytical problems.

Plan and assist in the implementation of new methods, instruments and equipment to meet changing regulatory or production requirements. Assure compliance with methods, SOP's, the QAP and CHP prior to startup.

Perform and manage special or non-routine projects requiring new or unique methods, SOP's or data quality objectives.

Maintain working knowledge regulations and new developments in analytical and environmental chemistry as they relate to services performed by the lab.

Write and revise SOP's and methods as necessary.

Perform other duties as required or as needed.

PROJECT MANAGER/PROJECT COORDINATOR

QUALIFICATIONS

Position	Education	Experience
Project Manager	BS/BA Science	2 years
Project Coordinator	HS	3 years

Other experience, advanced education and/or proven aptitude and performance may count for education or experience. Experience may include laboratory, regulatory or other related environmental or management experience.

DUTIES/RESPONSIBILITIES

Provide primary interface between the customer and the lab. Assure that the customers regulatory and data quality objectives, schedule and workload volume are known to the lab. Maintain contact and document correspondence with customers through all phases of project.

Prepare quotations, proposals and work plans to match the clients regulatory and data quality objectives. Assure that the lab's methods, pricing and capacity are known to the client. Obtain all appropriate business related information.

Maintain working knowledge of local, state and federal regulations as they relate to services performed by the lab.

Review sample submission documentation and appropriate LIMS reports to insure correctness prior to initiation of work. Review data deliverables for completeness and conformance to customer requirements.

Perform other duties as required or as needed.

Job Description

GROUP LEADER/ASSISTANT GROUP LEADER

QUALIFICATIONS

Position	Education	Experience
Group Leader	BS/BA Science	3 years
Asst. Group Leader	BS/BA Science	2 years

Other experience, advanced education and/or proven aptitude and performance may count for education or experience. Experience may include laboratory, regulatory or other related environmental or management experience.

DUTIES/RESPONSIBILITIES

Schedule personnel, equipment and resources to produce data which complies with methods, SOP's, the QAP and customer data quality objectives and customer due dates.

Insure training of analysts on methods, SOP's, the CHP and the QAP prior to performing procedures. Document training and maintain training files. Maintain methods, SOP's, the QAP and the CHP on file and ensure document control.

Assure instruments and equipment are inspected, cleaned, maintained and as applicable, calibrated and standardized.

Review raw data for conformance with methods, SOP's, the QAP and client data quality objectives. Document all deviations from methods, SOP's and the QAP. Provide case narratives and supporting analytical documentation for data packages when necessary. Forward data to Data Management Group. Archive raw data files following data entry.

Inform the Lab Director immediately of any personnel, instrument, equipment or materials problems. Inform the Lab Director, Project Managers and QA Unit(s) of any deviations from schedule, methods, SOP's or the QAP.

Respond to and undertake corrective action to external and internal audits.

Perform other duties as required or as needed.

LAB ANALYST/LAB TECHNICIAN/FIELD TECHNICIAN

QUALIFICATIONS

Position	Education
Lab Analyst	Degree Preferred
Field Technician	Degree Preferred

Other experience, advanced education and/or proven aptitude and performance may count for education or experience. Experience may include laboratory, regulatory or other related environmental or management experience.

DUTIES/RESPONSIBILITIES

Perform sample collection, preparation and analysis in conformance with methods, SOP's and the QAP to meet client due dates and data quality objectives.

Obtain training on and read and understand all methods, SOP's and the QAP prior to performing new procedures.

Inspect, clean, calibrate, standardize and maintain sampling, analysis and measurement equipment, glassware and instrumentation. Document these activities as required by SOP's, methods and the QAP.

Accurately and neatly document all calculations, observations and deviations as required by methods, SOP's and the QAP and forward raw data to Group Leader.

Handle lab chemicals and samples per custody requirements, SOP's, QAP and the CHP. Properly dispose of laboratory waste. Maintain organized work area.

Inform the Group Leader or Lab Director immediately of any personnel, instrument, equipment or material problems or shortages. Inform the Group Leader or Lab Director of any deviations from schedule, methods, SOP's or the QAP.

Perform other duties as required or as needed.

Job Description

SAMPLE CUSTODIAN/SHIPPING COORDINATOR

QUALIFICATIONS

Position	Education
Sample Custodian	BS/BA Science
Shipping Coordinator	HS

Other experience, advanced education and/or proven aptitude and performance may count for education or experience. Experience may include laboratory, regulatory or other related environmental or management experience.

DUTIES/RESPONSIBILITIES

Receive, handle, ship, store and dispose of samples and sample containers in conformance with methods, SOP's, the CHP, the QAP and shipping regulations to meet client due dates and data quality objectives. Coordinate shipping and receiving with client and Project Manager.

Maintain inventory of all supplies.

Validate and maintain legal chain of custody of samples and necessary documentation. Document and inform Project Managers immediately of any deviations from anticipated work volume or schedule, methods, SOP's or the QAP.

Obtain training on and read and understand all methods, SOP's and the QAP prior to performing new procedures.

Maintain organization of sample and waste storage areas. Coordinate disposal of samples and lab waste.

Assure that samples are logged into the LIMS timely and accurately.

Perform other duties as required or as needed.

DATA PACKAGE COORDINATOR/DATA ENTRY TECHNICIAN/DOCUMENT CONTROL OFFICER

QUALIFICATIONS

Position	Education
Data Package Coordinator	HS
Document Control Officer	HS
Data Entry Technician	HS

Other experience, advanced education and/or proven aptitude and performance may count for education or experience. Experience may include laboratory, regulatory or other related environmental or management experience.

DUTIES/RESPONSIBILITIES

Accurately and expediently record all required analytical, sample, and accounting data in LIMS in conformance with methods, SOP's and the QAP.

Obtain training on and read and understand all relevant methods, SOP's and the QAP prior to performing new procedures.

Assemble, copy and distribute to the Project Manager, data packages and data deliverables per client specified requests, SOP's and the QAP to meet clients' due dates.

Coordinate archiving of raw data for GLP, CLP and other client specified projects.

Inform the Lab Director immediately of any personnel or equipment problems. Inform the Lab Director of any deviations from schedule, methods, SOP's or the QAP.

Perform other duties as required or as needed.

APPENDIX F

Appendix F
Revision 0
Nov. 1, 1991

FINAL REPORT EXAMPLES

CERTIFICATE OF ANALYSIS

Service Location	Received	Lab ID
EMS HERITAGE LABORATORIES, INC. 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8305	23-APR-91	A228370
	Complete 05-JUN-91	PO Number 90607684-59A
	Printed 13-JUN-91	Sampled

Report To	Bill To

Sample Description

FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

Analyst: J. CARSON Analysis Date: 30-APR-91 Test: P130.4. 0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL WEIGHT OR VOLUME	50		mL

BARIUM ICP SW846-6010

Analyst: M. JAO Analysis Date: 01-MAY-91 Instrument: ICP Test: M104.3. 0

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

Parameter	Result	Det. Limit	Units
BARIUM	0.049	0.010	mg/L

CADMIUM ICP SW846-6010

Analyst: M. JAO Analysis Date: 01-MAY-91 Instrument: ICP Test: M108.3. 0

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

Parameter	Result	Det. Limit	Units
CADMIUM	BDL	0.0050	mg/L

CHROMIUM ICP SW846-6010

Analyst: M. JAO Analysis Date: 01-MAY-91 Instrument: ICP Test: M110.3. 0

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

Parameter	Result	Det. Limit	Units
CHROMIUM	BDL	0.010	mg/L

NICKEL ICP SW846-6010

Analyst: M. JAO Analysis Date: 01-MAY-91 Instrument: ICP Test: M122.3. 0

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

Parameter	Result	Det. Limit	Units
NICKEL	BDL	0.010	mg/L

SILVER ICP SW846-6010

Analyst: M. JAO Analysis Date: 01-MAY-91 Instrument: ICP Test: M130.3. 0

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

Parameter	Result	Det. Limit	Units
SILVER	BDL	0.010	mg/L

IRON ICP SW846-6010

Analyst: M. JAO Analysis Date: 01-MAY-91 Instrument: ICP Test: M115.3. 0

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

Parameter	Result	Det. Limit	Units
IRON	BDL	0.020	mg/L

SODIUM ICP SW846-6010

Analyst: M. JAO Analysis Date: 01-MAY-91 Instrument: ICP Test: M131.3. 0

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

Parameter	Result	Det. Limit	Units
SODIUM	6.7	0.20	mg/L

MANGANESE ICP SW846-6010

Analyst: M. JAO Analysis Date: 01-MAY-91 Instrument: ICP Test: M119.3. 0

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

Parameter	Result	Det. Limit	Units
MANGANESE	BDL	0.010	mg/L

GFAA ACID DIGESTION OF AQUEOUS SAMPLES SW846-3020

Analyst: K. HACK Analysis Date: 04-MAY-91 Test: P130.6. 0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	50		mL
FINAL WEIGHT OR VOLUME	50		mL

ARSENIC GFAA SW846-7060

Analyst: K. KEHOE Analysis Date: 10-MAY-91 Instrument: GFAA Test: M103.2. 0

Prep: GFAA ACID DIGESTION OF AQUEOUS SAMPLES SW846-3020

Parameter	Result	Det. Limit	Units
ARSENIC	BDL	0.0050	mg/L

LEAD GFAA SW846-7421

Analyst: M. BAUER Analysis Date: 09-MAY-91 Instrument: GFAA Test: M116.2. 0

Prep: GFAA ACID DIGESTION OF AQUEOUS SAMPLES SW846-3020

Parameter	Result	Det. Limit	Units
LEAD	BDL	0.0050	mg/L

SELENIUM GFAA SW846-7740

Analyst: K. KEHOE Analysis Date: 07-MAY-91 Instrument: GFAA Test: M128.2. 0

Prep: GFAA ACID DIGESTION OF AQUEOUS SAMPLES SW846-3020

Parameter	Result	Det. Limit	Units
SELENIUM	BDL	0.0050	mg/L

MERCURY CVAA ACID DIGESTION OF AQUEOUS SAMPLES SW846-7470

Analyst: J. WARE Analysis Date: 08-MAY-91 Test: P131.6. 0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	100		mL
FINAL VOLUME	100		mL

MERCURY CVAA SW846-7470

Analyst: J. WARE Analysis Date: 08-MAY-91 Instrument: CVAA Test: M120.1. 0

Prep: MERCURY CVAA ACID DIGESTION OF AQUEOUS SAMPLES SW846-7470

Parameter	Result	Det. Limit	Units
MERCURY	BDL	0.00020	mg/L

CHLORIDE (COLORIMETRIC, AUTOMATED) EPA 325.1

Analyst: C. BRODERICK Analysis Date: 15-MAY-91 Instrument: AUTO-ANALYZER Test: G102.9. 0

Parameter	Result	Det. Limit	Units
CHLORIDE	2	1.0	mg/L

PHENOLS DISTILLATION SW846-9065

Analyst: D. JOSEPH Analysis Date: 24-APR-91 Test: P405.7. 0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	100		mL
FINAL VOLUME	100		mL

PHENOLS 4AAP (AUTOMATED) SW846-9066

Analyst: J. GRIFFIN Analysis Date: 25-APR-91 Instrument: AUTO-ANALYZER Test: O405.7. 0

Prep: PHENOLS DISTILLATION SW846-9065

Parameter	Result	Det. Limit	Units
PHENOLS	BDL	0.01	mg/L

SULFATE TURBIDIMETRIC METHOD SW846-9038

Analyst: K. RILEY Analysis Date: 16-MAY-91 Test: G108.6. 0

Parameter	Result	Det. Limit	Units
SULFATE	200	125	mg/L

PH (AQUEOUS) SW846-9040

Analyst: M. BAUER Analysis Date: 23-APR-91 Test: G607.5. 0

Parameter	Result	Det. Limit	Units
PH	7.2	0.1	Std. Units

SPECIFIC CONDUCTANCE SW846-9050

Analyst: L. MATTINGLY Analysis Date: 24-APR-91 Test: G604.4. 0

Parameter	Result	Det. Limit	Units
CONDUCTIVITY	870	1.0	umHOS/cm

TOTAL ORGANIC CARBON SW846-9060

Analyst: L. BUTLER Analysis Date: 25-APR-91 Instrument: TOC Test: O401.0. 0

Parameter	Result	Det. Limit	Units
TOTAL ORGANIC CARBON (TOC)	BDL	3	mg/L

TOTAL ORGANIC HALIDES SW846-9020

Analyst: S. HALLORAN Analysis Date: 25-APR-91 Instrument: TOX Test: O404.0. 0

Parameter	Result	Det. Limit	Units
TOTAL ORGANIC HALOGEN (TOX)	BDL	0.04	mg/L

DISSOLVED SOLIDS EPA 160.1

Analyst: P. ANDERSON Analysis Date: 24-APR-91 Test: G402.7. 0

Parameter	Result	Det. Limit	Units
SOLIDS	570	10	mg/L

TOTAL SOLIDS EPA 160.3

Analyst: P. ANDERSON Analysis Date: 30-APR-91 Test: G401.7. 0

Parameter	Result	Det. Limit	Units
SOLIDS	570	10	mg/L

CYANIDE DISTILLATION SW846-9010

Analyst: D. JOSEPH Analysis Date: 24-APR-91 Test: P101.4. 0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	250		mL
FINAL VOLUME	250		mL

CYANIDE, TOTAL (AUTOMATED) SW846-9012

Analyst: J. GRIFFIN Analysis Date: 24-APR-91 Instrument: AUTO-ANALYZER Test: G101.4. 0

Prep: CYANIDE DISTILLATION SW846-9010

Parameter	Result	Det. Limit	Units
CYANIDE	BDL	0.01	mg/L

SULFIDE SW846-9030

Analyst: L. HETTICH Analysis Date: 30-APR-91 Test: G110.4. 0

Parameter	Result	Det. Limit	Units
SULFIDE	BDL	1.0	mg/L

VOLATILE ORGANICS TARGET COMPOUND LIST SW846-8240

Analyst: H. WILLIAMS Analysis Date: 02-MAY-91 Instrument: GC/MS VOA Test: 0530.1. 0

Parameter	Result	Det. Limit	Units
ACETONE	BDL	20	ug/L
ACROLEIN	BDL	50	ug/L
ACRYLONITRILE	BDL	70	ug/L
BENZENE	BDL	5	ug/L
BROMODICHLOROMETHANE	BDL	5	ug/L
BROMOFORM	BDL	5	ug/L
BROMOMETHANE	BDL	10	ug/L
CARBON DISULFIDE	BDL	5	ug/L
CARBON TETRACHLORIDE	BDL	5	ug/L
CHLOROBENZENE	BDL	5	ug/L
CHLOROETHANE	BDL	10	ug/L
CHLOROFORM	BDL	5	ug/L
CHLOROMETHANE	BDL	10	ug/L
DIBROMOCHLOROMETHANE	BDL	5	ug/L
CIS-1,3-DICHLOROPROPENE	BDL	5	ug/L
DICHLORODIFLUOROMETHANE	BDL	5	ug/L
1,1-DICHLOROETHANE	BDL	5	ug/L
1,2-DICHLOROETHANE	BDL	5	ug/L
1,1-DICHLOROETHENE	BDL	5	ug/L
1,2-DICHLOROPROPANE	BDL	5	ug/L
ETHYLBENZENE	BDL	5	ug/L
FLUOROTRICHLOROMETHANE	BDL	5	ug/L
2-HEXANONE	BDL	10	ug/L
METHYLENE CHLORIDE	BDL	5	ug/L
METHYL ETHYL KETONE	BDL	10	ug/L
4-METHYL-2-PENTANONE	BDL	10	ug/L
STYRENE	BDL	5	ug/L
1,1,2,2-TETRACHLOROETHANE	BDL	5	ug/L
TETRACHLOROETHENE	BDL	5	ug/L
TETRAHYDROFURAN	BDL	25	ug/L
TOLUENE	BDL	5	ug/L
1,2-DICHLOROETHENE (TOTAL)	BDL	5	ug/L
TRANS-1,3-DICHLOROPROPENE	BDL	5	ug/L
1,1,1-TRICHLOROETHANE	BDL	5	ug/L
1,1,2-TRICHLOROETHANE	BDL	5	ug/L
TRICHLOROETHENE	BDL	5	ug/L
VINYL ACETATE	BDL	10	ug/L
VINYL CHLORIDE	BDL	10	ug/L
XYLENE (TOTAL)	BDL	5	ug/L
2-CHLOROETHYLVINYLETHER	BDL	10	ug/L
DIETHYLETHER	BDL	5	ug/L
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	BDL	5	ug/L
ETHYL ACETATE	BDL	5	ug/L

EMS HERITAGE LABORATORIES, INC. Lab Sample ID: A228370

Parameter	Result	Det. Limit	Units
METHYL-T-BUTYL ETHER	BDL	5	ug/L
SURROGATE RECOVERY			
DICHLOROETHANE-D4	93		% Rec
TOLUENE-D8	101		% Rec
BROMOFLUOROBENZENE	101		% Rec

GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION SW846-3510

Analyst: M. FRANK Analysis Date: 27-APR-91 Test: P233.4. 0

Parameter	Result	Det. Limit	Units
INITIAL WEIGHT OR VOLUME	1		Liters
FINAL VOLUME	1		mL

