N00210.AR.000254
NTC GREAT LAKES
5090.3a

FIRE FIGHTING TRAINING UNIT (FFTU)

QUALITY ASSURANCE PROJECT PLAN (QAPP) FOR THE REMEDIAL INVESTIGATION

GREAT LAKES NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

August 1997

Prepared by:

BELING CONSULTANTS

Professional Engineering and Environmental Services

August 28, 1997

Ms. Laura J. Ripley
Federal Facilities Project Manager
U.S. Environmental Protection Agency
77 West Jackson Boulevard
Chicago, IL 60602-3590

SUBJECT: USEPA REVIEW OF THE DRAFT QUALITY ASSURANCE PROJECT PLAN (QAPP) DATED JULY 21, 1997 FIRE FIGHTING TRAINING UNIT GREAT LAKES NAVAL TRAINING CENTER GREAT LAKES, IL

Dear Ms. Ripley:

Thank you for your letter dated July 29, 1997 wherein you presented your comments on the draft Quality Assurance Project Plan (QAPP) referenced above. This submittal provides the final QAPP which incorporates your comments of July 29, 1997.

The removal of subsurface structures and approximately 21,600 linear feet of piping is underway. Activities to collect soil samples from trenches and to profile derived wastes have been conducted in accordance with the approved workplans, and the Field Sampling Plan (FSP) which was included in the Draft QAPP reference above. The biopiles for the (pilot remediation) project have also been constructed in accordance with workplans.

The discussion below is provided to directly address each item raised in your letter of July 29, 1997

1.) **Due to the quick review time requested by the Navy, a Region V Quality Assurance Reviewer was unable to review this document. U.S. EPA has provided limited comments on this document that will assist the Navy in proceeding with its project. As this is a federal facility lead site, the Navy is responsible for the Quality Assurance and Quality Control of the work performed on site as well as the analytical results from this work. U.S.**

Moline • Chicago • Joliet • Peoria • Davenport • Beloit • Columbus

1001 16th Street, Moline, Illinois 61265 • (309) 757-9800 • FAX (309) 757-9812

EPA takes this responsibility when they are the lead agency. In reviewing the signature page, the Navy Project Manager should be listed. U.S. EPA will submit a letter concerning whether or not substantive comments have been addressed in the revision of this document. Our response letter will serve to document whether the revisions to the document were acceptable rather than this signature page.

Response: The Navy understands that USEPA is not the Lead Agency and that the comments provided on July 29, 1997 were provided as a courtesy. The Navy appreciates that USEPA is acting in an advisory capacity because FFTU is a Federal Facility formerly under USEPA's purview.

The Navy accepts responsibility for the Quality Assurance and Quality Control at the FFTU site. The signature page has been revised to include the project manager for the U.S. Navy. Reference to USEPA Region V has been removed from the signature page.

2. **Page 4 of 11, Section 1.4.1 - The rationale for eliminating the Target Analyte List should be provided. The applicability of referencing TACO is inappropriate for CERCLA type of investigations. In addition, U.S. EPA understood that the TAL metals list which were analyzed during the initial characterization would be narrowed down to the eight metals analyzed for the Resource Conservation and Recovery Act (RCRA) based upon comparison to U.S. EPA Region IX's Preliminary Remediation Goals (PRGs). Was this a misunderstanding?**

   Also, when closure sampling is conducted, the full TAL list will be required and analytical results shall be subsequently compared to U.S. EPA Region IX's PRGs to maintain consistency. Some provision in this document may be necessary to specify the data quality objectives for these analyses.

   Response: The rationale for eliminating the TAL compounds from the soil and groundwater during investigation has been expanded to explain that neither the TACO background levels nor the Region IX PRGs were exceeded during the initial site characterization analyses. The initial samples included waste collection areas, standing water, vaulted water and drains within the carrier compartments (burn buildings). Please refer again to Section 1.4.1, page 4 of 12 for an expanded discussion regarding this issue.

   Closure of the pilot remediation biopiles is planned for early 1998. Closure sampling of the biopiles will be expanded to include the TAL.

Risk analysis calculations and modeling, if necessary to achieve closure of the site, will not necessarily include TAL compounds for reasons described in Section 1.4.1, Page 4 of 12.

3. **Page 7 of 11, Section 1.5, Paragraphs 1 and 2 - How will it be determined whether contamination is associated with general historical land use, product and waste storage and uncontrolled waste management practices or whether contamination is associated with fuel oil and combustion of petroleum?**

   Response: Based upon research and analyses to date, TCL compounds detected at the site are believed to be related to combustion and fire-fighting training activities, except for a few pesticides/herbicides which are believed to be sourced from the golf course.

   Compounds which are not related to combustion or fire-fighting practices, where detected, will be evaluated using a risk-based corrective action approach.

4. **Page 8 of 11, Section 1.5, second bullet - Will the groundwater samples taken upgradient, downgradient and from areas suspected of contamination be from temporary monitoring locations, monitoring wells or exposed groundwater found in excavated areas? Is this described in the FSP? If so, please reference this document and the section(s).**

   Response: During the trenching activities, groundwater samples will be limited to waters which are stored or managed for potential off-site disposal. Following evaluation of analytical reports of trenching activities, areas of potential contamination will be identified.