SEMI-VOLATILE TARGET COMPOUND LIST SW846-8270

Analyst: K. STONER Analysis Date: 21-MAY-91 Instrument: GC/MS SVOA Test: 0531.1. 0

Prep: GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION SW846-3510

Parameter	Result	Det. Limit	Units
ACENAPHTHENE	BDL	10	ug/L
ACENAPHTHYLENE	BDL	10	ug/L
ANTHRACENE	BDL	10	ug/L
BENZ(A)ANTHRACENE	BDL	10	ug/L
BENZO(A)PYRENE	BDL	10	ug/L
BENZO(B)FLUORANTHENE	BDL	10	ug/L
BENZO(G,H,I)PERYLENE	BDL	10	ug/L
BENZO(K)FLUORANTHENE	BDL	10	ug/L
BENZYL ALCOHOL	BDL	10	ug/L
BENZYLBUTYLPHTHALATE	BDL	10	ug/L
BIS(2-CHLOROETHOXY)METHANE	BDL	10	ug/L
BIS(2-CHLOROETHYL)ETHER	BDL	10	ug/L
BIS(2-CHLOROISOPROPYL)ETHER	BDL	10	ug/L
BIS(2-ETHYLHEXYL)PHTHALATE	13	10	ug/L
4-BROMOPHENYLPHENYLETHER	BDL	10	ug/L
CARBAZOLE	BDL	10	ug/L
4-CHLOROANILINE	BDL	10	ug/L
2-CHLORONAPHTHALENE	BDL	10	ug/L
4-CHLOROPHENYLPHENYLETHER	BDL	10	ug/L
CHRYSENE	BDL	10	ug/L
DIBENZ(A,H)ANTHRACENE	BDL	10	ug/L
DIBENZOFURAN	BDL	10	ug/L
1,2-DICHLOROBENZENE	BDL	10	ug/L
1,3-DICHLOROBENZENE	BDL	10	ug/L
1,4-DICHLOROBENZENE	BDL	10	ug/L
3,3'-DICHLOROBENZIDINE	BDL	20	ug/L
DIETHYLPHTHALATE	BDL	10	ug/L
DIMETHYLPHTHALATE	BDL	10	ug/L
DI-N-BUTYLPHTHALATE	BDL	10	ug/L
DINITROBENZENES	BDL	50	ug/L
2,4-DINITROTOLUENE	BDL	10	ug/L
2,6-DINITROTOLUENE	BDL	10	ug/L
DI-N-OCTYLPHTHALATE	BDL	10	ug/L
FLUORANTHENE	BDL	10	ug/L
FLUORENE	BDL	10	ug/L
HEXACHLOROBENZENE	BDL	10	ug/L
HEXACHLOROBUTADIENE	BDL	10	ug/L
HEXACHLOROCYCLOPENTADIENE	BDL	10	ug/L
HEXACHLOROETHANE	BDL	10	ug/L

Parameter	Result	Det. Limit	Units
INDENO(1,2,3-CD)PYRENE	BDL	10	ug/L
ISOPHORONE	BDL	10	ug/L
2-METHYLNAPHTHALENE	BDL	10	ug/L
NAPHTHALENE	BDL	10	ug/L
2-NITROANILINE	BDL	50	ug/L
3-NITROANILINE	BDL	50	ug/L
4-NITROANILINE	BDL	50	ug/L
NITROBENZENE	BDL	10	ug/L
N-NITROSO-DIPHENYLAMINE	BDL	10	ug/L
N-NITROSO-DI-N-PROPYLAMINE	BDL	10	ug/L
PHENANTHRENE	BDL	10	ug/L
2-PICOLINE	BDL	50	ug/L
PYRENE	BDL	10	ug/L
PYRIDINE	BDL	50	ug/L
TETRACHLOROBENZENES	BDL	10	ug/L
TOLUENEDIAMINE	BDL	50	ug/L
1,2,4-TRICHLOROBENZENE	BDL	10	ug/L
BENZOIC ACID	BDL	50	ug/L
4-CHLORO-3-METHYLPHENOL	BDL	10	ug/L
2-CHLOROPHENOL	BDL	10	ug/L
2,4-DICHLOROPHENOL	BDL	10	ug/L
2,4-DIMETHYLPHENOL	BDL	10	ug/L
4,6-DINITRO-2-METHYLPHENOL	BDL	50	ug/L
2,4-DINITROPHENOL	BDL	50	ug/L
2-METHYLPHENOL	BDL	10	ug/L
4-METHYLPHENOL	BDL	10	ug/L
2-NITROPHENOL	BDL	10	ug/L
4-NITROPHENOL	BDL	50	ug/L
PENTACHLOROPHENOL	BDL	50	ug/L
PHENOL	BDL	10	ug/L
TETRACHLOROPHENOL	BDL	10	ug/L
2,4,5-TRICHLOROPHENOL	BDL	10	ug/L
2,4,6-TRICHLOROPHENOL	BDL	10	ug/L
1,2-DIPHENYLHYDRAZINE	BDL	10	ug/L
N-NITROSODIMETHYLAMINE	BDL	10	ug/L
1,2,3,4-TETRACHLOROBENZENE	BDL	10	ug/L
1,2,4,5-TETRACHLOROBENZENE	BDL	10	ug/L
SURROGATE RECOVERY			
2-FLUOROPHENOL	52		% Rec
PHENOL-D5	32		% Rec
NITROBENZENE-D5	94		% Rec
2-FLUOROBIPHENYL	78		% Rec
2,4,6-TRIBROMOPHENOL	78		% Rec
TERPHENYL-D14	82		% Rec

Sample Comments

BDL Below Detection Limit

Quality Assurance Officer: _____

QUALITY ASSURANCE REPORT

Service Location	Received	Lab ID
EMS HERITAGE LABORATORIES, INC. 7901 W. MORRIS ST. INDIANAPOLIS, IN 46231 (317)243-8305	23-APR-91	A228370
	Complete 05-JUN-91	PO Number 90607684-59A
	Printed 13-JUN-91	Sampled

Sample Description

BARIUM ICP SW846-6010

Analyst : M. JAO — Analysis Date: 01-MAY-91 — Instrument: ICP — Test: M104.3.0

Reviewer: S. ENDERSEN — Review Date: 02-MAY-91 — File ID: — Run: R119838

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
ICV01	Q239253	WP1083	BARIUM	2.00		2.06	mg/L	103	
DPS02	Q231974	A228372	BARIUM	0	2.00	1.92	mg/L	96	4
SPI02	Q231973	A228372	BARIUM	0	2.00	1.84	mg/L	92	
CCV	Q239277	INORGANIC	BARIUM	5.00		4.52	mg/L	90	
BLA01	Q239276	NA	BARIUM			< 0.004	mg/L		
LCS	Q231971	NA	BARIUM	20.0		18.9	mg/L	94	
BLA02	Q231972	NA	BARIUM			< 0.004	mg/L		
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q239275	INORGANIC	BARIUM	5.00		4.81	mg/L	96	
BLA01	Q239274	NA	BARIUM			< 0.004	mg/L		

CADMIUM ICP SW846-6010

Analyst : M. JAO — Analysis Date: 01-MAY-91 — Instrument: ICP — Test: M108.3.0

Reviewer: S. ENDERSEN — Review Date: 02-MAY-91 — File ID: — Run: R119838

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
ICV01	Q239254	WP1083	CADMIUM	0.400		0.425	mg/L	106	
ICV01	Q239259	WP1083	CADMIUM	0.400		0.407	mg/L	102	
DPS02	Q231974	A228372	CADMIUM	0	0.050	0.0415	mg/L	83	4
SPI02	Q231973	A228372	CADMIUM	0	0.050	0.0398	mg/L	80	
CDL01	Q239279	NA	CADMIUM	0.0100		0.0116	mg/L	116	
CCV	Q239277	INORGANIC	CADMIUM	5.00		4.48	mg/L	90	
BLA01	Q239276	NA	CADMIUM			< 0.002	mg/L		
LCS	Q231971	NA	CADMIUM	0.500		0.407	mg/L	81	
BLA02	Q231972	NA	CADMIUM			< 0.002	mg/L		
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q239275	INORGANIC	CADMIUM	5.00		4.80	mg/L	96	
BLA01	Q239274	NA	CADMIUM			< 0.002	mg/L		
CDL01	Q239270	NA	CADMIUM	0.0100		0.0122	mg/L	122	

CHROMIUM ICP SW846-6010

Analyst : M. JAO — Analysis Date: 01-MAY-91 — Instrument: ICP — Test: M110.3.0

Reviewer: S. ENDERSEN — Review Date: 02-MAY-91 — File ID: — Run: R119838

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
ICV01	Q239254	WP1083	CHROMIUM	0.400		0.421	mg/L	105	
ICV01	Q239259	WP1083	CHROMIUM	0.400		0.400	mg/L	100	
DPS02	Q231974	A228372	CHROMIUM	0	0.200	0.193	mg/L	97	3
SPI02	Q231973	A228372	CHROMIUM	0	0.200	0.188	mg/L	94	
CDL01	Q239279	NA	CHROMIUM	0.0200		0.0260	mg/L	130	

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CCV	Q239277	INORGANIC	CHROMIUM	5.00		4.54	mg/L	91	
BLA01	Q239276	NA	CHROMIUM			< 0.004	mg/L		
LCS	Q231971	NA	CHROMIUM	2.00		1.85	mg/L	92	
BLA02	Q231972	NA	CHROMIUM			< 0.004	mg/L		
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q239275	INORGANIC	CHROMIUM	5.00		4.83	mg/L	97	
BLA01	Q239274	NA	CHROMIUM			< 0.004	mg/L		
CDL01	Q239270	NA	CHROMIUM	0.0200		0.0210	mg/L	105	

NICKEL ICP SW846-6010

Analyst : M. JAO Analysis Date: 01-MAY-91 Instrument: ICP Test: M122.3.0
Reviewer: S. ENDERSEN Review Date: 02-MAY-91 File ID: Run: R119838

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
ICV01	Q239254	WP1083	NICKEL	0.400		0.419	mg/L	105	
ICV01	Q239259	WP1083	NICKEL	0.400		0.408	mg/L	102	
DPS02	Q231974	A228372	NICKEL	0	0.500	0.468	mg/L	94	3
SPI02	Q231973	A228372	NICKEL	0	0.500	0.457	mg/L	91	
CDL01	Q239279	NA	NICKEL	0.0200		0.0229	mg/L	115	
CCV	Q239277	INORGANIC	NICKEL	5.00		4.50	mg/L	90	
BLA01	Q239276	NA	NICKEL			< 0.004	mg/L		
LCS	Q231971	NA	NICKEL	5.00		4.62	mg/L	92	
BLA02	Q231972	NA	NICKEL			< 0.004	mg/L		
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q239275	INORGANIC	NICKEL	5.00		4.79	mg/L	96	
BLA01	Q239274	NA	NICKEL			< 0.004	mg/L		
CDL01	Q239270	NA	NICKEL	0.0200		0.0199	mg/L	99	

SILVER ICP SW846-6010

Analyst : M. JAO Analysis Date: 01-MAY-91 Instrument: ICP Test: M130.3.0
Reviewer: S. ENDERSEN Review Date: 02-MAY-91 File ID: Run: R119838

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
ICV01	Q239253	WP1083	SILVER	2.00		2.05	mg/L	102	
DPS02	Q231974	A228372	SILVER	0	0.050	0.0492	mg/L	98	2
SPI02	Q231973	A228372	SILVER	0	0.050	0.0479	mg/L	96	
CDL01	Q239252	NA	SILVER	0.0200		0.0200	mg/L	100	
CCV	Q239277	INORGANIC	SILVER	1.00		0.912	mg/L	91	
BLA01	Q239276	NA	SILVER			< 0.004	mg/L		
LCS	Q231971	NA	SILVER	0.500		0.468	mg/L	94	
BLA02	Q231972	NA	SILVER			< 0.004	mg/L		
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q239275	INORGANIC	SILVER	1.00		0.950	mg/L	95	
BLA01	Q239274	NA	SILVER			< 0.004	mg/L		
CDL01	Q239271	NA	SILVER	0.0200		0.0208	mg/L	104	

IRON ICP SW846-6010

Analyst : M. JAO Analysis Date: 01-MAY-91 Instrument: ICP Test: M115.3.0
Reviewer: S. ENDERSEN Review Date: 02-MAY-91 File ID: Run: R119838

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
ICV01	Q239254	WP1083	IRON	0.400		0.425	mg/L	106	
ICV01	Q239259	WP1083	IRON	0.400		0.413	mg/L	103	
DPS02	Q231974	A228372	IRON	0	1.00	0.968	mg/L	97	3
SPI02	Q231973	A228372	IRON	0	1.00	0.942	mg/L	94	
CDL01	Q239279	NA	IRON	0.0400		0.0407	mg/L	102	
CCV	Q239277	INORGANIC	IRON	5.00		4.59	mg/L	92	

EMS HERITAGE LABORATORIES, INC. Lab Sample ID: A228372

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
BLA01	Q239276	NA	IRON			< 0.008	mg/L		
LCS	Q231971	NA	IRON	10.0		9.40	mg/L	94	
BLA02	Q231972	NA	IRON			< 0.008	mg/L		
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q239275	INORGANIC	IRON	5.00		4.89	mg/L	98	
BLA01	Q239274	NA	IRON			< 0.008	mg/L		
CDL01	Q239270	NA	IRON	0.0400		0.0453	mg/L	113	

SODIUM ICP SW846-6010

Analyst : M. JAO Analysis Date: 01-MAY-91 Instrument: ICP Test: M131.3.0

Reviewer: S. ENDERSEN Review Date: 02-MAY-91 File ID: Run: R119838

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
DPS02	Q231974	A228372	SODIUM	0.202	100	94.7	mg/L	94	4
SPI02	Q231973	A228372	SODIUM	0.202	100	91.5	mg/L	91	
CCV	Q239277	INORGANIC	SODIUM	50.0		45.2	mg/L	90	
BLA01	Q239276	NA	SODIUM			< 0.08	mg/L		
LCS	Q231971	NA	SODIUM	100		95.7	mg/L	96	
BLA02	Q231972	NA	SODIUM			< 0.08	mg/L		
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q239275	INORGANIC	SODIUM	50.0		47.6	mg/L	95	
BLA01	Q239274	NA	SODIUM			< 0.08	mg/L		

MANGANESE ICP SW846-6010

Analyst : M. JAO Analysis Date: 01-MAY-91 Instrument: ICP Test: M119.3.0

Reviewer: S. ENDERSEN Review Date: 02-MAY-91 File ID: Run: R119838

Prep: FAA OR ICP ACID DIGESTION OF AQUEOUS SAMPLES SW846-3005

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
ICV01	Q239254	WP1083	MANGANESE	0.400		0.423	mg/L	106	
ICV01	Q239259	WP1083	MANGANESE	0.400		0.414	mg/L	103	
DPS02	Q231974	A228372	MANGANESE	0	0.500	0.485	mg/L	97	2
SPI02	Q231973	A228372	MANGANESE	0	0.500	0.473	mg/L	95	
CDL01	Q239279	NA	MANGANESE	0.0200		0.0211	mg/L	105	
CCV	Q239277	INORGANIC	MANGANESE	5.00		4.54	mg/L	91	
BLA01	Q239276	NA	MANGANESE			< 0.004	mg/L		
LCS	Q231971	NA	MANGANESE	5.00		4.79	mg/L	96	
BLA02	Q231972	NA	MANGANESE			< 0.004	mg/L		
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q239275	INORGANIC	MANGANESE	5.00		4.82	mg/L	96	
BLA01	Q239274	NA	MANGANESE			< 0.004	mg/L		
CDL01	Q239270	NA	MANGANESE	0.0200		0.0211	mg/L	105	

ARSENIC GFAA SW846-7060

Analyst : K. KEHOE Analysis Date: 10-MAY-91 Instrument: GFAA Test: M103.2.0

Reviewer: S. ENDERSEN Review Date: 13-MAY-91 File ID: 020782 Run: R120843

Prep: GFAA ACID DIGESTION OF AQUEOUS SAMPLES SW846-3020

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CAL01	Q245956		ARSENIC	0.000		0.000	mg/L		
CAL01	Q245957		ARSENIC	0.0050		0.034	mg/L		
CAL01	Q245958		ARSENIC	0.0100		0.059	mg/L		
CAL01	Q245959		ARSENIC	0.0200		0.111	mg/L		
CAL01	Q245960		ARSENIC	0.0400		0.219	mg/L		
ICV01	Q245962		ARSENIC	0.0100		0.0104	mg/L	104	
DPS02	Q239846	A228368	ARSENIC	0.00	0.0400	0.0357	mg/L	89	
SPI02	Q239845	A228368	ARSENIC	0.00	0.0400	0.0359	mg/L	90	
BLA01	Q245961		ARSENIC			< 0.0020	mg/L		
CCV	Q245963		ARSENIC	0.0200		0.0201	mg/L	101	

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CDL01	Q245964		ARSENIC	0.0100		0.0101	mg/L	101	
LCS	Q239843		ARSENIC	0.0200		0.0183	mg/L	92	
BLA02	Q239844		ARSENIC			< 0.0020	mg/L		
SAMPLE	A228370		See Certificate of Analysis						
BLA01	Q245965		ARSENIC			< 0.0020	mg/L		
CCV	Q245966		ARSENIC	0.0200		0.0196	mg/L	98	
CDL01	Q245969		ARSENIC	0.0100		0.0087	mg/L	87	