   Direct push (soil probe) technology together with a mobile laboratory and a conventional drill rig will be used to further characterize suspected hot spots, including upgradient and downgradient locations. In addition to on-site analyses, laboratory confirmation samples will be taken from contaminated areas and sent to ARDL per the QAPP and FSP (Attachment A to QAPP).

5. **Page 9 of 11, Section 1.5.2 - The fourth sentence in this section is somewhat misleading. In the event that analytical results are to be used to conduct the baseline risk assessment, this risk assessment will be evaluated in terms of whether the potential contaminant of concern present a cancer risk or a noncancer risk to human health and the environment. Please clarify intended data usages.**

Response: The laboratory data (mobile laboratory data and laboratory confirmation data) from the trenching activities and from the subsurface investigation will be used to evaluate a cancer risk and noncancer risk for contaminants present in concentrations greater than the Tier 1 TACO rules for LUST sites in Illinois or greater than the PRGs for USEPA Region IX previously referenced.

6. **Table 1-6, Intended Data Usage - The initial characterization sampling included TAL analyses. This is not noted in the parameters column. Also the intended data usage of this data should be specified.**

   It should be noted that this table is incomplete for Grab Samples during trenching and excavating activities and the Remedial Investigation the parameters are not designated. In addition, if the intended data usage for this is different, this needs to be identified.

   Response: Table 1-6 has been revised to reflect the extensive analyses of initial characterization sampling. Revisions to Table 1-6 include elaboration of intended data usage for the grab samples, subsurface remedial investigation and biopile closure.

7. **Table 1-7, Summary Table of Sampling and Analysis Program - As the initial characterization focused on soils, surface water and sediment were not characterized. The full TAL list is recommended for initial characterization of these media.**

   Response: Surface water is not present at the site except in the perimeter ditch. Sediment is not present except within the perimeter ditch. Metals are not expected to be in the perimeter ditch at concentrations which exceed TACO Tier 1 levels or Region IX PRG levels as previously provided in this letter and in Section 1.4.1 (as revised) of the final QAPP, attached. Therefore, TAL compounds are not included in the QAPP except as mentioned in Table 1-6 for closure of the biopiles.

8. **Table 1-8, Rationale for Sample Locations - The category indicates that both TCL/TAL analyses will be conducted. This is inconsistent with the text and other tables. A thorough check of this in coordination with our other comments on this document should be taken into consideration in the revision.**

The rationale for the number of samples and location should include the dimensions of the area or compartment as well as information pertaining to why the number of samples are proposed. For example, if there is a trench it is logical to take a sample on the bottom and the side walls.

Response: The reference to TAL was removed from Table 1-8. Rationale on Table 1-8 has been expanded in an attempt to fulfill USEPA requirements for detail.

9. **Table 1-9, Data Quality Objectives Process - How was it determined that 95% laboratory analysis and 90% field measurements will meet the DQOs? If the DQOs are not met, will additional sampling occur at no additional cost to the Navy?**

Response: Figure 1-4 is labeled Data Quality Objectives Process. Percentages were taken from the Region V Model QAPP. We do not anticipate additional sampling after completion of planned field work. If DQOs are not met, samples will not be recollected unless this measure is required for closure per the implementing agency.

10. **Page 2 of 8, Section 2.2, Beling Project Manager - As the Project Manager is under the direction of the Navy, ensuring that the project meets U.S. EPA's objectives is inappropriate. The project should meet the Navy's quality standards and objectives for fulfilling their legal and regulatory requirements.**

Response: The Navy accepts responsibility for ensuring quality standards and objectives are met throughout the project.

11. **Page 3 of 8, Section 2.3, U.S. EPA Region V Superfund Division Quality Assurance Reviewer - See comment #1.**

Response: See response to Comment #1.

12. **Page 4 of 8, Section 2.4, On-Site Laboratory Manager - Will samples run at the mobile laboratory meet the same data quality objectives of those that are sent to an off-site laboratory? Is this just for the Biopile analyses?**

Response: Samples analyzed in the mobile laboratory will not be subject to the same Data Quality Objectives (DQOs) as those analyzed in a fixed laboratory. The mobile samples will be analyzed for indicator parameters as identified from trenching activity analyses. The mobile laboratory samples are not for the

biopile; they are for soils, for groundwater, and the perimeter ditch. The data from both laboratories will be used to assess the potential risk to human health posed by contaminants.

13. **Page 5 of 8, Section 2.5, Laboratory Responsibilities - Who will be responsible for identifying problems at ARDL level and its potential inability to meet requirements of the project specific QAPP and discuss and document resolutions with the laboratory technicians and Project Manager?**

    Response: The ARDL Project Manager, Dan Gillespie, or his assistant, Dick Curtin.

14. **Page 2 of 5, Section 3.3, Completeness - How were the percentage for field and laboratory completeness objectives determined? What occurs if these objectives are not met?**

    Response: The target values for completeness were excerpted from the Region V Model QAPP. If these objectives are not met, the Report of Trenching Activities and Analyses will address the issue. Some data may be discarded, but re-sampling will not necessarily be required.

15. **Table 3-5, QA Objectives for Field Measurements - Please indicate the source for the precision specification or Note 2 on Page 2 of 2.**

    Response: These values were excerpted from the Region V Model QAPP.

16. **Table 3-6, QA Objectives for Laboratory Parameters - Please cite the source of this table.**

    Response: Excerpted from the Region V Model QAPP.

17. **Page 1 of 2, Section 4 - What is the RS/RI work plan which is referred to in the first paragraph?**

    Response: The text was meant to be "RI/FS". It pertains to the subsurface (direct-push and drilling activities) investigation workplan to be finalized following evaluation of analytical results obtained during trenching activities.

18. **Table 4-1, Sample Container, Preservation and Holding Time Requirements - Please cite the source of this table.**

Response: Region V Model QAPP

19. **Page 4 of 4, Section 5.3 - The final evidence file will include any variance or deviation reports implemented by the laboratory/field personnel, etc.**

Response: This project will not require an "evidence" file, however the final project file will be maintained with reports of variance of deviations. Section 5.3 has been amended to incorporate this modification.

20. **Page 1 of 1, Section 7.1.2 - Herbices should be herbicides. Please correct.**

Response: Comment incorporated.

21. **Page 4 of 5, Section 9.3.2 - It is unclear whether the task to report laboratory data to the U.S. EPA is applicable. As this project is being conducted by the Navy, the Navy shall be responsible for the quality of the data. This is related to comment #1.**

Response: Comment incorporated.

22. **Table 11-1 - GPC Frequency states every 1500-200 hours of use. Please clarify. Also, cite the source for this table. Is it a compilation of manufacturer's specifications?**

Response: The frequency of GC maintenance as described on page 1 of 2 Table 11-1 should read 150-200 hours per the manufacturers specifications.

22. (sic) **Table 11-2 - Cite the source for this table. Is it a compilation of manufacturer's specifications?**

Response: Yes

23. **Page 1 of 4, Section 13 - It is unclear as to whether U.S. EPA will be responsible for issuing a nonconformance report is applicable. As this project is being conducted by the Navy, the Navy shall be responsible for the quality of the data. This is related to comment #1.**

Response: The U.S. Navy Project Manager or his designees will issue non-conformance reports, if appropriate.

24. **Appendix A - This section is deficient. There is very little information on environmental sampling depending upon the media which is to be**

sampled. What procedures will be followed for sample collection and handling? How will VOC samples be collected in the various media? In what order will groundwater samples be taken from direct push sampling points? How will the groundwater level measurements be taken? Please describe the process for lithologic sampling. What classification system will be used?

Response: Refer to Tables 1-7 and 1-8 of the QAPP for information on sample media and sample parameters. Sample collection and handling will be in accordance with accepted USEPA guidance such as the 1986 Technical Enforcement Guidance Document for Groundwater Monitoring, as revised by the 1992 Draft Technical Guidance EPA/530-R-93-001, and USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA. EPA/540/6-89/004.

Please describe the process for logging unconsolidated materials, consolidated materials, and what information which will be recorded.

An amendment to the FSP will be provided for subsurface (soil probe and drilling) activities. The amendment will include logging requirements. The amendment will be prepared following evaluation of analyses from trenching activities.

Page 5 of 10, Section 4.3 - The log book should also note that the date and time of activity, location of samples in relation to easily identifiable landmark using a tape and compass, identifying and calibration of field instruments, the depth at which saturated conditions were encountered, identity of people and subcontractors performing activities. Also, how was it determined that areas where PID readings exceeding 50 ppm would be noted?

See comment above regarding sampling protocols and the amendment to the FSP. 50 ppm on a PID was determined to be a noteworthy threshold for higher-density sample collection and safety.

Page 7 of 10, Section 7.0 - For equipment decontamination, there is no mention for how the equipment will be cleaned if oily waste is present.

Steam cleaned.

Page 7 of 10, Section 8.2 - How was it determined that the screen would be five feet in length with 0.01 inch slot screens?

Why not? The minimum requirement for piezometers is to maintain hydraulic connection with the saturated interval of interest.

Page 9 of 10, Section 8.4 - If the tubing is oscillated up and down, will this process inadvertently volatilize potential contaminants of concern?

No, not if an inertial pump is properly used.

Page 10 of 10, Section 15 - To dispose of IDW into on-site holding tanks for treatment in the BioPile may require RCRA permitting. This may also be a requirement of the BioPile itself. Has this been researched?

No RCRA permitting will be required because hazardous waste if detected, will not be stored for more than 90 days. Treatment of LUST soils and LUST groundwater does not require RCRA permitting as referenced in your letter.

I appreciate you comments on the QAPP and look forward to further communications with you regarding the closure of the FFTU. Please call me at (309) 757-9800 if you have any questions or need additional information.