LEAD GFAA SW846-7421

Analyst : M. BAUER Analysis Date: 09-MAY-91 Instrument: GFAA Test: M116.2.0

Reviewer: S. O'NEAL Review Date: 10-MAY-91 File ID: 020779 Run: R120734

Prep: GFAA ACID DIGESTION OF AQUEOUS SAMPLES SW846-3020

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CAL01	Q245452		LEAD	0.000		0.000	mg/L		
CAL01	Q245453		LEAD	0.0050		0.026	mg/L		
CAL01	Q245454		LEAD	0.010		0.068	mg/L		
CAL01	Q245455		LEAD	0.020		0.122	mg/L		
CAL01	Q245456		LEAD	0.030		0.174	mg/L		
ICV01	Q245457		LEAD	0.0100		0.0095	mg/L	95	
DPS02	Q239846	A228368	LEAD	0.00	0.0200	0.0224	mg/L	112	9.3
SPI02	Q239845	A228368	LEAD	0.00	0.0200	0.0204	mg/L	102	
BLA01	Q245458		LEAD			< 0.0020	mg/L		
CCV	Q245459		LEAD	0.0200		0.0190	mg/L	95	
CDL01	Q245460		LEAD	0.0100		0.0095	mg/L	95	
LCS	Q239843		LEAD	0.0200		0.0189	mg/L	95	
BLA02	Q239844		LEAD			0.0021	mg/L		
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q245461		LEAD	0.0200		0.0201	mg/L	101	
BLA01	Q245462		LEAD			< 0.0020	mg/L		
CDL01	Q245463		LEAD	0.0100		0.0103	mg/L	103	

SELENIUM GFAA SW846-7740

Analyst : K. KENOE Analysis Date: 07-MAY-91 Instrument: GFAA Test: M128.2.0

Reviewer: S. ENDERSEN Review Date: 08-MAY-91 File ID: 020760 Run: R120361

Prep: GFAA ACID DIGESTION OF AQUEOUS SAMPLES SW846-3020

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CAL01	Q243258		SELENIUM	0.000		0.000	mg/L		
CAL01	Q243259		SELENIUM	0.0050		0.016	mg/L		
CAL01	Q243260		SELENIUM	0.0100		0.031	mg/L		
CAL01	Q243261		SELENIUM	0.0200		0.063	mg/L		
CAL01	Q243262		SELENIUM	0.0400		0.119	mg/L		
ICV01	Q243264		SELENIUM	0.0100		0.0103	mg/L	103	
DPS02	Q239846	A228368	SELENIUM	0.0033	0.0100	0.0135	mg/L	102	3.4
SPI02	Q239845	A228368	SELENIUM	0.0033	0.0100	0.0139	mg/L	106	
CDL01	Q243266		SELENIUM	0.0100		0.0110	mg/L	110	
BLA01	Q243271		SELENIUM			< 0.0020	mg/L		
CCV	Q243272		SELENIUM	0.0200		0.0205	mg/L	103	
LCS	Q239843		SELENIUM	0.0200		0.0200	mg/L	100	
BLA02	Q239844		SELENIUM			< 0.0020	mg/L		
SAMPLE	A228370		See Certificate of Analysis						
BLA01	Q243273		SELENIUM			0.0021	mg/L		
CCV	Q243274		SELENIUM	0.0200		0.0212	mg/L	106	
CDL01	Q243279		SELENIUM	0.0100		0.0124	mg/L	124	

MERCURY CVAA SW846-7470

Analyst : J. WARE Analysis Date: 08-MAY-91 Instrument: CVAA Test: M120.1.0
Reviewer: S. O'NEAL Review Date: 10-MAY-91 File ID: 020776 Run: R120668

Prep: MERCURY CVAA ACID DIGESTION OF AQUEOUS SAMPLES SW846-7470

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CAL01	Q244981		MERCURY	0.0000		0.000	mg/L		
CAL01	Q244982		MERCURY	0.00020		0.009	mg/L		
CAL01	Q244983		MERCURY	0.00050		0.021	mg/L		
CAL01	Q244984		MERCURY	0.0010		0.039	mg/L		
CAL01	Q244985		MERCURY	0.0020		0.079	mg/L		
CAL01	Q244986		MERCURY	0.0030		0.105	mg/L		
CAL01	Q244987		MERCURY	0.0050		0.178	mg/L		
ICV01	Q244989		MERCURY	0.00200		0.00191	mg/L	96	
DPS02	Q237814	A228366	MERCURY	0.00	0.0010	0.00105	mg/L	105	21
SPI02	Q237813	A228366	MERCURY	0.00	0.0010	0.00085	mg/L	85	
BLA01	Q244991		MERCURY			< 0.000020	mg/L		
CCV	Q244992		MERCURY	0.00300		0.00290	mg/L	97	
LCS	Q237811		MERCURY	0.00300		0.00273	mg/L	91	
BLA02	Q237812		MERCURY			< 0.000020	mg/L		
SAMPLE	A228370		See Certificate of Analysis						
BLA01	Q244993		MERCURY			< 0.000020	mg/L		
CCV	Q244994		MERCURY	0.00300		0.00290	mg/L	97	

CHLORIDE (COLORIMETRIC, AUTOMATED) EPA 325.1

Analyst : C. BRODERICK Analysis Date: 15-MAY-91 Instrument: AUTO-ANALYZER Test: G102.9.0
Reviewer: B. SHRAKE Review Date: 16-MAY-91 File ID: 91051501 Run: R121362

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CAL01	Q249487		CHLORIDE	100		99.75	mg/L	100	
CAL01	Q249488		CHLORIDE	80		81.01	mg/L	101	
CAL01	Q249489		CHLORIDE	60		59.57	mg/L	99	
CAL01	Q249490		CHLORIDE	40		41.71	mg/L	104	
CAL01	Q249491		CHLORIDE	20		19.96	mg/L	100	
CAL01	Q249492		CHLORIDE	8		8.27		103	
CAL01	Q249493		CHLORIDE	4		3.898	mg/L	97	
ICV01	Q249495		CHLORIDE	34.4		36.5	mg/L	106	
ICV01	Q249504		CHLORIDE	34.4		35.6	mg/L	103	
ICV01	Q249521		CHLORIDE	34.4		38.0	mg/L	110	
SPI01	Q249501	A228357	CHLORIDE	15	20	36	mg/L	105	
DPS01	Q249502	A228357	CHLORIDE	15	20	36	mg/L	105	0
BLA01	Q249494		CHLORIDE			-0.529	mg/L		
CCV	Q249496		CHLORIDE	40		40.68	mg/L	102	
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q249503		CHLORIDE	40		40.62	mg/L	101	

PHENOLS 4AAP (AUTOMATED) SW846-9066

Analyst : J. GRIFFIN Analysis Date: 25-APR-91 Instrument: AUTO-ANALYZER Test: 0405.7.0
Reviewer: B. SHRAKE Review Date: 29-APR-91 File ID: 356 Run: R119428

Prep: PHENOLS DISTILLATION SW846-9065

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CAL01	Q236757		PHENOL	0.90		0.90	mg/L	100	
CAL01	Q236758		PHENOL	0.70		0.70	mg/L	100	
CAL01	Q236759		PHENOL	0.50		0.50	mg/L	100	
CAL01	Q236760		PHENOL	0.30		0.30	mg/L	100	
CAL01	Q236761		PHENOL	0.10		0.10	mg/L	100	
CAL01	Q236762		PHENOL	0.00		-0.001	mg/L		
ICV01	Q236765		PHENOL	0.400		0.382	mg/L	96	
ICV01	Q236782		PHENOL	0.40		0.390	mg/L	98	
ICV01	Q236793		PHENOL	0.400		0.384	mg/L	96	

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
ICV01	Q236797		PHENOL	0.40		0.410	mg/L	103	
ICV02	Q236767		PHENOL	0.40		0.37	mg/L	93	
DUP01	Q236779	A228361	PHENOL	0.00		0.00	mg/L		0
SPI01	Q236780	A228362	PHENOL	0.00	0.40	0.40	mg/L	100	
DPS02	Q236790	A228370	PHENOL	0.00	0.20	0.18	mg/L	90	5
SPI02	Q236783	A228370	PHENOL	0.00	0.20	0.19	mg/L	95	
DUP02	Q236777	A228356	PHENOL	0.00		0.00	mg/L		0
BLA01	Q236763		PHENOL			-0.001	mg/L		
CDL01	Q236764		PHENOL	0.01		0.01	mg/L	100	
CCV	Q236781		PHENOL	0.30		0.30	mg/L	100	
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q236785		PHENOL	0.30		0.28	mg/L	93	
BLA01	Q236798		PHENOL			-0.001	mg/L		
BLA02	Q236766		PHENOL			0.001	mg/L		

SULFATE TURBIDIMETRIC METHOD SW846-9038

Analyst : K. RILEY Analysis Date: 16-MAY-91 Test: G108.6.0
Reviewer: B. SHRAKE Review Date: 17-MAY-91 File ID: 801-803 Run: R121440

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CAL01	Q250109		SULFATE	0.00		0.51	mg/L		
CAL01	Q250110		SULFATE	5		4.3	mg/L	86	
CAL01	Q250111		SULFATE	10		9.7	mg/L	97	
CAL01	Q250112		SULFATE	20		20.8	mg/L	104	
CAL01	Q250113		SULFATE	30		29.7	mg/L	99	
ICV01	Q250117		SULFATE	16.8		16.7	mg/L	99	
ICV01	Q250125		SULFATE	16.8		18.3	mg/L	109	
SPI01	Q250122	A228360	SULFATE	7.9	10	17.6	mg/L	97	
DPS01	Q250132	A228360	SULFATE	7.9	10	17	mg/L	91	3.5
BLA01	Q250116		SULFATE			0.505	mg/L		
CCV	Q250120		SULFATE	20		21.1	mg/L	106	
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q250124		SULFATE	20		20.48	mg/L	102	

PH (AQUEOUS) SW846-9040

Analyst : M. BAUER Analysis Date: 23-APR-91 Test: G607.5.0
Reviewer: A. DATTILO Review Date: 24-APR-91 File ID: Run: R119190

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CAL01	Q235059		PH	10.0		9.99	Std. Units		
CAL01	Q235060		PH	7.0		7.03	Std. Units		
CAL01	Q235061		PH	4.0		4.02	Std. Units		
ICV01	Q235062		PH	7.80		7.87	Std. Units	101	
DUP01	Q235068	A228356	PH	6.9		6.9	Std. Units		0
CCV	Q235071		PH	7.00		7.08	Std. Units	101	
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q235073		PH	7.00		7.00	Std. Units	100	

SPECIFIC CONDUCTANCE SW846-9050

Analyst : L. MATTINGLY Analysis Date: 24-APR-91 Test: G604.4.0
Reviewer: B. SHRAKE Review Date: 26-APR-91 File ID: 0856-0858 Run: R119306

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
ICV01	Q235845		CONDUCTIVITY	340		314	umHOS/cm	92	
DUP01	Q235846	A228363	CONDUCTIVITY	750		730	umHOS/cm		2.7
BLA01	Q235844		CONDUCTIVITY			1.14	umHOS/cm		
SAMPLE	A228370		See Certificate of Analysis						

TOTAL ORGANIC CARBON SW846-9060

Analyst : L. BUTLER Analysis Date: 25-APR-91 Instrument: TOC Test: 0401.0.0
Reviewer: B. SHRAKE Review Date: 26-APR-91 File ID: 1059 Run: R119531

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CAL01	Q237419		TOTAL ORGANIC CARBON (TOC)	1000		1005	mg/L	100	
ICV01	Q237420		TOTAL ORGANIC CARBON (TOC)	100		104.5	mg/L	105	
ICV01	Q237432		TOTAL ORGANIC CARBON (TOC)	100		107.8	mg/L	108	
DUP01	Q237429	C129570	TOTAL ORGANIC CARBON (TOC)	18		18	mg/L		0
SPI01	Q237421	A228359	TOTAL ORGANIC CARBON (TOC)	4	10	14	mg/L	100	
DPS01	Q237422	A228359	TOTAL ORGANIC CARBON (TOC)	4	10	14	mg/L	100	0
BLA01	Q237418		TOTAL ORGANIC CARBON (TOC)			1.544	mg/L		
CCV	Q237424		TOTAL ORGANIC CARBON (TOC)	200		211.2	mg/L	106	
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q237431		TOTAL ORGANIC CARBON (TOC)	200		212.6	mg/L	106	

TOTAL ORGANIC HALIDES SW846-9020

Analyst : S. HALLORAN Analysis Date: 25-APR-91 Instrument: TOX Test: 0404.0.0
Reviewer: B. SHRAKE Review Date: 30-APR-91 File ID: 1434 Run: R119944

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CAL01	Q240124		TOTAL ORGANIC HALOGEN (TOX)	30.00		34.63	mg/L	115	
ICV01	Q240125		TOTAL ORGANIC HALOGEN (TOX)	0.15		0.175	mg/L	117	
ICV01	Q240141		TOTAL ORGANIC HALOGEN (TOX)	0.15		0.165	mg/L	111	
ICV01	Q240196		TOTAL ORGANIC HALOGEN (TOX)	0.15		0.1607	mg/L	107	
ICV01	Q240197		TOTAL ORGANIC HALOGEN (TOX)	0.15		0.1619	mg/L	108	
DUP01	Q240175	A228370	TOTAL ORGANIC HALOGEN (TOX)	0.00		0.00	mg/L		0
DPS01	Q240169	A228366	TOTAL ORGANIC HALOGEN (TOX)	0.00	0.025	0.0269	mg/L	108	0.93
SPI01	Q240168	A228366	TOTAL ORGANIC HALOGEN (TOX)	0.00	0.025	0.0268	mg/L	107	
CCV	Q240166		TOTAL ORGANIC HALOGEN (TOX)	30.00		31.69	mg/L	107	
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q240193		TOTAL ORGANIC HALOGEN (TOX)	31.00		35.08	mg/L	113	

DISSOLVED SOLIDS EPA 160.1

Analyst : P. ANDERSON Analysis Date: 24-APR-91 Test: G402.7.0
Reviewer: B. SHRAKE Review Date: 29-APR-91 File ID: 1071-1073 Run: R119463

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
ICV01	Q236961		SOLIDS	131.2		145	mg/L	111	
DUP01	Q236963	A228357	SOLIDS	1300		1300	mg/L		0
BLA01	Q236960		SOLIDS			0.0006	mg/L		
SAMPLE	A228370		See Certificate of Analysis						

TOTAL SOLIDS EPA 160.3

Analyst : P. ANDERSON Analysis Date: 30-APR-91 Test: G401.7.0
Reviewer: B. SHRAKE Review Date: 01-MAY-91 File ID: 1541 Run: R119879

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
ICV01	Q239627		SOLIDS	10.0794		10.0784	mg/L	100	
ICV01	Q239630		SOLIDS	12.4845		12.4832	mg/L	100	
DUP01	Q239628	A228356	SOLIDS	7800		7900	mg/L		1
SAMPLE	A228370		See Certificate of Analysis						

CYANIDE, TOTAL (AUTOMATED) SW846-9012

Analyst : J. GRIFFIN Analysis Date: 24-APR-91 Instrument: AUTO-ANALYZER Test: G101.4.0
Reviewer: B. SHRAKE Review Date: 29-APR-91 File ID: 667 Run: R119513
Prep: CYANIDE DISTILLATION SW846-9010

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CAL01	Q237268		CYANIDE	0.45		0.44	mg/L	98	
CAL01	Q237269		CYANIDE	0.30		0.31	mg/L	103	
CAL01	Q237270		CYANIDE	0.20		0.21	mg/L	105	
CAL01	Q237271		CYANIDE	0.10		0.098	mg/L	98	

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CAL01	Q237272		CYANIDE	0.00		-0.006	mg/L		
ICV01	Q237274		CYANIDE	2.40		2.05	mg/L	85	
CAL01	Q237275		CYANIDE	0.40		0.40	mg/L	100	
ICV01	Q237306		CYANIDE	2.40		2.10	mg/L	88	
ICV01	Q237308		CYANIDE	2.40		2.06	mg/L	86	
ICV01	Q237338		CYANIDE	2.40		2.18	mg/L	91	
ICV02	Q237320		CYANIDE	0.30		0.31	mg/L	103	
ICV02	Q237332		CYANIDE	0.30		0.32	mg/L	107	
ICV02	Q237426		CYANIDE	0.30		0.29	mg/L	97	
DUP01	Q237296	A228062	CYANIDE	0.00		0.00	mg/L		0
SPI01	Q237301	A228068	CYANIDE	0.00	0.40	0.39	mg/L	98	
DPS02	Q237327	A228358	CYANIDE	0.00	0.10	0.10	mg/L	100	9.5
SPI02	Q237325	A228358	CYANIDE	0.00	0.10	0.11	mg/L	110	
DUP02	Q237324	A228331	CYANIDE	0.02		0.02	mg/L		0
BLA01	Q237273		CYANIDE			-0.006	mg/L		
CCV	Q237330		CYANIDE	0.30		0.33	mg/L	110	
SAMPLE	A228370		See Certificate of Analysis						
CCV	Q237337		CYANIDE	0.30		0.29	mg/L	97	
BLA01	Q237339		CYANIDE			-0.006	mg/L		
BLA02	Q237321		CYANIDE			-0.003	mg/L		

SULFIDE SW846-9030

Analyst : L. HETTICH Analysis Date: 30-APR-91 Test: G110.4.0
Reviewer: B. SHRAKE Review Date: 01-MAY-91 File ID: 673 Run: R119834

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
ICV01	Q239227		SULFIDE	46.8		47.1	mg/L	101	
DUP01	Q239242	A228320	SULFIDE	0.00		0.00	mg/L		0
DPS01	Q239237	A228362	SULFIDE	0.00	23.4	22	mg/L	94	5
SPI01	Q239235	A228362	SULFIDE	0.00	23.4	21	mg/L	90	
BLA01	Q239226		SULFIDE			0.23	mg/L		
SAMPLE	A228370		See Certificate of Analysis						

VOLATILE ORGANICS TARGET COMPOUND LIST SW846-8240

Analyst : H. WILLIAMS Analysis Date: 02-MAY-91 Instrument: GC/MS VOA Test: 0530.1.0
Reviewer: C. KOLANOWSKI Review Date: 07-MAY-91 File ID: >4713C Run: R120316

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
CCV	Q242750		See Attached Report g4710c.ind						
BLA01	Q242764		See Attached Report g4712c.ind						
SAMPLE	A228370		See Certificate of Analysis						

SEMI-VOLATILE TARGET COMPOUND LIST SW846-8270

Analyst : K. STONER Analysis Date: 21-MAY-91 Instrument: GC/MS SVOA Test: 0531.1.0
Reviewer: S. BROTHERTON Review Date: 23-MAY-91 File ID: >14488 Run: R121927
Prep: GC/MS SEPARATORY FUNNEL LIQUID-LIQUID EXTRACTION SW846-3510

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
DPS02	Q229907	A228362	PHENOL	0.00	200	58	ug/L	29	0
DPS02	Q229907	A228362	2-CHLOROPHENOL	0.00	200	170	ug/L	85	6
DPS02	Q229907	A228362	1,4-DICHLOROBENZENE (P-DICHLOROBENZE	0.00	100	71	ug/L	71	4
DPS02	Q229907	A228362	N-NITROSO-DI-N-PROPYLAMINE	0.00	100	110	ug/L	110	10
DPS02	Q229907	A228362	1,2,4-TRICHLOROBENZENE	0.00	100	74	ug/L	74	7
DPS02	Q229907	A228362	4-CHLORO-3-METHYLPHENOL	0.00	200	170	ug/L	85	0
DPS02	Q229907	A228362	ACENAPHTHENE	0.00	100	98	ug/L	98	2
DPS02	Q229907	A228362	4-NITROPHENOL	0.00	200	110	ug/L	55	15
DPS02	Q229907	A228362	2,4-DINITROTOLUENE	0.00	100	* 120	ug/L	120	6
DPS02	Q229907	A228362	PENTACHLOROPHENOL	0.00	200	170	ug/L	85	13
DPS02	Q229907	A228362	PYRENE	0.00	100	74	ug/L	74	4
SPI02	Q229906	A228362	PHENOL	0.00	200	58	ug/L	29	

EMS HERITAGE LABORATORIES, INC. Lab Sample ID: A228370

QC Type	Identifier	Source	Parameter	True/Sampl	Spike Val	Observed	Units	% Rec	RPD
SPIO2	Q229906	A228362	2-CHLOROPHENOL	0.00	200	160	ug/L	80	
SPIO2	Q229906	A228362	1,4-DICHLOROBENZENE (P-DICHLOROBENZE	0.00	100	68	ug/L	68	
SPIO2	Q229906	A228362	N-NITROSO-DI-N-PROPYLAMINE	0.00	100	100	ug/L	100	
SPIO2	Q229906	A228362	1,2,4-TRICHLOROBENZENE	0.00	100	68	ug/L	68	
SPIO2	Q229906	A228362	4-CHLORO-3-METHYLPHENOL	0.00	200	170	ug/L	85	
SPIO2	Q229906	A228362	ACENAPHTHENE	0.00	100	96	ug/L	96	
SPIO2	Q229906	A228362	4-NITROPHENOL	0.00	200	85	ug/L	43	
SPIO2	Q229906	A228362	2,4-DINITROTOLUENE	0.00	100	* 110	ug/L	110	
SPIO2	Q229906	A228362	PENTACHLOROPHENOL	0.00	200	150	ug/L	75	
SPIO2	Q229906	A228362	PYRENE	0.00	100	77	ug/L	77	
CCV	Q253419		See Attached Report g1442b.ind						
BLA01	Q253420		See Attached Report g1452b.ind						
BLA02	Q229904		See Attached Report g1454b.ind						
SAMPLE	A228370		See Certificate of Analysis						

Comments

*Q229907 NOTE: * OUT OF QC LIMITS.*
*Q229906 NOTE: * OUT OF QC LIMITS*

Notes

< *Less Than Lower Detection Limit*
* *See Note for Parameter*

Quality Assurance Officer: _____

Continuing Calibration Check
HSL Compounds

Case No:

Calibration Date: 05/02/91

Contractor: EMSIN

Time: 09:04

Contract No:

Laboratory ID: >4710C

Instrument ID: GCMS#3

Initial Calibration Date: 03/11/91

Minimum $\overline{RF}$ for SPCC is .30

Maximum % Diff for CCC is 25%

Compound	$\overline{RF}$	RF	%Diff	CCC	SPCC	
Acrolein	.11587	.10133	12.55			(Conc=1250.00)
Acrylonitrile	.29668	.33265	12.12			(Conc=1750.00)
Chloromethane	.63154	.58524	7.33		**	(Conc=50.00)
Bromomethane	.65134	.87492	34.33			(Conc=50.00)
Vinyl Chloride	.75090	.92693	23.44	*		(Conc=50.00)
Dichlorodifluoromethane	1.01974	.54595	46.46			(Conc=50.00)
Chloroethane	.63228	.62693	.85			(Conc=50.00)
Methylene Chloride	1.61904	1.49554	7.63			(Conc=50.00)
Acetone	.33471	.40335	20.51			(Conc=50.00)
Carbon Disulfide	3.29353	3.28110	.38			(Conc=50.00)
Trichlorofluoromethane	1.93412	.51768	73.23			(Conc=50.00)
1,1-Dichloroethene	1.18569	1.25511	5.85	*		(Conc=50.00)
1,1-Dichloroethane	1.72263	1.84894	7.33		**	(Conc=50.00)
[Tetrahydrofuran]	.26479	.35856	35.41			(Conc=125.00)
1,2-Dichloroethene (total)	1.29508	1.35569	4.68			
Diethyl Ether	.75636	.81135	7.27			(Conc=50.00)
Chloroform	2.32848	2.68099	15.14	*		(Conc=50.00)
Trichloro-trifluoroethane	2.33924	2.29346	1.96			(Conc=50.00)
1,2-Dichloroethane-d4	1.36023	1.40512	3.30			(Conc=50.00)
2-Butanone	.63507	.75060	18.19			
1,2-Dichloroethane	1.69415	1.60860	5.05			(Conc=50.00)
Methyl-t-butyl ether	.71056	.72126	1.51			(Conc=50.00)
1,1,1-Trichloroethane	.60935	.54319	10.86			(Conc=50.00)
Carbon Tetrachloride	.64329	.55867	13.15			(Conc=50.00)
Vinyl Acetate	.01637	.01512	7.67			(Conc=50.00)
Bromodichloromethane	.74434	.69331	6.86			(Conc=50.00)
1,2-Dichloropropane	.37629	.42102	11.89	*		(Conc=50.00)
cis-1,3-Dichloropropene	.80279	.88405	10.12			(Conc=50.00)
Trichloroethene	.45850	.47329	3.22			(Conc=50.00)
Diisopropyl Ether	1.10339	1.26629	14.76			(Conc=50.00)
2-Chloroethyl Vinyl Ether	.21128	.23324	10.39			(Conc=50.00)
Dibromochloromethane	.65723	.67803	3.16			(Conc=50.00)

RF - Response Factor from daily standard file at 50.00 ug/L

$\overline{RF}$ - Average Response Factor from Initial Calibration Form VI
%Diff - % Difference from original average or curve
CCC - Calibration Check Compounds (*) SPCC - System Performance Check Compounds

Continuing Calibration Check
HSL Compounds

Case No:

Contractor: EMSIN

Contract No:

Instrument ID: GCMS#3

Calibration Date: 05/02/91

Time: 09:04

Laboratory ID: >4710C

Initial Calibration Date: 03/11/91

Minimum $\overline{RF}$ for SPCC is .30 Maximum % Diff for CCC is 25%

Compound	$\overline{RF}$	RF	%Diff	CCC	SPCC	
1,1,2-Trichloroethane	.34707	.40198	15.82			(Conc=50.00)
Benzene	.80989	.91181	12.58			(Conc=50.00)
trans-1,3-Dichloropropene	.24801	.25932	4.56			(Conc=50.00)
Bromoform	.59242	.58411	1.40		**	(Conc=50.00)
4-Methyl-2-Pentanone	.43460	.55971	28.79			(Conc=50.00)
2-Hexanone	.32002	.01998	93.76			(Conc=50.00)
Tetrachloroethene	.46675	.47916	2.66			(Conc=50.00)
1,1,2,2-Tetrachloroethane	.67351	.81681	21.28		**	(Conc=50.00)
Toluene-d8	.87905	1.10181	25.34			(Conc=50.00)
Toluene	.59101	.67996	15.05	*		(Conc=50.00)
Chlorobenzene	.85636	.99806	16.55		**	(Conc=50.00)
Ethylbenzene	.41045	.46285	12.77	*		(Conc=50.00)
Bromofluorobenzene	.75389	.82421	9.33			(Conc=50.00)
Styrene	.84683	.99194	17.14			(Conc=50.00)
Xylene (total)	.49361	.56280	14.02			(Conc=100.00)
1,3-Dichlorobenzene	-	-	-			(Conc=50.00)
1,2-Dichlorobenzene	-	-	-			(Conc=50.00)
1,4-Dichlorobenzene	-	-	-			(Conc=50.00)

RF - Response Factor from daily standard file at 50.00 ug/L

$\overline{RF}$ - Average Response Factor from Initial Calibration Form VI
%Diff - % Difference from original average or curve
CCC - Calibration Check Compounds (*) SPCC - System Performance Check Compounds (

EMS LABORATORIES, INC
VOLATILES ANALYSIS-WATER METHOD BLANK
ANALYSIS METHOD: SW846-8240

MASS SPEC FILE: >4712C
ANALYSIS DATE/TIME: 5/2/91 11:31

TARGET COMPOUND LIST	RESULT	UNITS	DET. LIMIT
Acetone	BDL	uG/L	20
Acrolein	BDL	uG/L	50
Acrylonitrile	BDL	uG/L	70
Benzene	BDL	uG/L	5
Bromodichloromethane	BDL	uG/L	5
Bromoform	BDL	uG/L	5
Bromomethane	BDL	uG/L	10
Carbon disulfide	BDL	uG/L	5
Carbon tetrachloride	BDL	uG/L	5
Chlorobenzene	BDL	uG/L	5
Chloroethane	BDL	uG/L	10
Chloroform	BDL	uG/L	5
Chloromethane	BDL	uG/L	10
Dibromochloromethane	BDL	uG/L	5
cis-1,3-Dichloropropene	BDL	uG/L	5
Dichlorodifluoromethane	BDL	uG/L	5
1,1-Dichloroethane	BDL	uG/L	5
1,2-Dichloroethane	BDL	uG/L	5
1,1-Dichloroethene	BDL	uG/L	5
1,2-Dichloropropane	BDL	uG/L	5
Ethylbenzene	BDL	uG/L	5
Fluorotrichloromethane	BDL	uG/L	5
2-Hexanone	BDL	uG/L	10
Methylene chloride	BDL	uG/L	5
Methyl ethyl ketone	15	uG/L	10
4-Methyl-2-pentanone	BDL	uG/L	10
Styrene	BDL	uG/L	5
1,1,2,2-Tetrachloroethane	BDL	uG/L	5
Tetrachloroethene	BDL	uG/L	5
Tetrahydrofuran	BDL	uG/L	25
Toluene	BDL	uG/L	5
1,2-Dichloroethene (total)	BDL	uG/L	5
trans-1,3-Dichloropropene	BDL	uG/L	5
1,1,1-Trichloroethane	BDL	uG/L	5
1,1,2-Trichloroethane	BDL	uG/L	5
Trichloroethene	BDL	uG/L	5
Vinyl acetate	BDL	uG/L	10
Vinyl chloride	BDL	uG/L	10
Xylenes (total)	BDL	uG/L	5

SURROGATE LIST			(spike conc)
Dichloroethane-d4	95	% Rec	(50)
Toluene-d8	100	% Rec	(50)
Bromofluorobenzene	104	% Rec	(50)

( ) = ESTIMATED CONCENTRATION

Continuing Calibration Check
HSL Compounds

Case No:

Contractor: EMSIN

Contract No:

Instrument ID: 8702

Calibration Date: 05/21/91

Time: 10:15

Laboratory ID: >1442B

Initial Calibration Date: 05/17/91

Minimum $\overline{RF}$ for SPCC is 0.05

Maximum % Diff for CCC is 25.0%

Compound	$\overline{RF}$	RF	%Diff	CCC	SPCC
Pyridine	1.40716	1.48479	5.52		
2-Picoline	1.12030	1.20043	7.15		
2-Fluorophenol	1.00770	1.08768	7.94		
Phenol	1.07453	1.15241	7.25	*	
bis(2-chloroethyl)ether	.96355	1.04985	8.96		
2-Chlorophenol	1.09656	1.20328	9.73		
1,3-Dichlorobenzene	1.25708	1.46410	16.47		
1,4-Dichlorobenzene	1.27960	1.47382	15.18	*	
Phenol-d6	1.10952	1.12745	1.62		
Benzyl alcohol	.53476	.61047	14.16		
1,2-Dichlorobenzene	1.21605	1.37808	13.33		
2-Methylphenol	.87910	.89638	1.97		
bis(2-chloroisopropyl)ether	.37546	.54768	45.87		
4-Methylphenol	.87388	.88904	1.73		
N-Nitroso-di-n-propylamine	.48043	.52000	8.24		**
Hexachloroethane	.49557	.57938	16.91		
Nitrobenzene	.23870	.24652	3.28		
Isophorone	.46888	.54378	15.97		
2-Nitrophenol	.18165	.20085	10.57	*	
Nitrobenzene-d5	.25501	.28795	12.92		
2,4-Dimethylphenol	.26185	.28206	7.72		
Benzoic acid	.12175	.14259	17.11		
bis(2-Chloroethoxy)methane	.33428	.38039	13.79		
2,4-Dichlorophenol	.28626	.30624	6.98	*	
1,2,4-Trichlorobenzene	.30170	.34484	14.30		
Naphthalene	.88128	1.01269	14.91		
4-Chloroaniline	.36021	.37813	4.97		
Hexachlorobutadiene	.16956	.20393	20.26	*	
4-Chloro-3-methylphenol	.19495	.20068	2.93	*	
2-Methylnaphthalene	.55158	.62951	14.13		
Toluenediamine	.10407	.06917	33.53		
Hexachlorocyclopentadiene	.38031	.44859	17.95		**

RF - Response Factor from daily standard file at 50.00 UG/KG

$\overline{RF}$ - Average Response Factor from Initial Calibration Form VI
%Diff - % Difference from original average or curve
CCC - Calibration Check Compounds (*) SPCC - System Performance Check Compounds (*

Continuing Calibration Check
HSL Compounds

Case No:

Contractor: EMSIN

Contract No:

Instrument ID: 8702

Calibration Date: 05/21/91

Time: 10:15

Laboratory ID: >1442B

Initial Calibration Date: 05/17/91

Minimum $\overline{RF}$ for SPCC is 0.05 Maximum % Diff for CCC is 25.0%

Compound	$\overline{RF}$	RF	%Diff	CCC	SPCC
2-Fluorobiphenyl	1.23839	1.44046	16.32		
2,4,6-Trichlorophenol	.35678	.38323	7.42	*	
2,4,5-Trichlorophenol	.30380	.38614	27.10		
2-Chloronaphthalene	1.02258	1.19625	16.98		
2-Nitroaniline	.15123	.16983	12.30		
1,2,4,5-Tetrachlorobenzene	.42329	.50075	18.30		
Dimethylphthalate	.98965	1.15999	17.21		
Acenaphthylene	1.57083	1.73013	10.14		
2,6-Dinitrotoluene	.26521	.29451	11.05		
3-Nitroaniline	.25231	.27629	9.51		
Acenaphthene	.93021	1.04910	12.78	*	
1,3-Dinitrobenzene	.19259	.23346	21.22		
2,4-Dinitrophenol	.13419	.16626	23.90		**
4-Nitrophenol	.08508	.09787	15.03		**
Dibenzofuran	1.28132	1.43937	12.33		
2,4-Dinitrotoluene	.27927	.32557	16.58		
Diethylphthalate	.90502	1.00344	10.87		
4-Chlorophenyl-phenylether	.47746	.54894	14.97		
Fluorene	.93687	1.07397	14.63		
4-Nitroaniline	.21400	.23937	11.85		
2,4,6-Tribromophenol	.12392	.13984	12.85		
4,6-Dinitro-2-methylphenol	.12689	.14420	13.65		
Carbazole	.76787	.84763	10.39		
N-Nitrosodiphenylamine (1)	.46498	.52084	12.01	*	
1,2-Diphenylhydrazine	.55044	.59770	8.59		
4-Bromophenyl-phenylether	.21997	.23207	5.50		
Hexachlorobenzene	.24896	.24990	.38		
Pentachlorophenol	.12693	.13953	9.92	*	
Phenanthrene	.95001	1.01674	7.02		
Anthracene	.92119	1.02705	11.49		
Di-n-butylphthalate	1.05195	1.19282	13.39		
Fluoranthene	.86757	.96555	11.29	*	