Sincerely,

BELING CONSULTANTS, INC.

Molly E. Arp Newell, Geologist, CHMM
Manager - Environmental Compliance

cc: J.P. Messier - FFTU
Donald Harrison (2 copies) - IEPA
Dan Gillespie - ARDL, Inc.
Dale Duffala - Beling QA/QC
Fred Lawrence - Beling Hydrogeologist
Phil Ramos - Beling Field Coordinator

QUALITY ASSURANCE PROJECT PLAN
FOR THE REMEDIAL INVESTIGATION
THE FIRE FIGHTING TRAINING UNIT, NAVAL TRAINING CENTER, GREAT LAKES, ILLINOIS

REVISION 1

AUGUST 28, 1997

Prepared by: Beling Consultants

_____ _____

Beling Project Manager
Molly E. Arp

Date

_____ _____

Beling Quality Assurance Manager
Dale S. Duffala

Date

_____ _____

State Project Manager
Donald Harrison, Environmental Protection Specialist
Federal Facilities Unit, Illinois Environmental Protection Agency

Date

_____ _____

U.S. Navy Project Manager
J.P. Messier

Date

TABLE OF CONTENTS

TITLE AND SIGNATURE PAGE

LIST OF TABLES

LIST OF FIGURES, ATTACHMENTS, AND APPENDICES

LIST OF ACRONYMS/ABBREVIATIONS

LIST OF PERSONS WHO HAVE RECEIVED THIS QAPP

TABLE OF CONTENTS

1.0 PROJECT DESCRIPTION

- 1.1 Introduction
- 1.2 Site Description
  - 1.2.1 Facility/Site Size and Borders
  - 1.2.2 Topography
  - 1.2.3 Local Geology & Hydrogeology
- 1.3 Past Data Collection Activities
- 1.4 Current Status
  - 1.4.1 Target Compounds and Target Analytes
  - 1.4.2 Sources
- 1.5 Project Objectives
  - 1.5.1 Specific Objectives and Associated Tasks
  - 1.5.2 Project Target Parameters and Intended Data Usages
  - 1.5.3 Quality Objectives and Criteria for Measurement Data

1.6 Sample Network Design and Rationale

1.6.1 Sample Network by Task and Matrix
1.6.2 Site Maps of Sampling Locations
1.6.3 Rationale of Selected Sampling Locations

1.7 Project Schedule

1.7.1 Anticipated Date of Project Mobilization
1.7.2 Task Bar Chart and Associated Timeframes

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

2.1 Project Organization Chart
2.2 Management Responsibilities
2.3 Quality Assurance Responsibilities
2.4 Field Responsibilities
2.5 Laboratory Responsibilities

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT

3.1 Precision

3.1.1 Definition
3.1.2 Field Precision Objectives
3.1.3 Laboratory Precision Objectives

3.2 Accuracy

3.2.1 Definition
3.2.2 Field Accuracy Objectives
3.2.3 Laboratory Precision Objectives

3.3 Completeness

3.3.1 Definition
3.3.2 Field Completeness Objectives

3.3.3 Laboratory Precision Objectives

3.4 Representativeness

3.4.1 Definition
3.4.2 Measures to Ensure Representativeness of Field Data
3.4.3 Measures to Ensure Representativeness of Lab Data

3.5 Comparability

3.5.1 Definition
3.5.2 Measures to Ensure Comparability of Field Data
3.5.3 Measures to Ensure Comparability of Lab Data

3.6 Level of Quality Control Effort

4.0 SAMPLING PROCEDURES DURING TRENCHING AND EXCAVATING ACTIVITIES

5.0 CUSTODY PROCEDURES

5.1 Field Custody Procedures
5.2 Laboratory Custody Procedures
5.3 Final Files

6.0 CALIBRATION PROCEDURES AND FREQUENCY

6.1 Field Instrument Calibration

6.1.1 pH Meter Calibration
6.1.2 PID Meter
6.1.3 Conductivity Meter Calibration
6.1.4 Lower Explosive Level Meter
6.1.5 Water Level Meter

6.2 Laboratory Instrument Calibration

6.2.1 Calibration Procedures and Frequency for RAS and SAS Analysis
6.2.2 Organic Analyses

7.0 ANALYTICAL PROCEDURES

7.1 Field Analytical Procedures
7.2 Laboratory Analytical & Measurement Procedures
7.3 Special Analytical Services laboratory Procedures (SAS)

8.0 INTERNAL QUALITY CONTROL CHECKS

8.1 Field Quality Control Checks
8.2 Laboratory QC Checks

8.2.1 RAS Internal Quality Control Checks
8.2.2 SAS Internal Quality Control Checks

9.0 DATA REDUCTION, VALIDATION AND REPORTING

9.1 Data Reduction

9.1.1 Field Data Reduction Procedures
9.1.2 Laboratory Data Reduction Procedures

9.2 Data Validation

9.2.1 Procedures Used to Validate Field Data
9.2.2 Procedures Used to Validate Lab Data

9.3 Data Reporting

9.3.1 Field Data Reporting
9.3.2 Laboratory Data Reporting

10.0 PERFORMANCE AND SYSTEMS AUDITS

10.1 Field Performance and System Audits

10.1.1 Internal Field Audits
10.1.2 External Field Audits

10.2 Laboratory Performance and Systems Audits

10.2.1 Internal Laboratory Audits
10.2.2 External Laboratory Audits

11.0 PREVENTATIVE MAINTENANCE

11.1 Field Instrument Preventative Maintenance
11.2 Laboratory Instrument Preventative Maintenance

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

12.1 Accuracy Assessment
12.2 Precision Assessment
12.3 Completeness Assessment

13.0 CORRECTIVE ACTION

13.1 Field Corrective Action
13.2 Laboratory Corrective Action
13.3 Corrective Action During Data Validation and Data Assessment

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

14.1 Contents of Project QA Reports
14.2 Frequency of QA Reports
14.3 Individuals Receiving/Reviewing QA Reports

APPENDICES

APPENDIX A - FIELD SAMPLING PLAN
APPENDIX B - SPECIAL ANALYTICAL SERVICES TEST PROCEDURES

LIST OF TABLES

TABLE

1-1 Description of Initial Characterization Samples

1-2 Summary of Initial Characterization Samples, Metals, Organic Pesticides, PCBs, and Herbicides

1-3 Summary of Initial Characterization Samples, Volatile Organic Compounds

1-4 Summary of Initial Characterization Samples, Solids/Slude, Semi-Volatile Organic Compounds

1-5 Summary of Initial Characterization Samples Liquid, Semi-Volatile Organic Compounds

1-6 Intended Data Usage

1-7 Summary Table of Sampling and Analysis Programs

1-8 Rationale for Sample Locations

3-1 Target Compound List and Contract Required Quantitation Limits - Volatile Organics

3-2 Target Compound List and Contract Required Quantitation Limits - Semi-volatiles

3-3 Target Compound List and Contract Required Quantitation Limits - Organic Pesticides, Herbicides and PCBs

3-4 Field Measurement Parameter List and Required Detection Limits

3-5 QA Objectives for Field Parameters

3-6 QA Objectives for Laboratory Parameters

4-1 Sample Containers, Preservation and Holding Time Requirements

7-1 Summary of Organic Analytical Procedures for Non-Contract Laboratory Program (Non-CLP).

7-2 Summary of Inorganic Analytical Procedures for Non-CLP Program

11-1 Preventative Maintenance Procedures and Schedules

11-2 Preventive Maintenance for Field Instruments

LIST OF FIGURES

FIGURE

1-1 The Data Quality Objective Process

1-2 Project Schedule

2-1 Project Organization

LIST OF ATTACHMENTS

Attachment I, Chain-of-Custody Example

Attachment II, Sample Tag Example

Attachment III, Sample Label and Custody Seal Example

LIST OF APPENDICES

APPENDIX

A Field Sampling Plan (FSP)

Attachment A - Figure 1 - Location Map
Figure 2 - Site Map
Figure 3 - Initial Characterization Sample Location Map

B Special Analytical Services Test Procedures

C Mobile Laboratory SOP

LIST OF ACRONYMS/ABBREVIATIONS

ARARs	Applicable or Relevant and Appropriate Requirements
ASTM	American Standards for Testing Materials
BNA	Base-Neutral-Acid Extractables (Semi-volatile Organics)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act (Superfund)
COC	Chain of Custody
CLP	Contract Laboratory Program
CPT	Cone Penetrometer
CRDL	Contract Required Detection Limits
CRQL	Contract Required Quantitation Limits
CRL	Central Regional Laboratory
DAF	Dilution Alternative Factor for soil screening levels (SSLs)
DCF	Document Control Format
DQO	Data Quality Objective
EMSL	Environmental Monitoring and Support Laboratory
FSP	Field Sampling Plan
FFTU	Fire Fighting Training Unit
HASP	Health & Safety Plan
IEPA	Illinois Environmental Protection Agency
LUST	Leaking Underground Storage Tank
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NIST	National institute of Standard Technology
NPL	National Priorities List
OSC	On-Site Coordinator
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control
QAMP	Quality Assurance Management Plan
QAPP	Quality Assurance Project Plan
PNAs	Poly Nuclear Aromatic Compounds
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
RD/RA	Remedial Design/Remedial Action
RPM	Remedial Project Manager
FSP	Field Sampling Plan
SARA	Superfund Amendments and Reauthorization Act

LIST OF ACRONYMS/ABBREVIATIONS

SAS	Special Analytical Services
SMC	Sample Management Coordinator
SOP	Standard Operating Procedure
SOW	Statement of Work
SSL	Soil Screening Levels
SW846	Test Methods for Evaluating Solid Waste 1986.
TAL	Target Analyze List
TCL	Target Compound List
TIC	Tentatively Identified Compound
USEPA	United States Environmental Protection Agency
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound

LIST OF PERSONS WHO HAVE RECEIVED THIS QAPP

1. J.P. Messier, U.S. Navy, (847) 688-5999, Ext. 51

2. Molly E. Arp, Beling Consultants, (309) 757-9849

3. Dale S. Duffala, Beling Consultants, (312) 986-0390

4. Fred W. Lawrence, Beling Consultants, (309) 757-9831

5. Phil A. Ramos, Beling Consultants, (312) 986-0390

6. Laura Ripley, USEPA, Region V, (313) 886-0850

7. Donald Harrison, IEPA, (217) 524-5953

8. Dan Gillespie, ARDL, Inc. (618) 244-32357

9.