RF - Response Factor from daily standard file at 50.00 UG/KG

$\overline{RF}$ - Average Response Factor from Initial Calibration Form VI
%Diff - % Difference from original average or curve
CCC - Calibration Check Compounds (*) SPCC - System Performance Check Compounds (

Continuing Calibration Check
HSL Compounds

Case No:

Calibration Date: 05/21/91

Contractor: EMSIN

Time: 10:15

Contract No:

Laboratory ID: >1442B

Instrument ID: 8702

Initial Calibration Date: 05/17/91

Minimum $\overline{RF}$ for SPCC is 0.05

Maximum % Diff for CCC is 25.0%

Compound	$\overline{RF}$	RF	%Diff	CCC	SPCC
Pyrene	1.48723	2.27924	53.25		
Butylbenzylphthalate	.56314	.80726	43.35		
3,3'-Dichlorobenzidine	.25126	.28365	12.89		
Benzo(a)anthracene	.98093	1.21182	23.54		
Chrysene	.84411	1.09577	29.81		
bis(2-Ethylhexyl)phthalate	.70335	.89543	27.31		
Terphenyl-d14	1.03844	1.50580	45.01		
Di-n-octylphthalate	1.74984	1.88885	7.94	*	
Benzo(b)fluoranthene	1.21802	1.32625	8.89		
Benzo(k)fluoranthene	1.07580	1.22572	13.94		
Benzo(a)pyrene	.95949	1.14897	19.75	*	
Indeno(1,2,3-cd)pyrene	.53019	.64396	21.46		
Dibenz(a,h)anthracene	.57317	.69495	21.25		
Benzo(g,h,i)perylene	.54625	.66448	21.64		

RF - Response Factor from daily standard file at 50.00 UG/KG
RF - Average Response Factor from Initial Calibration Form VI
%Diff - % Difference from original average or curve

CCC - Calibration Check Compounds (*) SPCC - System Performance Check Compounds (*

EMS LABORATORIES, INC
SEMI-VOLATILES ANALYSIS-INSTRUMENT BLANK
ANALYSIS METHOD: SW846-8270

MASS SPEC FILE: >1452B

ANALYSIS DATE/TIME: 5/21/91 12:09

TARGET COMPOUND LIST	RESULT	UNITS	DET. LIMIT
Acenaphthene	BDL	mG/L	10
Acenapthylene	BDL	mG/L	10
Anthracene	BDL	mG/L	10
Benz(a)anthracene	BDL	mG/L	10
Benzo(a)pyrene	BDL	mG/L	10
Benzo(b)fluoranthene	BDL	mG/L	10
Benzo(ghi)perylene	BDL	mG/L	10
Benzo(k)fluoranthene	BDL	mG/L	10
Benzyl Alcohol	BDL	mG/L	10
Benzylbutylphthalate	BDL	mG/L	10
Bis(2-chloroethoxy)methane	BDL	mG/L	10
Bis(2-chloroethyl)ether	BDL	mG/L	10
Bis(2-chloroisopropyl)ether	BDL	mG/L	10
Bis(2-ethylhexyl)phthalate	BDL	mG/L	10
4-Bromophenylphenylether	BDL	mG/L	10
Carbazole	BDL	mG/L	10
4-Chloroaniline	BDL	mG/L	10
2-Chloronaphthalene	BDL	mG/L	10
4-Chlorophenylphenylether	BDL	mG/L	10
Chrysene	BDL	mG/L	10
Dibenz(a,h)anthracene	BDL	mG/L	10
Dibenzofuran	BDL	mG/L	10
1,2-Dichlorobenzene	BDL	mG/L	10
1,3-Dichlorobenzene	BDL	mG/L	10
1,4-Dichlorobenzene	BDL	mG/L	10
3,3' -Dichlorobenzidine	BDL	mG/L	20
Diethylphthalate	BDL	mG/L	10
Dimethylphthalate	BDL	mG/L	10
Di-n-butylphthalate	BDL	mG/L	10
Dinitrobenzenes	BDL	mG/L	50
2,4-Dinitrotoluene	BDL	mG/L	10
2,6-Dinitrotoluene	BDL	mG/L	10
Di-n-octylphthalate	BDL	mG/L	10
Fluoranthene	BDL	mG/L	10
Fluorene	BDL	mG/L	10
Hexachlorobenzene	BDL	mG/L	10
Hexachlorobutadiene	BDL	mG/L	10
Hexachlorocyclopentadiene	BDL	mG/L	10
Hexachloroethane	BDL	mG/L	10
Indeno(1,2,3-cd)pyrene	BDL	mG/L	10
Isophorone	BDL	mG/L	10
2-Methylnaphthalene	BDL	mG/L	10
Naphthalene	BDL	mG/L	10

MASS SPEC FILE: >1452B

2-Nitroaniline	BDL	mG/L	50
3-Nitroaniline	BDL	mG/L	50
4-Nitroaniline	BDL	mG/L	50
Nitrobenzene	BDL	mG/L	10
N-Nitroso-diphenylamine	BDL	mG/L	10
N-Nitroso-di-n-propylamine	BDL	mG/L	10
Phenanthrene	BDL	mG/L	10
2-Picoline	BDL	mG/L	50
Pyrene	BDL	mG/L	10
Pyridine	BDL	mG/L	50
Tetrachlorobenzenes	BDL	mG/L	10
Toluenediamine	BDL	mG/L	50
1,2,4-Trichlorobenzene	BDL	mG/L	10
Benzoic Acid	BDL	mG/L	50
4-Chloro-3-methylphenol	BDL	mG/L	10
2-Chlorophenol	BDL	mG/L	10
2,4-Dichlorophenol	BDL	mG/L	10
2,4-Dimethylphenol	BDL	mG/L	10
4,6-Dinitro-2-methylphenol	BDL	mG/L	50
2,4-Dinitrophenol	BDL	mG/L	50
2-Methylphenol	BDL	mG/L	10
4-Methylphenol	BDL	mG/L	10
2-Nitrophenol	BDL	mG/L	10
4-Nitrophenol	BDL	mG/L	50
Pentachlorophenol	BDL	mG/L	50
Phenol	BDL	mG/L	10
Tetrachlorophenol	BDL	mG/L	10
2,4,5-Trichlorophenol	BDL	mG/L	50
2,4,6-Trichlorophenol	BDL	mG/L	10

( ) = ESTIMATED CONCENTRATION

EMS LABORATORIES, INC
SEMI-VOLATILES ANALYSIS-WATER METHOD BLANK
ANALYSIS METHOD: SW846-8270

MASS SPEC FILE: >1454B QC#- A229904

ANALYSIS DATE/TIME: 5/21/91 13:57

PREP DATE: 4/27/91

TARGET COMPOUND LIST	RESULT	UNITS	DET. LIMIT
Acenaphthene	BDL	uG/L	10
Acenapthylene	BDL	uG/L	10
Anthracene	BDL	uG/L	10
Benz(a)anthracene	BDL	uG/L	10
Benzo(a)pyrene	BDL	uG/L	10
Benzo(b)fluoranthene	BDL	uG/L	10
Benzo(ghi)perylene	BDL	uG/L	10
Benzo(k)fluoranthene	BDL	uG/L	10
Benzyl Alcohol	BDL	uG/L	10
Benzylbutylphthalate	BDL	uG/L	10
Bis(2-chloroethoxy)methane	BDL	uG/L	10
Bis(2-chloroethyl)ether	BDL	uG/L	10
Bis(2-chloroisopropyl)ether	BDL	uG/L	10
Bis(2-ethylhexyl)phthalate	BDL	uG/L	10
4-Bromophenylphenylether	BDL	uG/L	10
Carbazole	BDL	uG/L	10
4-Chloroaniline	BDL	uG/L	10
2-Chloronaphthalene	BDL	uG/L	10
4-Chlorophenylphenylether	BDL	uG/L	10
Chrysene	BDL	uG/L	10
Dibenz(a,h)anthracene	BDL	uG/L	10
Dibenzofuran	BDL	uG/L	10
1,2-Dichlorobenzene	BDL	uG/L	10
1,3-Dichlorobenzene	BDL	uG/L	10
1,4-Dichlorobenzene	BDL	uG/L	10
3,3' -Dichlorobenzidine	BDL	uG/L	20
Diethylphthalate	BDL	uG/L	10
Dimethylphthalate	BDL	uG/L	10
Di-n-butylphthalate	BDL	uG/L	10
Dinitrobenzenes	BDL	uG/L	50
2,4-Dinitrotoluene	BDL	uG/L	10
2,6-Dinitrotoluene	BDL	uG/L	10
Di-n-octylphthalate	BDL	uG/L	10
Fluoranthene	BDL	uG/L	10
Fluorene	BDL	uG/L	10
Hexachlorobenzene	BDL	uG/L	10
Hexachlorobutadiene	BDL	uG/L	10
Hexachlorocyclopentadiene	BDL	uG/L	10
Hexachloroethane	BDL	uG/L	10
Indeno(1,2,3-cd)pyrene	BDL	uG/L	10
Isophorone	BDL	uG/L	10
2-Methylnaphthalene	BDL	uG/L	10
Naphthalene	BDL	uG/L	10

MASS SPEC FILE: >1454B

2-Nitroaniline	BDL	uG/L	50
3-Nitroaniline	BDL	uG/L	50
4-Nitroaniline	BDL	uG/L	50
Nitrobenzene	BDL	uG/L	10
N-Nitroso-diphenylamine	BDL	uG/L	10
N-Nitroso-di-n-propylamine	BDL	uG/L	10
Phenanthrene	BDL	uG/L	10
2-Picoline	BDL	uG/L	50
Pyrene	BDL	uG/L	10
Pyridine	BDL	uG/L	50
Tetrachlorobenzenes	BDL	uG/L	10
Toluenediamine	BDL	uG/L	50
1,2,4-Trichlorobenzene	BDL	uG/L	10
Benzoic Acid	BDL	uG/L	50
4-Chloro-3-methylphenol	BDL	uG/L	10
2-Chlorophenol	BDL	uG/L	10
2,4-Dichlorophenol	BDL	uG/L	10
2,4-Dimethylphenol	BDL	uG/L	10
4,6-Dinitro-2-methylphenol	BDL	uG/L	50
2,4-Dinitrophenol	BDL	uG/L	50
2-Methylphenol	BDL	uG/L	10
4-Methylphenol	BDL	uG/L	10
2-Nitrophenol	BDL	uG/L	10
4-Nitrophenol	BDL	uG/L	50
Pentachlorophenol	BDL	uG/L	50
Phenol	BDL	uG/L	10
Tetrachlorophenol	BDL	uG/L	10
2,4,5-Trichlorophenol	BDL	uG/L	50
2,4,6-Trichlorophenol	BDL	uG/L	10

SURROGATE LIST			(spike conc)
2-Fluorophenol	62	% Rec	(100)
Phenol-d5	39	% Rec	(100)
Nitrobenzene-d5	91	% Rec	(50)
2-Fluorobiphenyl	88	% Rec	(50)
2,4,6-Tribromophenol	91	% Rec	(100)
Terphenyl-d14	76	% Rec	(50)

( ) = ESTIMATED CONCENTRATION

APPENDIX G

FORM 1

DATE _____

LOCATION _____

AUDITOR _____

GENERAL INFORMATION

		YES	NO	COMMENTS
1)	Does the laboratory have copies of SOPs/methods manuals and QA Plans available to all personnel?			
2)	Are training records maintained and up to date? Is training by group leader or above?			
3)	Is a Sample Custodian designated?			
4)	Are written Standard Operating Procedures (SOPs) developed for receipt and storage of samples?			
5)	Are samples stored in such a way that their preservation is maintained?			
6)	Are refrigerator/freezer logs maintained, checked daily and up to date?			
7)	Are excursions in cooler temperature noted and appropriate actions taken as required?			
8)	Are volatiles stored separately from semi-vols?			
9)	Does someone responsible review and initial the sample log and log sheets daily?			
10)	Are contamination free areas provided for trace level analytical work?			
11)	Does the facility appear clean and safe?			
12)	Are toxics handled in fume hoods? Are fume hoods checked & documented quarterly?			
13)	Are the toxic chemical handling areas either a stainless steel bench or an impervious material covered with absorbent material?			

PAGE 2 OF FORM 1

		YES	NO	COMMENTS
14)	Is there documented "trace-free" water available for preparing standards and blanks?			
15)	Is the conductivity of "trace-free" water routinely checked and recorded?			
16)	Is (Are) the analytical balance(s) correctly located (free from drafts and rapid temperature changes) and checked semi-annually by a certified technician and documented?			
17)	Are the balances checked with class S weights and documented at least weekly?			
18)	Are solvent storage cabinets properly vented in order to prevent possible laboratory contamination?			
19)	Are reagent grade (or higher purity) chemicals used to prepare standards and reagents?			
20)	Are reagents dated upon receipt and upon opening? Is First-in, First-out method used?			
21)	Are reagents standardized before use?			
22)	Generally, are reference materials properly labeled with concentrations, preparation date, solvent, preservative expiration date and name of person preparing?			
23)	Are spike/calibration stock standards preparation and tracking logbook(s) maintained?			
24)	Are the primary standards approved by the EMS QAP?			
25)	Are bench sheets filed so that they are readily accessible?			
26)	Are standards and samples (& extracts) stored separately?			
27)	Are samples checked for proper preservation upon arrival? Is this noted within LIMS?			
28)	Are logs maintained for all ovens and incubators?			
29)	Is an NBS thermometer available?			

PAGE 3 OF FORM 1

		YES	NO	COMMENTS
30)	Are copies of EPA - PEs and others such as APG on file?			
31)	Is the distilled/deionized water system functioning properly? Is it checked daily and noted in a logbook?			
32)	Are samples requiring chain of custody documentation properly checked before signing chain of custody papers?			
33)	What is done with lab waste? _____ _____ _____			
34)	Are chemical waste disposal policies/procedures adequate?			
35)	Are blind samples introduced into the lab by the QAO?			
36)	Are corrections on bench sheets, lab books, etc. made in such a way that initial entries are legible?			
37)	Are such corrections initialed and dated?			

FORM 2

DATE_____

SERVICE GROUP _____ AUDITOR _____

LOCATION _____ ANALYST _____

	TEST	YES	NO	COMMENTS
1)	Are methods manuals & QAP's available to the analysts?			
2)	Is the SOP for glassware washing posted at the cleaning stations?			
3)	Are the types and numbers of required Blanks being checked? Bla 01? Bla 02? Cal 00?			
4)	Are blank data logged to the QA sheet and transferred to LIMS?			
4a)	Does blank data appear to be "in control"?			
4b)	Do original instrument outputs agree with what was reported?			
5)	Are calibration curves maintained for all analytes?			
6)	Are calibrations verified (1 point) or performed (5 points) prior to the analysis of samples CAL01 + CAL00? Comment: _____			
7)	Is an EPA, NIST or other approved external reference used to check and verify concentrations of CAL standards and is the result recorded on the QA sheet?			
7a)	Are the results recorded in LIMS?			
8)	Do the analysts record bench data in a neat and accurate manner?			

PAGE 2 OF FORM 2

		YES	NO	COMMENTS
8a)	Is all quality assurance data correctly transferred from the Bench/QA sheets into LIMS?			
9)	Is a calibration verification performed at the correct frequency?			
9a)	Documented to LIMS?			
10)	Is a prepped performance check (LCS) analyzed once per run or as required by the QAP? (eg one per set of 10)			
11)	Is a prepped sample spike (SPI02) analyzed with each run or as required by the QAP? (eg one per set of 10)			
12)	Is a prepped sample replicate analyzed (or a duplicate spike?) at the appropriate frequency according to the QAP? (eg one per set of 10)			
13)	If any problems occur, has corrective action been taken and documented?			
	Comments: _____			
14)	Is a calibration verification solution analyzed at the end of each run?			
15)	Is the method of internal standards used for GC/MS?			
16)	List internal standards used for VOA. (Attach copy of report)			
	Are these correct for the method?			
17)	List internal standards used for SVOA's. (attach copy of report)			
	Are these correct for the method?			
18)	Are surrogates properly analyzed and reported? Are surrogates within CLP acceptance ranges?			

PAGE 3 OF FORM 2

		YES	NO	COMMENTS
19)	Are standard recoveries correctly calculated? Are spike recoveries correctly calculated? Are duplicate recoveries correctly calculated? Are they all documented in LIMS?			
20)	Does a manual recalculation agree with concentrations otherwise calculated and/or reported? (ie verify electronic integrator performing and correct peaks were chosen for GC, GC/MS)			
21)	For GC/MS, are unknowns (non-target compounds) correctly searched in the NBS library and documented as present with an estimated concentration?			
22)	For ICP, are interelement interference check solutions properly analyzed and documented prior to each run?			
23)	Have detection limits been empirically determined according to 40CFR136 for the analytes determined?			
24)	Are standards correctly Labelled? Logged & documented?			
25)	Are instrument operating manuals readily available?			
26)	Are data acceptance criteria developed and used for Blanks? Duplicates? Verification standards? Spikes?			
27)	Are instrument maintenance logs in place and maintained?			
28)	Is the mercury analyzer operational and well maintained (i.e. properly vented)?			
29)	Is preventive maintenance applied and documented?			
30)	Are data calculations spot-checked by a second person? Does this person initial these checked calculations?			