10.

11.

12.

SECTION 1

PROJECT DESCRIPTION

SECTION 1

PROJECT DESCRIPTION

1.1 Introduction

The purpose of this remedial investigation/feasibility study (RI/FS) is to gather sufficient information to quantify risk to public health and environment, to develop and evaluate viable remedial alternatives and to close the leaking underground storage tank (LUST) site. During the RI, data collection will be conducted in phases, with the results being a determining factor in decisions regarding the necessity for remediation and closure. This QAPP has been prepared on behalf of the Department of the Navy by Beling Consultants. A Field Sampling Plan (FSP) is included in this QAPP as Appendix A. A Health and Safety Plan (HASP) dated July, 1997 was previously submitted under separate cover.

1.2 Site Description

The Fire Fighting Training Unit (FFTU) is an abandoned section of the Naval Training Center, Great Lakes, located in Lake County, Illinois. The facility occupies approximately 8.5 acres, north and west of the intersection of Buckley Road and Green Bay Road, or State Highways 137 & 131. The location is shown on Figure 1. The site is surrounded by the Willow Glen Golf Course, which is operated by the U.S. Navy. The FFTU is separated from Willow Glen Golf Course by a chain link fence. The study area for the FFTU RI/FS is within the chain-link fence.

Based on review of the historical documents the FFTU was established in 1944 and taken out of service in 1989. The FFTU was used to train Navy recruits the fundamentals of fire fighting. Fuel in open burn pits, concrete carrier compartments, and gasoline burning compartments (Christmas trees) were ignited to simulate fires (Figure 2). Unburned fuel and wastewater was drained from the burn areas and treated on the west side of the FFTU. Treated wastewater was commingled with stormwater and discharged into Skokie Creek, approximately 1/3 mile west of the site.

Fuels were delivered to the burn areas through underground pressurized pipes. Samples were collected in 1996 from solids and liquids accumulated in the wastewater treatment structures and in drain pipes to assess hazardous constituents. The soils at the site have been contaminated with fuel oil, gasoline, and undetermined accelerants/fuels. Sources of contamination include surface spills and ruptured or leaking underground storage tanks, piping and sewers.

1.2.1 Facility/Size and Borders

The facility is approximately 8½ acres as provided on Figures 1 and 2. The Workplan for Limited Demolition Services and the HASP, hereby incorporated into this QAPP through reference, describe the previous practices at the site.

1.2.2 Topography

The site's general topography is flat with a wetland ditch around the west and north perimeters. The wetland ditch is bermed on both sides, which provides topographic relief of six to eight inches above grade.

1.2.3 Local Geology & Hydrogeology

Local geology consists of fill dirt, ash, gravel, and clay just below surface. The clay appears to be a native, unconsolidated glacial deposit. A cone penetrometer survey to 77 feet below grade provides indications of a sandy, silty clay with variations to silty sand from two to twelve feet thick below the shallow clay. The permeable layer appears to be correlative across most of the site. Below the sandy layer, a dense, stiff, clay till up to 25 feet thick, with unsaturated layers acts as a confining layer.

The surface water runoff from the east and northeastern part of the golf course drains to the wetland ditch through culverts and tiles. Stormwater drainage from the 8.5 acre FFTU percolates to the sandy strata below, and discharges through tile or seeps into the Skokie Ditch. Skokie Ditch, which is the headwaters of Skokie Creek, crosses the golf course west and downgradient of the FFTU site.

1.3 Past Data Collection Activities

In 1996, Beling was contracted by the Department of the Navy to perform a limited characterization study prior to the planned removal of underground piping and demolition of surface structures. Liquids, sludges, and residual material were sampled from burn structures, underground wastewater treatment tanks, drains, and an underground storage tank (refer to Initial Characterization Sampling Map, Figure 3).

Table 1-1 describes the samples and sample locations for initial characterization study. Refer to Beling Consultants letter report to Mr. Tony Andrews, dated September 16, 1996,

for sampling methods, summary of results, and copies of the laboratory reports. Table 1-2 summarizes the analytical results for volatile organic compounds (VOCs). Compounds detected include methylene chloride, xylene, toluene, naphthalene, 1,2,4-trichlorobenzene, 1,2-dibromo-3-chloropropane, benzene, ethyl benzene, isopropyl benzene, N-propybenzene, 1,2,4-trimethyl benzene, 1,3,5 trimethylbenzene, and trichlororflouromethane.

Table 1-3 summarizes the analytical results for semi-volatile organic compounds (SVOCs) in solid/soil samples. Compounds detected include 25 semi-volatile organic compounds, mostly associated with petroleum product combustion. Table 1-3 also summarizes the analytical results for SVOCs in liquid samples. Twelve SVOC constituents were detected.

Tables 1-4 and 1-5 summarize the analytical results for metals, organic pesticides/PCBs and herbicides. PCBs were not detected in any of the samples. Lindane was detected in a liquid sample collected from an oil/water separator. 4,4-DDD, Beta-BHC, and 4,4-DDE and the herbicides 2,4-D, Silvex, and 2,4-DB were detected in residual material sampled from drains. Heptachlor, Dieldrin and Gamma Chlordane were detected in the sludge sample.

1.4 Current Status

As of July 21, 1997, all man-made surface structures have been demolished and removed from the site, with the following exceptions:

Perimeter chain link fence and gates.
Building 3304
Golf Cart storage building
Fire hydrant and fill box
Transformer and pad
Crumbled asphaltic surfaces
Perimeter drainage ditch structures
Manholes, catch basins and clean-outs
2 decant ponds

Based on reports and documents reviewed for the site, and a current assessment of available information, the following target compounds and source area release mechanisms have been targeted for further investigation.

1.4.1 Target Compounds and Target Analytes

Refer to Tables 3-1 through 3-4 for this project's Target Compound List and Contract Required Quantitation Limits. All compounds listed in Region V's model QAPP have been included in the Target Compound tables referenced above. Chlorinated herbicides have been added to this QAPP because six herbicide compounds were detected during the initial characterization study.

The Target Analyte List (TAL) has been eliminated from the sampling regime because, of the ten inorganic compounds detected in wastes and standing water, none of them exceeded the "clean up objectives" of Illinois IEPA (LUST) or the "proposed remediation goals (PRGs)" as established by USEPA (Region IX PRGs).

A careful evaluation of the PRGs was undertaken with regard to residential soil concentrations, industrial soil concentrations, top water concentrations, and the soil screening levels (SSL) [with and without the dilution attenuation factor (DAF) of 20 as presented by Region 9]. The concentrations detected at FFTU in sludge, drain tiles, and standing water do not exceed the most conservative "PRGs" listed on the Region 9 table.

For example, Arsenic was detected at 50.5 ppb in the floor drain materials at carrier compartment D. The PRGs for arsenic are as follows: 380 ppb residential soil; 2,400 ppb industrial soil; 2.5 E-4 ug/m^3 in the air; 450 ug/l tap water; 2,900 ppb SSL w/DAF of 20; 1,000 ppb SSL w/DAF of 1.0. Since the site is not dusty, air sampling has not been conducted. It is the professional opinion of Beling Consultants that the ambient air PRGs will not be exceeded with regard to any inorganic constituents during this project. The sludges and accumulated wastes known to be present at the site are to be containerized and profiled for disposal in accordance with the derived waste guidance previously provided with the Demolition/Bioremediation Work Plan dated July 1997.

Region IX PRGs, as described on the August 1, 1996 Publication from USEPA, "combine current EPA Toxicity values with standard exposure factors to estimate contaminant concentrations in environmental media (soil, air and water) that are protective of humans, including sensitive groups, over a lifetime. Chemical concentrations above (the PRG) levels would not automatically designate a site as 'dirty' or trigger a response

action...Exceeding a PRG suggests that further evaluation of the potential risks...may be...appropriate." Therefore, based upon the low concentrations of inorganic compounds detected during initial site characterization, the QAPP for FFTU remediation proposes that further evaluation of inorganics is not necessary nor appropriate for this site.

1.4.2 Sources

- Gas/Oil/Vent Lines and Underground Fuel Storage Tanks.

  Records indicate that during FFTU activities, diesel fuel and gasoline were stored in a total of eight (8) underground storage tanks and supplied to the burn areas using pressurized pipes. Diesel fuel was pumped to 4 carrier compartments, which are reinforced concrete structures, along the east side of the FFTU and to six burn pits. The burn pits were 3 feet high, 15 feet diameter metal pans with a concrete slab base and open at the top. Gasoline was pumped to six "Christmas tree enclosures". The enclosures were metal nozzles on a vertical pipe which resembled the structure of an evergreen Christmas tree. The Christmas trees were enclosed in a wood/metal structure approximately 10x10x10 feet on concrete slabs. Fuel oil and gasoline may have contaminated the site from ruptured fuel or vent lines, leaking underground storage tanks and surface spills during filling of the storage tanks.

- Wastewater Pipes.

  Records indicate that the burn areas were ignited and smoke was generated during fire fighting training. It is possible that accelerants or waste solvents may have been added to the burning mixtures for training purposes. A review of the site drawings indicates that each burn area was equipped with a gate valve which, when opened, would drain extinguished fire liquids (and solids) from the burn area (wastewater). Drainage of the wastewater from the burn areas was through cast iron pipes, which drained towards the west end of the site. Soils around gate valves and drains, around ruptured wastewater pipes, and below the slabs of the burn pits, Christmas tree enclosures and carrier compartments may be

contaminated. Residual material sampled from the drains of wastewater pipes contained detectable concentrations of target compounds.