PAGE 4 OF FORM 2

		YES	NO	COMMENTS
31)	Do supervisory personnel review bench sheets and initial them?			
32)	Do records indicate that corrective action was taken as necessary?			
33)	Has a cooperative attitude been displayed?			
34)	Has corrective action indicated during previous visits been implemented?			
35)	Are extractions/digestion performed within holding times?			
36)	Are analyses performed within holding times?			
37)	Are sample preparation methods correct?			
38)	Is a background corrector properly used? (AA, GFAA, ICP)			
39)	Is an approved methodology used for the runs being examined?			
40)	Have acceptance criteria for start-up QC been met?			
41)	Do instrument outputs (strip charts, print-outs, bench sheets, etc.) agree with what is in the final report?			
42)	Are labs data validation procedures adequate?			
43)	Based upon blank, standard, spike and duplicate data, are goals of data accuracy and precision being met?			
44)	Is the method of standard additions being used correctly for HGA analyses?			
45)	Is analytical sensitivity adequate?			
46)	Are instrument guidelines and/or acceptance criteria used at the bench and at data review which determine the acceptability and reportability of data?			
47)	Are Blanks carried through entire process?			
48)	Are desiccants changed and documented?			

PAGE 5 OF FORM 2

		YES	NO	COMMENTS
49)	Are TOC, TOX and BTU instrument logs current?			
50)	Are normalities of titrants routinely checked?			
51)	Are sufficient cyanide distillation apparatus available to routinely analyze all samples within the required holding period?			

FORM 3

LAB _____

DATE _____

AUDITOR _____

METALS GROUPS

		YES	NO	COMMENTS
1)	Are samples for mercury analysis collected in glass and preserved with HNO_3 and Permanganate?			
2)	Are mercury determinations performed within 28 days of sample collection?			
3)	Are proper sample digestion techniques used and documented?			
4)	Is background correction used a) For all HGA work? b) As required for flame AA work?			
5)	Are correct matrix modifiers used for HGA?			
6)	Is an ionization suppressor used as needed for flame AA?			
7)	For ICP are interelement corrections checked?			
8)	Do prep sets of 10 include proper QA and acceptance criteria?			
9)	Are wavelengths used recorded on bench sheets?			
10)	Are flame/furnace/ICP programs adequate? a) Integration times adequate? b) Furnace temperature programs correct? c) Sample aliquot or deposition times adequate?			
11)	Are sensitivity guidelines available at instruments?			

FORM 4

LAB _____

DATE _____

AUDITOR _____

GAS CHROMATOGRAPHY

		YES	NO	COMMENTS
1)	Are samples collected in amber glass bottle with teflon-lined lids?			
2)	Are samples kept at 4°C			
3)	Are samples extracted within 7 days?			
3a)	Analyzed within 40 days?			
4)	Are standards properly documented?			
5)	Are standards prepared fresh regularly?			
6)	Is there a well maintained log, documenting stability of all detectors?			
7)	Are Arochlor 1221 and 1232 standards run at the proper frequency and the data maintained for on-site inspection?			

FORM 5

LAB _____

DATE _____

AUDITOR _____

GC/MS

		YES	NO	COMMENTS
1)	Are samples extracted and/or analyzed within all required holding times?			
2)	Are control limits established and used for CCC and SPCC samples?			
3)	Is QA data properly transferred to LIMS?			
4)	Are Blanks, Spikes and Standards analyzed at the appropriate frequency?			
5)	Is Spike/spike duplicate data being generated?			
6)	Are surrogates properly analyzed with all samples?			
7)	Are surrogate results tabulated?			
8)	Are both 5 and 25 ml purge vessels available and properly used?			
9)	Are correct internal standards being used?			
10)	Is data reviewed prior to issuing final report?			
11)	Has QAO reviewed 2-5% of the runs?			
12)	Are reviewed bench sheets initialed?			
13)	Are all tuning criteria met?			
14)	Is the trap for the purge and trap filled with the proper adsorbent?			

PAGE 2 OF FORM 5

	YES	NO	COMMENTS
15) Is raw data being archived and documented properly (i.e magnetic tape)?			
16) Is a split/splitless capillary injector in place?			

APPENDIX H

STANDARD OPERATING PROCEDURE AND DOCUMENTATION OF LABORATORY PERSONNEL TRAINING

It is the responsibility of the Group Leader or designee to conduct preliminary training to insure assimilation of the new employee into the mainstream of analytical methodology at EMS-Heritage.

To assist EMS-Heritage, the employee, and the Group Leader, various training forms are kept in each employee's file.

1. Form One contains the steps taken during the employees first days to accomplish orientation and start training.

2. Form Two contains a checklist, to be completed by each laboratory employee and their group leader to assure familiarity with basic laboratory equipment and technologies.

3. Form Three is a data review sheet containing a check list. The analyst must use during review of their own data.

4. Form Four is provided to document on-going training including in-house training seminars, group meetings, outside seminars, additional classes, accomplishments, etc.

5. The remaining forms include documentation of the employee's training on specific methodologies. At the onset of training, the employees are assigned to a trainer. The employee's trainer is the group leader or his/her designee, who is an experienced and audited chemist for that methodology.

   The first step in the employee's training is the reading of the approved method. Employees will observe and assist their trainer for a period of time dependent on the complexity of the analysis. At such time, as the trainer deems appropriate, training employees will run the analysis independently as the trainer observes and instructs. Information regarding the first run is recorded on the training document. The trainer will continue to review the employee's data and technique until the trainer considers the employee trained. The last step in the training process is the performance audit, to be given by the Group Leader, or designee. The performance audit will cover adherence to method technique, documentations and knowledge of interferences, chemistry, etc. A blind standard may also be issued at this time. Successful completion of a performance audit must occur before analyst may operate independently.

6. Retraining verification will occur formally just prior to each employees winter review, on an annual basis. The verification will occur through one or more of the following mechanisms; a Blind Performance Evaluation sample, a Written Test, or a Performance Audit.

FORM I

NEW EMPLOYEE ORIENTATION CHECK LIST

NAME: _____

DATE OF EMPLOYMENT: _____

POSITION: _____

LAB GROUP: _____

_____ Fill out all necessary forms through the Personnel Department

_____ Get fitted for lab coats through our Purchasing Department

_____ Obtain safety glasses and/or goggles. Prescription wearers should set up an eye appointment to obtain prescription safety glasses.

_____ General tour of facility and introduction to key personnel

_____ Meeting with the QA/QC Office. At this time employee should sign our Signature List and Confidentiality Agreement

_____ Introduction to the LIMS system through the Computer Department. An analyst parameter number should be issued, if appropriate.

_____ Schedule New Employee Orientation through HERITAGE Personnel Department

_____ Safety tour and orientation from Safety Team member

_____ Obtain building entry code from Lab Director with a demonstration and explanation of our security system

_____ Obtain explanation of the following:

Time Cards (How to fill out and where to keep)
Pay Day
Dress Code
Break Time Policy/Smoking Hours
Lunch Hour
Overtime Policy

_____ Obtain copy of the Personnel Manual and Standard Operating Procedures for your respective group, and a job description

Supervisor's Initials _____ Date _____

FORM TWO

NAME:_____

TRAINING CHECKLIST FOR BASIC LABORATORY EQUIPMENT AND TECHNIQUES.

_____ Analytical Balance

_____ Use of and Cleaning Procedure for Pipettes

_____ Fume Hood

_____ Operation of Centrifuge

_____ Waste Solvent Information and Disposal

_____ Use of pH paper

_____ Gas Cylinder Training

_____ Glassware Description and Cleaning S.O.P.

_____ Disposal of Broken Glassware

_____ Water Types and Usages

_____ Sampling a Sample

_____ Cooler Arrangements - Sample and Extract Storage

_____ Tour of Stock Room

_____ Standards and Reagents (Labelling and Storage)

FORM THREE

DATA REVIEW

I. Completeness

A. Name
B. Date
C. Instrument
D. Units
E. DL
F. QA Types
G. % Recoveries or RSD

II. Accuracy

A. Spot-check calculations for samples and QA
B. Are dilutions accounted for?
C. Are weight/volume factors accounted for?
D. Are absorbance or results within the linear range?

III. QA

A. Are all QA requirements met?
B. Proper frequency and recoveries?
C. Are QA IDs and true values recorded?
D. Are cal. curve units, cc, y intercept and slope recorded?

FORM FOUR

ON-GOING TRAINING FORM

NAME: _____

DATE OF EMPLOYMENT: _____

POSITION: _____

LAB GROUP: _____

(Include Date, Topic, Description and Trainer):

_____

EMS HERITAGE- INDIANAPOLIS, INDIANA

Analyst:_____ Education:_____

Date Employed:_____ Prior Experience:_____ Page____of____

General Organic Group Starting Date:_____

Analytical Method	Method Referenced	Date Trained	Trained By	Approved	EPA %Recov	Run

90LO2566.G

Analyst _____ Education _____

Date Employed _____ Prior Experience _____

Metals Group _____ _____

Analytical Method	Method Referenced	Date Trained	Trained By	Approved	EPA % Recovery	Run #
QC, Calculations, Paperwork	NA				NA	NA
General FAA	NA				NA	NA
IL S12 FAA	NA					
PE 2380 FAA	NA					
PE 5100 FAA	NA					
General GFAA	NA				NA	NA
PE 3030 GFAA	NA					
PE 5100 GFAA	NA					
General CVAA	SW846-7470 and EPA 245.1				NA	NA
PE 403 CVAA	"					
PE 2380 CVAA	"					
PE 5100 CVAA	"					
IL S12 CVAA	"					

Analytical Method	Method Referenced	Date Trained	Trained By	Approved	EPA % Recovery	Run #
General ICP IL ICAP-61	EPA 200.7 and and SW846-6010				NA	NA
E.P. Toxicity	SW846-1310				NA	NA
T.C.L.P.	Federal Register				NA	
pH - Water	SW846-9040					
pH - Soil	SW846-9045					
General Sample Prep	NA				NA	NA
ICP, FAA Water Prep	SW846-3005, 3010, EPA 200.0					
GFAA Water Prep	SW846-3020, EPA 200.0					
Extract Preparation	SW846-3010, 3020					
Solid Preparation	SW846-3050					
Oil Prep - Acid Digestion	SW846-3030					
Oil Prep - MIBK Dissolution	SW846-3040					
Hg In Soils Prep	SW846-7471, EPA 245.5					

Analytical Method	Method Referenced	Date Trained	Trained By	Approved	EPA % Recovery	Run #
Cation Exchange Capacity	SW846-9081				NA	
Paint Filter Test	SW846-9095				NA	
Mobile Metals (Oily Waste)	SW846-1330				NA	NA
Glassware	EPA 200.0				NA	NA

CONTINUED TRAINING

Type of Training	Date Completed	Location	Instructor	Comments

TRAINING CHECK LIST - EXTRACTION PREPARATION

AREA OF TRAINING	DATE	TRAINED BY
Read Methods SW846-3010, 3020, EPA 200.0		
Sample Volumne		

ADDITIONAL TRAINING

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TRAINING CHECK LIST - T.C.L.P.

AREA OF TRAINING	DATE	TRAINED BY
Read Method - Federal Register		
Purpose of Test		
Extraction Fluid Preparation		
Selecting Representative Sample		
Extractor		
pH Meter Calibration		
Contamination and Safety Hazards		
Filtration of Extract		
Paperwork		
Routine Maintenance		
Test Passed		

ADDITIONAL TRAINING

Troubleshooting _____

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TRAINING CHECK LIST - QC, CALCULATIONS, PAPERWORK

AREA OF TRAINING	DATE	TRAINED BY
Types and Frequency of QC Samples		
Acceptance Criteria For QC Samples		
Instrument Log Books		
Reagent Prep Log Book		
Glassware Types		
Sources of PERs		
DL Determinations		
Significant Figures		
Reporting Units		
Linear Regression		
Dilutions		
Reproducibility/Spike Recovery Calculations		
Test Code Organization		
Data Sheet Corrections		
Raw Data ID/Filing		
Rush Samples		
Test Passed		

ADDITIONAL TRAINING

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TRAINING CHECK LIST - GENERAL GFAA

AREA OF TRAINING	DATE	TRAINED BY
Theory of GFAA		
STPF System		
Tube Installation		
Inert Gas/Stop Gas		
EDL Operation		
Hazards		
Contamination Sources		
Common Interferences		
Zeeman Background Correction		
Matrix Modifiers		
Characteristic Mass		
Calibration		
Theory of Standard Additions		
GFAA Quantitation		
Peak Height vs. Peak Area		
Paperwork		
Test Passed		

ADDITIONAL TRAINING

Trouble Shooting _____

End Cone Installation _____

_____

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TRAINING CHECK LIST - GENERAL ICP

AREA OF TRAINING	DATE	TRAINED BY
Read Method EPA 200.7		
Principles of ICP		
Simultaneous/Sequential		
Linear Range		
Interferences		
a. Chemical		
b. Physical		
c. Spectral		
Background Correction		
Interfering Element Corrections		
Multielement Standards		
Paperwork		
Test Passed		

ADDITIONAL TRAINING

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TRAINING CHECK LIST - PE 5100 CVAA

AREA OF TRAINING	DATE	TRAINED BY
Computer Functions/Log In		
Recalling CVAA Program		
Instrument Set Up		
CVAA Apparatus Set Up		
Cell Alignment		
Energy Maximization		
Sample Analysis		
Leachate Analysis		
Routine Maintenance		
Instrument Shutdown		
General CVAA Test Passed		

ADDITIONAL TRAINING

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TRAINING CHECK LIST - pH - WATER

AREA OF TRAINING	DATE	TRAINED BY
Read Method SW846-9040		
Meter Calibration		
Sample Analysis		
Electrode Cleaning		
Electrode Storage		
Paperwork		
Test Passed		

ADDITIONAL TRAINING

Troubleshooting _____

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TRAINING CHECK LIST - GLASSWARE

AREA OF TRAINING	DATE	TRAINED BY
Read Glassware Washing Procedure		
Principles of Steps Involved		
Contamination		
Reagent Preparation		
Acid Bath Use and Cleaning		
Pipet Washing		
Hg Bottles		
Safety Hazards		
Test Passed		

ADDITIONAL TRAINING

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TRAINING CHECK LIST - PE 3030 GFAA

AREA OF TRAINING	DATE	TRAINED BY
Keyboard Functions		
Instrument Settings		
Load Floppy Disks		
User Index		
File Storage		
Energy Maximization		
Premix Method		
Autosampler/Tip Alignment		
Sample Analysis		
Printer Operation		
Instrument Shutdown		
Routine Maintenance		
Test Passed		

ADDITIONAL TRAINING

Write GFAA Programs _____

_____

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TRAINING CHECK LIST - PE 5100 FAA

AREA OF TRAINING	DATE	TRAINED BY
Computer Functions/Log In		
Recalling FAA Programs		
Energy Maximization		
D_2 Lamp Alignment		
Burner Alignment		
Gas Box/Ignition		
Absorbance Maximization		
Nitrous Oxide Procedures		
Atomic Emission Procedures		
Calibration		
Sample Analysis		
Instrument Shutdown		
Routine Maintenance		
Test Passed		

ADDITIONAL TRAINING

D_2 Lamp Replacement _____

Data File Management _____

Automated Runs _____

Multielement Runs _____

Write FAA Programs _____

_____

TRAINING CHECK LIST - PE 2380 FAA

AREA OF TRAINING	DATE	TRAINED BY
Keyboard Functions		
Instrument Settings		
Energy Maximization		
D_2 Lamp Alignment		
D_2 Energy Setting		
Burner Alignment		
Gas Box/Ignition		
Absorbance Maximization		
Nitrous Oxide Procedures		
Atomic Emission Procedures		
Calibration		
Sample Analysis		
Instrument Shutdown		
Routine Maintenance		
Test Passed		

ADDITIONAL TRAINING

D_2 Lamp Replacement _____

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TRAINING CHECK LIST - GENERAL FAA

AREA OF TRAINING	DATE	TRAINED BY
Principles of Atomic Absorption and Emission		
Single Beam/Double Beam		
Modulation		
D_2 Background Correction		
Matrix Modifiers		
Flow Spoiler/Impact Bead		
Hollow Cathode Lamps		
Sample Introduction System		
Air-Acetylene/Nitrous Oxide-Acetylene Flames		
Common Interferences		
Theory of Standard Additions		
Paperwork		
Test Passed		

ADDITIONAL TRAINING

Troubleshooting _____

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TRAINING CHECK LIST - OIL PREPARATION (ACID DIGESTION)

AREA OF TRAINING	DATE	TRAINED BY
Read Method SW846-3030		
Modifications in SW846-3030		
Sample Preparation		
General Prep Test Passed		

ADDITIONAL TRAINING

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TRAINING CHECK LIST - Hg IN SOILS PREPARATION

AREA OF TRAINING	DATE	TRAINED BY
Read Methods SW846-7471, EPA 245.5		
Aqua Regia Preparation		
Sample Preparation		
Safety Hazards		
Sample Digestion		
General Prep Test Passed		

ADDITIONAL TRAINING

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TRAINING CHECK LIST - CATION EXCHANGE CAPACITY

AREA OF TRAINING	DATE	TRAINED BY
Read Method SW846-9081		
Reagent Preparation		
Centrifuge		
Calculations		
Paperwork		
General Prep Test Passed		

ADDITIONAL TRAINING

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TRAINING CHECK LIST - PAINT FILTER TEST

AREA OF TRAINING	DATE	TRAINED BY
Read Method SW846-9095		
Sample Size		
Duration of Test		
Paperwork		
Test Passed		

ADDITIONAL TRAINING

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TRAINING CHECK LIST - MOBILE METALS (OILY WASTE)

AREA OF TRAINING	DATE	TRAINED BY
Read Method SW846-1330		
Soxhlet Extraction		
Preparation of Solvent Phase		
Calculations		
Safety Hazards		
Paperwork		
Test Passed		

ADDITIONAL TRAINING

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TRAINING CHECK LIST - SOLID PREPARATION

AREA OF TRAINING	DATE	TRAINED BY
Read Method SW846-3050	_____	_____
Sample Preparation	_____	_____
GFAA vs. ICP, FAA Prep	_____	_____
General Prep Test Passed	_____	_____

ADDITIONAL TRAINING

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TRAINING CHECK LIST - GFAA WATER PREPARATION

AREA OF TRAINING	DATE	TRAINED BY
Read Methods SW846-3020, EPA 200.0	_____	_____
Sample Volume/Dilution	_____	_____
Total, Dissolved, and Suspended Metals	_____	_____
Sample Preparation	_____	_____
General Prep Test Passed	_____	_____

ADDITIONAL TRAINING

_____

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TRAINING CHECK LIST - GENERAL SAMPLE PREPARATION

AREA OF TRAINING	DATE	TRAINED BY
Principles of Sample Preparation		
Multiphase Samples		
Representative Samples		
GFAA/ICP, FAA Preps		
Glassware Types		
Contamination Sources		
Spikes and Duplicates		
Safety Hazards		
EMS Prep Codes		
Paper Work		
Test Passed		

ADDITIONAL TRAINING

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TRAINING CHECK LIST - pH - SOIL

AREA OF TRAINING	DATE	TRAINED BY
Read Method SW846-9045		
Meter Calibration		
Sample Analysis		
Electrode Cleaning		
Electrode Storage		
Paperwork		
Test Passed		

ADDITIONAL TRAINING

Troubleshooting _____

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TRAINING CHECK LIST - E.P. TOXICITY

AREA OF TRAINING	DATE	TRAINED BY
Read Method SW846-1310		
Purpose of Test		
Selecting Representative Sample		
Extractor		
pH Meter Calibration		
Contamination and Safety Hazards		
Filtration of Extract		
Paperwork		
Routine Maintenance		
Test Passed		

ADDITIONAL TRAINING

Troubleshooting _____

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TRAINING CHECK LIST - IL S12 CVAA

AREA OF TRAINING	DATE	TRAINED BY
Instrument Set Up		
CVAA Apparatus Set Up		
Cell Alignment		
Energy Maximization		
Sample Analysis		
Leachate Analysis		
Routine Maintenance		
General CVAA Test Passed		

ADDITIONAL TRAINING

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TRAINING CHECK LIST - OIL PREPARATION (MIBK DISSOLUTION)

AREA OF TRAINING	DATE	TRAINED BY
Read Method SW846-3040		
Limitations of Method		
Sample Preparation		
Safety Hazards		
General Prep Test Passed		
Dissolution Test Passed		

ADDITIONAL TRAINING

_____

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_____

TRAINING CHECK LIST - PE 2380 CVAA

AREA OF TRAINING	DATE	TRAINED BY
Instrument Set Up		
CVAA Apparatus Set Up		
Cell Alignment		
Energy Maximization		
Sample Analysis		
Leachate Analysis		
Routine Maintenance		
General CVAA Test Passed		

ADDITIONAL TRAINING

_____

_____

_____

_____

_____

_____

TRAINING CHECK LIST - PE 403 CVAA

AREA OF TRAINING	DATE	TRAINED BY
Instrument Set Up		
CVAA Apparatus Set Up		
Cell Alignment		
Energy Maximization		
Sample Analysis		
Leachate Analysis		
Routine Maintenance		
General CVAA Test Passed		

ADDITIONAL TRAINING

_____

_____

_____

_____

_____

_____

TRAINING DOCUMENT

ANALYST _____ DATE HIRED _____

TEST _____ DATE _____ TRAINER _____

METHOD READ _____ 1ST RUN _____ % RECOVERY _____

AUDIT _____ BLIND STD. _____

TEST _____ DATE _____ TRAINER _____

METHOD READ _____ 1ST RUN _____ % RECOVERY _____

AUDIT _____ BLIND STD. _____

TEST _____ DATE _____ TRAINER _____

METHOD READ _____ 1ST RUN _____ % RECOVERY _____

AUDIT _____ BLIND STD. _____

TEST _____ DATE _____ TRAINER _____

METHOD READ _____ 1ST RUN _____ % RECOVERY _____

AUDIT _____ BLIND STD. _____

MASS SPEC TRAINING CHECKLIST - SAMPLE PREP

AREA OF TRAINING	DATE	TRAINED BY

VOLATILES

Soils		
ZHE		
FID Screening		

SEMI-VOLATILES

Water		
QC		
Emulsions		
Soil-Sonication		
QC		
Soil-Soxhlet		
QC		
Oil		
Making Surrogate		
Making Spike Solution		

ADDITIONAL TRAINING

MASS SPEC TRAINING CHECKLIST - LOGBOOKS

AREA OF TRAINING	DATE	TRAINED BY
Corrections		
Class S Weights		
Soil Prep		
Standard Prep		
Instrument; Maintenance		
Instrument; Run Sequences		

ADDITIONAL TRAINING

MASS SPEC TRAINING CHECKLIST - SAMPLE ANALYSIS

AREA OF TRAINING	DATE	TRAINED BY
Methods		
Read SW846-8240/8270		
Read EPA 624/625		
Read SDWA 524/525		
General		
Glassware Cleaning		
Tuning		
QC Frequency, Requirements and Preparation		
Tune Check		
Calibration		
Cal. Checks		
Blanks		
MS/MSD		
ISTD and Surr		
Calculations		
Response Factor		
Concentration		
Dilutions		
Units		
Sig Figs & Rounding		

AREA OF TRAINING	DATE	TRAINED BY
Data Review		
IDFILE Update		
FORMS		
Cover Sheet		
Initial Calibration		
Peak Clipping		

ADDITIONAL TRAINING

MASS SPEC TRAINING CHECKLIST - GENERAL MAINTENANCE

AREA OF TRAINING	DATE	TRAINED BY
Column Replacement		
Capillary		
Packed		
Tank Changing		
Changing Septum and Liner		
Cleaning the Source- including venting and pumpdown	Initial training	
MS	solo	
MSD	solo	
Cleaning the Quadrupole		
Replacing the Multiplier		
Cleaning and/or Replacing Jet Separator		
Changing trap		
Checking Tekmar flows		

ADDITIONAL TRAINING

MASS SPEC TRAINING CHECKLIST - SYSTEM MAINTENANCE

AREA OF TRAINING	DATE	TRAINED BY
Magnetic Tape		
Changing Tapes (how and when)		
Retrieving from Tape (Present and Past Tapes)		
Archiving		
Computer		
Rebooting		
Purging Files		

ADDITIONAL TRAINING

EMS Laboratories, Indianapolis IN

Pre-Employment Resources Data

NAME:_____

DATE OF EMPLOYMENT:_____

List of previous applicable work experience:_____

List of previous applicable academic training - both institutional and work-shop:_____

List any additional information:_____

Date form completed:_____

TRAINING DOCUMENT - PAPERWORK AND LOG BOOKS

The trainer should explain where each of the following can be found. Also the use and the purpose of each should be explained.

AREA OF TRAINING	DATE	TRAINED BY
CALCULATION FORMS:		
Prep/Bench sheets		
Calculating sheets		
Cover sheets		
Surrogate Recovery forms		
Blank-QC forms		
Run sheets		
Order sheet log book		
Response factor log book		
Concentration/Dilution log		
Verbal Result log		
Report packet forms		
OTHER LOG BOOKS:		
Log of Logs		
Standards log book		
Standards verification log		
Gases log book		
Verification log for repipeters and balances		
Refrigeration temperature log		
Extract log		
Instrument maintenance log		
Power Failure log		
Report Packet log		
Computer Tape log		
Log of Vaulted data		
OTHERS:		
Worklists		
ER forms		
Over time Forms		
Methods Manuals and SOPs		
Instrument Manuals		
Computer Manuals		

The trainer should explain the use and/or the purpose of each of the following.

AREA OF TRAINING	DATE	TRAINED BY
GLASSWARE:		
Identification of glassware	_____	_____
Disposal of broken glassware	_____	_____
Read glassware cleaning procedure	_____	_____
Washing extraction glassware	_____	_____
Washing microglassware	_____	_____
Pipet washing	_____	_____
Washing Herbicide glassware	_____	_____
Safety hazards	_____	_____
PREPARATION OF FLORISIL COLUMNS:		
Read procedure	_____	_____
Difference between "jumbo" and 5 1/4" columns	_____	_____
Storage of florisil, pipets, silica gel and glass wool	_____	_____
Prepararion of florisil columns	_____	_____
PREPARATION OF ALUMINA COLUMNS:		
Read procedure	_____	_____
Storage of alumina, pipets and glasswool	_____	_____
Deactivation - to activity III alumina	_____	_____
Alumina verification	_____	_____
Preparation of Alumina columns	_____	_____
PREPARATION OF SODIUM SULFATE		
Purpose for baking	_____	_____
Storage of sodium sulfate	_____	_____
Use of the muffle furnace	_____	_____
Dessicator/desicant	_____	_____
Storage of sodium sulfate after baking	_____	_____
STANDARDS TRAYS:		
Use of different standards	_____	_____
Storage of the standards and the standards trays	_____	_____
Organization of the standards refrigerator	_____	_____
Organization of the ASV trays	_____	_____
Filling the ASVs	_____	_____

TRAINING DOCUMENT - GC/ECD PREP METHODS

ANALYST _____
DATE HIRED _____

PREP	DESCRIPTION	Method
P229.1/P232.1	PCBs in Oil	SW846-3580

Difference between a "clean" and "waste" oil _____

Clean Oil Prep
Trainer _____ Date of training _____
Method read _____

Prep Book _____

Standard	Run	% Recovery	Approval by:
BLA			

Waste Oil Prep
Trainer _____ Date of training _____
Method read _____
Prep Book _____

Standard	Run	% Recovery	Approval by:
BLA			

Acetone Preps
Trainer _____ Date of training _____
Method read _____
Prep Book _____

Standard	Run	% Recovery	Approval by:
BLA			

TRAINING DOCUMENT - GC/ECD PREP METHODS

ANALYST _____
DATE HIRED _____

PREP	DESCRIPTION	Method
P231.1	PCBs in Soils	SW846-3550

Soil Prep

Trainer _____ Date of training _____
Method read _____
Prep Book _____

Standard	Run	% Recovery	Appoval by:
BLA			

Swipe Prep

Trainer _____ Date of training _____
Method read _____
Prep Book _____

Standard	Run	% Recovery	Appoval by:
BLA			

Air Sample Prep

Trainer _____ Date of training _____
Method read _____
Prep Book _____

Standard	Run	% Recovery	Appoval by:
BLA			

TRAINING DOCUMENT - GC/ECD PREP METHODS

ANALYST _____
DATE HIRED _____

PREP	DESCRIPTION	Method
P235.1	PCBs in Soils/soxhlet	SW846-3550

Soxhlet Prep

Trainer _____ Date of training _____
Method read _____

Prep Book _____
Soxhlet Glassware storage _____
Thimble storage _____
Using the continuous extractor _____

Standard	Run	% Recovery	Approval by:
BLA			

P230.1	PCBs in Water/sep.funnel extr	SW846-3510	

Water extractions - PCB only
Trainer _____ Date of training _____
Method read _____

Prep Book _____
KD Glassware _____
Salt & filter paper filters _____
Concentrating the sample _____

Standard	Run	% Recovery	Approval by:
BLA			

TRAINING DOCUMENT - GC/ECD PREP METHODS

ANALYST _____
DATE HIRED _____

PREP	DESCRIPTION	Method
P233.1	PCB/Pests in Water/sep. funnel extr.	SW846-3510

Water extraction - PCB/Pest

Trainer _____ Date of training _____
Method read _____

Prep Book _____
KD Glassware _____
Sodium sulfate & Glass wool filters _____
Concentrating the sample _____

Standard	Run	% Recovery	Approval by:
BLA			

P236.1	PCB/Pests in Soil/SPP!	SW846-3550

SPP! extractions - PCB/Pests

Trainer _____ Date of training _____
Method read _____

Prep Book _____
Using the ultrasonic probe _____
Concentrating the sample _____
Splitting the extract for semi-vols _____
Dilutions for GPC clean ups _____
GPC clean up training on page 8

Standard	Run	% Recovery	Approval by:
BLA			

TRAINING DOCUMENT - GC/ECD PREP METHODS

ANALYST _____
DATE HIRED _____

GPC training - The trainer should explain the purpose of the GPC clean up and the principle of the clean up. The trainer should also give an explantion of the flow through the system and the purpose of the various solvents.

Trainer _____ Date of training _____
Method read _____

AREA OF TRAINING

Pre-run:

_____ Reservoirs
_____ Air supply
_____ Vacuum pump
_____ Instrument settings & Run parameters
_____ Checking sample pump flow rate

Starting the run:

_____ Filtering samples
_____ Loading input vials
_____ Loading sample extract vials - crimp cap
_____ Starting the instrument

Shut down - at completion of the run:

_____ Vacuum & sample pump - shut off automatically
_____ Reservoir switch to fill & reservoirs removed
_____ Air tank turned off

Others (put date of training):

_____ Calibration
_____ Repacking the column
_____ Back flushing the valves

TRAINING DOCUMENT - GC/ECD PREP METHODS

ANALYST _____
DATE HIRED _____

PREP	DESCRIPTION	Method
P238.1	Herbicides in Water/SPE	SW846-3590
P201.4	Diazomethane Derivitization	SW846-8150

SPE extractions - Herbicides in Water
Trainer _____ Date of training _____
Method read _____

Prep Book _____
Using the SPE manifold _____
SPE Cartridges _____
Diazomethane derivatization _____
Include all safety precations to be taken
Calibration standard prep + log in

Standard	Run	% Recovery	Appoval by:
BLA			

Herbicides in Soils/Solids
Trainer _____ Date of training _____
Method read _____

Prep Book _____
Diazomethane derivatization _____
Include all safety precations to be taken
Calibration Std. prep + log in

Standard	Run	% Recovery	Appoval by:
BLA			

Herbicide Waters / Ether extraction

TRAINING DOCUMENT - GC/ECD PREP METHODS

ANALYST _____
DATE HIRED _____

PREP	DESCRIPTION	Method
	Herbicides in Water	SW846-3590
P201.4	Diazomethane Derivitization	SW846-8150

Liquid/liquid extractions - Herbicides in Water
Trainer _____ Date of training _____
Method read _____

Prep Book _____
Preparation of Reagents _____
Acid washed Glassware _____
Acid washed Sodium sulfate & Glass wool _____
Concentrating the sample _____
Diazomethane derivatization _____
Include all safety precations to be taken

Standard	Run	% Recovery	Appoval by:
BLA			

TRAINING DOCUMENT - GC/ECD PREP METHODS

ANALYST _____
DATE HIRED _____

PREP	DESCRIPTION	Method
P222.1	PCB or MCB extraction	EPA 608

This test should be used for Water extractions - only! It is used for CWA regulation. On rare occasions this test may be used for a sludge that may need to pass the CWA regulation. These prep methods are similar to the SW846 methods. If the employee is approved for the SW846 method they may also be approved for the EPA method if the differences between the methods are completely understood.

Water extractions - PCB only
Trainer _____ Date of training _____
Method read _____

Prep Book _____
KD Glassware _____
Salt & filter paper filters _____
Concentrating the sample _____

Standard	Run	% Recovery	Approval by:
BLA			

Soil extractions
Trainer _____ Date of training _____
Method read _____

Prep Book _____

Standard	Run	% Recovery	Approval by:
BLA			

TRAINING DOCUMENT - GC/ECD PREP METHODS

ANALYST _____
DATE HIRED _____

PREP	DESCRIPTION	Method
P223.1	PCB/Pest extraction	EPA 608

This test should be used for Water extractions - only! It is used for CWA regulation. On rare occasions this test may be used for a sludge that may need to pass the CWA regulation. These prep methods are similar to the SW846 methods. If the employee is approved for the SW846 method they may also be approved for the EPA method if the differences between the methods are completely understood.

Water extraction
Prep Books _____
KD Glassware _____
Sodium sulfate & Glass wool filters _____
Concentrating the sample _____

Trainer _____ Date of training _____
Method read _____

Standard	Run	% Recovery	Appoval by:
BLA			

Soil extractions
Trainer _____ Date of training _____
Method read _____

Standard	Run	% Recovery	Appoval by:
BLA			

TRAINING DOCUMENT - GC/ECD PREP METHODS

ANALYST _____
DATE HIRED _____

PREP	DESCRIPTION	Method
P903.0	PCB/Pest extraction	CLPSOW 2/88
P903.1	PCB/Pest extraction	CLPSOW 2/88

These tests are used for extracting samples under the CLP regulation. Prep P903.0 is used for USEPA CLP work only, and should be used only by analysts approved for EPA work. Prep P903.1 is used for submitters other than the USEPA who require CLP protocol. Both of these preps must, strictly, follow the method.

Water extraction - PCB/Pest
Prep Books _____
KD Glassware _____
Sodium sulfate & Glass wool filters _____
Concentrating the sample _____

Trainer _____ Date of training _____
Method read _____

Standard	Run	% Recovery	Appoval by:
BLA			

Soil/SPP!
Prep book _____
Using the ultrasonic probe _____
Concentrating the sample _____
Splitting the extract for semi-vols _____
Dilutions for GPC clean ups _____
GPC clean up training on page 9

SPP! extractions - PCB/Pests
Trainer _____ Date of training _____
Method read _____

Standard	Run	% Recovery	Appoval by:
BLA			

TRAINING DOCUMENT - GC/ECD PREP METHODS

ANALYST _____
DATE HIRED _____

PREP	DESCRIPTION	Method
P425.1	EDB/DBCP - microextractions	EPA 504

ECB/DBCP
Prep book _____
Storage of 40 mL VOA vials _____
Storage of baked Sodium chloride _____
Preparation of the Cal. Stds. _____

Trainer _____ Date of training _____
Method read _____

Standard	Run	% Recovery	Approval by:
BLA			

ANALYST _____
DATE HIRED _____

Computer training
Trainer _____
SOP read _____

TRAINING CHECK LIST - Each of the following should be explained by the trainer, and understood before checking off. Check off by putting date of training.

Identification of the instruments and devices:

Channel	Instrument ID	Device	LU
1	GC_ECD_1 (1)	T1	1
2	GC_ECD_2 (2)	T2	58
3	GC_ECD_3 (3)	T3	59
4	GC_ECD_4 (4)	T4	60
5	GC_ECD_5 (5)	T5	50
6	GC_ECD_6 (6)	L1	51
7	GC_ECD_7 (7)	L2	52
8	GC_ECD_8 (8)	L3	53
PID	PID_9 (9)	L5	55
ELCD	ELCD_10 (10)	L4	54
FID	FID (11)	L6	56
NPD	NPD (12)	L7	57

Logging onto the computer station
_____ logon code and working directory established
_____ password established
_____ using LDS, CI and LPLOT

Preparing a run for the instrument
_____ Selecting the instrument
_____ Preparing a new sequence
_____ Listing the sequence
_____ Assigning the sequence to the instrument

Copying files
_____ Copying a sequence
_____ Copying a method

Modifying a sequence
_____ Freeing the sequence before modifying
_____ Using the modify sequence command
_____ Modifying the assigned method
_____ Modifying the sample list
_____ Modifying the result files

ANALYST _____
DATE HIRED _____

Computer training
Trainer _____
SOP read _____

TRAINING CHECK LIST - Each of the following should be explained by the trainer, and understood before checking off. Check off by putting date of training.

Modifying a method
_____ Modifying the timed events table
_____ Modifying the run time
_____ Modifying the plot scale
_____ Modifying the output device
_____ Modifying the data input - ie: minimum area and threshold

Unlocking a locked file
_____ Running the CI mode
_____ Reseting a file
_____ Unlocking a file

Other CI commands
_____ Up a downed device
_____ Stopping the reanalysis of a sequence
_____ Checking the system status with IO listing

Archiving files
_____ When to archive
_____ Initializing storage tapes
_____ Directory listing of files
_____ Using the archive utility

Purging files
NOTE: Do <u>not</u> purge any files without asking first!!
_____ When to purge
_____ What files can be purged
_____ Using the purge utility

Note: These method and sequence files are set up for the GC/ECDs and should <u>never</u> be purged.
METHODS:
PCB1,PCB2,PCB3,PCB4,PCB5, and PCB6
CLP1,CLP2,CLP3,CLP4,CLP5, and CLP6
Sequences:
RECAL1 AND RECAL2

Approved by _____

TRAINING DOCUMENT - GC/ECD CALCULATIONS

ANALYST _____
DATE HIRED _____

PCB calculations - Daily Run
Trainer _____
SOP read _____

TRAINING CHECK LIST - Each of the following should be explained by the trainer, and understood before checking off. Check off by putting date of training.

_____ Run order & QC requirements
_____ Location of calculating forms, run forms, cover sheets & DCB recovery forms
_____ Identification of Aroclors
_____ Identification of baseline problems and baseline modifications (using the computer)
_____ Calculation of response factors
_____ Calculation of the % RSD (linearity)
_____ Calculation of the %D (between beginning & ending standards)
_____ Calculation of extract concentration
_____ Filling out the run sheets
_____ Calculation of the sample result including any dilution factors
_____ Calculation of the Standard recovery
_____ Calculation of the Spike recovery
_____ Calculation of the Dual Purpose Spike (DPS) % recovery and the % replicability
_____ Calculation of the % recovery for the RCS (ICV02)
_____ Calculation of the % recovery for the CCV (ending Medium)

First Run
Date _____
Channel _____
Run Number _____

Reviewed by _____
Comments _____
_____
_____
_____

Approved by _____

TRAINING DOCUMENT - GC/ECD CALCULATIONS

ANALYST _____
DATE HIRED _____

Herbicide calculations
Trainer _____
SOP read _____

TRAINING CHECK LIST - Each of the following should be explained by the trainer, and understood before checking off. Check off by putting date of training.

_____ Run order & QC requirements
_____ Location of calculating forms & run forms
_____ Identification of the Herbicides
_____ Calculation of the retention time windows
_____ Identification of baseline problems and baseline modifications (using the computer)
_____ Calculation of response factors
_____ Calculation of the % RSD (linearity)
_____ Calculation of the %D (between beginning & ending standards)
_____ Calculation of extract concentration
_____ Filling out the run sheets
_____ Calculation of the sample result including any dilution factors
_____ Calculation of the Standard recovery
_____ Calculation of the Spike recovery
_____ Calculation of the Dual Purpose Spike (DPS) % recovery and the % replicability
_____ Calculation of the % recovery for the RCS (ICV02)
_____ Calculation of the % recovery for the CCV (ending Medium)
_____ Second column confirmation of the herbicides
Packet + forms if needed

First Run
Date _____
Channel _____
Run Number _____

Reviewed by _____
Comments _____
_____
_____
_____

Approved by _____

TRAINING DOCUMENT - GC/ECD CALCULATIONS

ANALYST _____
DATE HIRED _____

PCB/Pest calculations
Trainer _____
SOP read _____

TRAINING CHECK LIST - Each of the following should be explained by the trainer, and understood before checking off. Check off by putting date of training.

_____ Run order & QC requirements
_____ Location of calculating forms, run forms & QC forms
_____ Identification of Pesticides and Aroclors
_____ Calculation of the retention time windows
_____ Identification of baseline problems and baseline modifications (using the computer)
_____ Calculation of response factors
_____ Calculation of the % RSD (linearity)
_____ Calculation of the %D (between beginning & ending standards)
_____ Calculation of extract concentration - including computerized calculations for the pesticides
_____ Filling out the run sheets
_____ Calculation of the sample result including any dilution factors
_____ Calculation of the Standard recovery
_____ Calculation of the Spike recovery
_____ Calculation of the Dual Purpose Spike (DPS) % recovery and the % replicability
_____ Calculation of the % recovery for the RCS (ICV02)
_____ Calculation of the % recovery for the CCV (ending Medium)
_____ Second column confirmation of pesticides and PCBs
Packet + Pos

First Run
Date _____
Channel _____
Run Number _____

Reviewed by _____
Comments _____
_____
_____
_____

Approved by _____

TRAINING DOCUMENT - GC/ECD CALCULATIONS

ANALYST _____
DATE HIRED _____

EDB/DBCP calculations
Trainer _____
SOP read _____

TRAINING CHECK LIST - Each of the following should be explained by the trainer, and understood before checking off. Check off by putting date of training.

_____ Run order & QC requirements
_____ Location of calculating forms & run forms
_____ Identification of EDB & DBCP
_____ Calculation of the retention time windows
_____ Identification of baseline problems and baseline modifications (using the computer)
_____ Calculation of the Cal Standard concentrations
_____ Calculation of response factors
_____ Calculation of the % RSD (linearity)
_____ Calculation of the %D (between beginning & ending standards)
_____ Calculation of extract concentration
_____ Filling out the run sheets
_____ Calculation of the sample result including any dilution factors
_____ Calculation of the Standard recovery
_____ Calculation of the Spike recovery
_____ Calculation of the Dual Purpose Spike (DPS) % recovery and the % replicability
_____ Calculation of the % recovery for the RCS (ICV02)
_____ Calculation of the % recovery for the CCV (ending Medium)
_____ Second column confirmation of EDB & DBCP

First Run
Date _____
Channel _____
Run Number _____

Reviewed by _____
Comments _____
_____
_____
_____

Approved by _____

TRAINING DOCUMENT - GC/ECD INSTUMETNATION

ANALYST _____
DATE HIRED _____

Trainer _____
SOP read _____

TRAINING CHECK LIST - Each of the following should be explained by the trainer, and understood before checking off. Check off by putting date of training.

Starting a Run
Trainer _____
SOP read _____

_____ Checking the paper - integrators and printers
_____ Checking the rinse bottles
_____ Loading the autosampler trays
_____ Autosampler control on the 5880 - starting the autosampler program for a single channel run
_____ Autosampler control on the 5880 - starting the autosampler program for a dual channel run
_____ Autosampler control on the 5890
_____ Starting the autosequence on the 5890

Instrument maintenance - 5880
Trainer _____ Approved by _____
SOP read _____

_____ Changing the syringe
_____ Septa and liner change
_____ Checking flows
_____ Sylonizing the injection ports
_____ Replacing a column
_____ Replacing the chemical filters
_____ Replacing the detector

Instrument maintenance - 5890
Trainer _____ Approved by _____
SOP read _____

_____ Changing the syringe
_____ Septa and liner change
_____ Checking flows
_____ Sylonizing the injection ports
_____ Replacing a column
_____ Replacing the chemical filters
_____ Replacing the detector

TRAINING DOCUMENT
Recertification on Prep Methods

ANALYST _____
DATE HIRED _____

Date of Recert.	Test Code	Test Method	Test score[1] Std. Recovery[2]	Approved by

[1]Tests are based on the procedures as listed in the method

[2]Standard are given as blind standards. These standards are to be prepared by the group leader.

EMS HERITAGE LABORATORIES, INC.
7910 West Morris Street
Indianapolis, Indiana 46231
1-317-243-0811
FAX 317/486-5095

1992 UPDATE SERVICE
for the
Comprehensive Quality Assurance Plan

EMS Heritage Laboratories, Inc. greatly appreciates an opportunity to serve your analytical needs. If you would like revision(s) and/or update(s) of the Comprehensive Quality Assurance Plan, please fill out the form below and send to Document Control Officer. You will receive any changes or updates to the material contained in the Comprehensive Quality Assurance Plan that occur in the upcoming year. Don't delay!!!

Comp. QAP No. _____
(Please use Comp. QAP Copy Number)

Title _____

Company _____

Address _____

_____

_____

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Send to: Document Control Officer
EMS Heritage Laboratories, Inc.
7910 West Morris Street
Indianapolis, Indiana 46231
Attn: Ramona Eaton

92GB1174.15

APPENDIX B
Audit Checklists

FIELD TEAM
FIELD AUDIT CHECKLIST

PROJECT NUMBER _____ DATE _____

PROJECT ABBREVIATION _____ SIGNATURE OF AUDITOR _____

FIELD TEAM _____

Yes ___ No ___ N/A ___ 1. Was a Work/Sampling Plan and Safety Plan prepared and reviewed?
Comments _____

Yes ___ No ___ 2. Was a project manager's briefing held with project participants?
Comments _____

Yes ___ No ___ N/A ___ 3. Was project confidentiality discussed? Was instruction given on how to answer inquiries?
Comments _____

Yes ___ No ___ N/A ___ 4. Is there a written list of sampling locations and descriptions?
Comments _____

Yes ___ No ___ N/A ___ 5. Were samples collected according to the procedures detailed in the Work Plan and Sampling and Analysis Plan?
Comments _____

Yes ___ No ___ N/A ___ 6. Does the sampling team follow a system of accountable documents? If yes, what documents are accountable?
Comments _____

Yes ___ No ___ N/A ___ 7. Is a daily accounting of subcontractors work (time and/or materials) documented and signed by the proper representative from each party?
Comments _____

Yes ___ No ___ N/A ___ 8. Are daily Health and Safety meetings given?
Comments _____

Yes ___ No ___ 9. Is data documented on field forms (observed water level, well development, slug test, drill log, chain-of-custody, calibration, air monitoring, field itemization)?
Comments _____

Yes ___ No ___ 10. Are all sample labels completed with date, time, sample number (group, point, designator, round), sample depth analysis, and preservatives?
Comments _____

FIELD LOG BOOK
FIELD AUDIT CHECKLIST

PROJECT NO. _____ DATE _____

PROJECT ABBREVIATION _____ SIGNATURE OF AUDITOR _____

FIELD LOGBOOK NUMBER _____

FIELD TEAM _____

Yes ___ No ___ *Page heading includes page number, date, project number (team members).

Yes ___ No ___ *Entries to logbook made in waterproof ink.

Yes ___ No ___ *Times are given for all activities (e.g., arrival, departure, sampling or drilling).

Yes ___ No ___ *At the end of field notes for the day, the page is signed and any area not used is marked with a slash.

Yes ___ No ___ N/A ___ Daily weather conditions are noted.

Yes ___ No ___ N/A ___ Sample descriptions are given including type of material, color, odor, etc.

Yes ___ No ___ N/A ___ Equipment Calibration, type of equipment and time noted.

Yes ___ No ___ *Corrections are crossed out with a single line and initialed.

Yes ___ No ___ *Time, name, and conversation summary of persons who come onto site are recorded, including: observers, regulatory personnel, contractors, and client and subjects discussed.

* = Item is required for every project field logbook.

FIELD SITE MANAGER
FIELD AUDIT CHECKLIST

PROJECT NUMBER _____ DATE _____

PROJECT ABBREVIATION _____ SIGNATURE OF AUDITOR _____

FIELD SITE MANAGER _____

Yes ___ No ___ N/A ___ 1. Was a list of contacts provided by the Project Manager including: office, client, drillers, lab, other?
Comments _____

Yes ___ No ___ N/A ___ 2. Was permission granted by client to enter and inspect the facility? Documented?
Comments _____

Yes ___ No ___ N/A ___ 3. Were all utilities cleared prior to drilling or trenching activities? Documented?
Comments _____

Yes ___ No ___ N/A ___ 4. Was a drilling permit issued?
Comments _____

Yes ___ No ___ N/A ___ 5. Were samples collected according to the procedures detailed in the Work Plan and Sampling and Analysis Plan?
Comments _____

Yes ___ No ___ N/A ___ 6. Were split samples offered to the client or facility? Documented?
Comments _____

Yes ___ No ___ N/A ___ 7. Are the number, frequency, and types of field measurements and observations taken as specified in the Sampling or Work Plan?
Comments _____

Yes ___ No ___ N/A ___ 8. Are field sample measurements recorded? (pH, SC., temp)?
Comments _____

Yes ___ No ___ N/A ___ 9. Are samples collected in containers specified in the Work or Sampling Plan?
Comments _____

Yes ___ No ___ N/A ___ 10. Are the number, frequency, and types of samples collected as specified in the Work/Sampling Plan?
Comments _____

Yes ___ No ___ N/A ___ 11. Are samples packed for preservation as specified in Sampling/Work Plan?
Comments _____

Yes ___ No ___ N/A ___ 12. Is sample custody maintained at all times?
Comments _____

Yes ___ No ___ N/A ___ 13. Are unique document control numbers given to each sample shipment?
Comments _____

Yes ___ No ___ N/A ___ 14. Are all samples identified with Sample ID tags?
Comments _____

Yes ___ No ___ N/A ___ 15. Are all samples collected, listed on Chain-of-Custody Record?
Comments _____

Yes ___ No ___ N/A ___ 16. Does information on sample label and chain-of-custody match?
Comments _____

Yes ___ No ___ N/A ___ 17. Is method of shipment and shipment number documented?
Comments _____

Yes ___ No ___ N/A ___ 18. Is the chain-of-custody included with sample shipment?
Comments _____

Yes ___ No ___ N/A ___ 19. Are sample blanks prepared?
Comments _____

Yes ___ No ___ N/A ___ 20. Are field notebooks project specific?
Comments _____

Yes ___ No ___ N/A ___ 21. Is the facility's approval or disapproval to take photographs documented?
Comments _____

Yes ___ No ___ N/A ___ 22. Are photographs documented with date, number, roll number and description?
Comments _____

Yes ___ No ___ N/A ___ 23. Are amendments to the Work or Sampling Plan documented?
Comments _____