- Wastewater Treatment Structures.

  Records indicate that drainage at the site was modified during the active period of the FFTU. Cast iron wastewater pipes converged at a reinforced concrete underground smothering pit. From the smothering pit, wastewater apparently flowed into an underground reinforced concrete and wooden oil/water separator. Originally, effluent from the separator was diverted to a "sludge pit". The former sludge pit is not within the fenced area of the FFTU and is not included in the scope of this project. Records indicate that an underground concrete overfill tank was installed in 1975 and that the sludge pit was abandoned in 1975. Record drawings indicate that two decant ponds were constructed to accept effluent from the overfill tank in 1976. Some time after 1960, a duplex oil separator was installed on the effluent side of the smothering pit. Modifications to treatment structures occurred from 1976 until the abandonment of the site. Standing water in the oil/water separator and sludge from the vault contained detectable levels of target compounds. Liquids and residual material in the structures and the connecting pipes, as well as downstream manholes, may contain target compounds.

  Sediment and standing water, if present in the decant ponds, will be analyzed.

- Storm Sewers.

  Records indicate that stormwater and water used to extinguish the fires was collected in a series of concrete catch basins and drained toward the west end of the site through vitreous clay tiles. Stormwaters co-mingled with "treated" wastewater in the vicinity of the decant ponds and flowed into Skokie Creek. Residual material, if present in storm sewers and manholes, may contain elevated concentrations of target compounds, due to surface spills. Contaminants may also be present in trench backfill materials where storm sewers intersect wastewater or petroleum delivery/vent pipe trenches.

- Water Pipes.

  Records indicate that extensive underground water pipes have been installed across the site. The water was primarily used to extinguish fires and also supplied to drinking fountains. It is not anticipated that contamination will be encountered in the water pipe trenches with the possible exception of where they intersect wastewater or petroleum delivery/vent pipe trenches.

The historical release of contaminants as described above resulted in the contamination of soils at the FFTU. The primary sources of fuel releases have been removed except for one underground storage tank. At this time, the soils in the pipe trenches and from beneath the burn pits, Christmas trees and carrier compartments, the residual material in the drains and manholes, the accumulated liquids in the remaining underground storage tank and wastewater treatment related subsurface structures, and the pipes and soils of the decant ponds may provide a secondary source of contamination.

1.5 Project Objectives

The purpose of this investigation is to gather sufficient information to quantify risk to public health and environment (Baseline Risk Assessment) and to consider possible remedial alternatives (Corrective Measures Study at the Site). The objectives of the investigation are to determine the nature and extent of contamination at the site. Objectives of the data collection will be as follows:

- Verify and further define the nature and extent of contamination in previously identified on-site areas. Data quality must be sufficient to be able to compare with State health-based criteria.

- Determine the nature and extent of contamination in previously uninvestigated areas. Data will be compared to State regulatory criteria.

  Contaminants associated with fuel oil and combustion of petroleum will be evaluated to assess risk to human health and the environment under the purview of Illinois EPA's 35 IL Admin. Code Part 731 and 742 as applicable. Clean-up objectives for soil and groundwater will be established using the Tiered Approach to Clean Up Objectives (TACO) in Part 742.

Contamination not attributed to fuel oil or combustion will be evaluated to assess risk to human health using Region IX's PRGs. Illinois TACO Cleanup Objectives, and/or the USEPA's Risk Assessment Guidance (RAGs) Volume I.

- Collect sufficient data from contaminated media to support a baseline risk assessment and feasibility study.

The approach for the site investigation incorporates sampling during trenching, pipe demolition activities, and subsurface investigation using a direct-push unit and mobile laboratory.

The Phase I field investigation will include:

- Subsurface soil sampling during pipe demolition. Samples will be taken from beneath existing fuel delivery pipes and vents, wastewater, stormwater and water delivery pipes; existing and former underground storage tanks; burn pits; Christmas tree enclosures; carrier compartments; and wastewater treatment structures.

- Waste characterization investigation of derived wastes including: pipes, sludges, groundwater and decontamination rinsate.

- Subsurface investigation with direct push unit and mobile laboratory.

- Discrete subsurface soil samples from areas suspected of contamination to define the extent of soil contamination.

- Groundwater samples from locations upgradient, downgradient and from areas of suspected contamination.

- Sediment samples from perimeter ditch and decant ponds.

Soil samples collected during trenching and excavating activities will be analyzed for volatile organics, semi-volatile organics, herbicides, and pesticides/PCBs.

Data from the investigation will be evaluated in conjunction with existing data to determine whether a Phase II investigation is necessary. The rationale and scope of any Phase II

investigation will be discussed with and approved by the U.S. Navy prior to implementation.

Potential Phase II work may include:

- Additional soil/sediment and groundwater sampling.
- Modelling for Risk Assessment.
- Installation of monitoring wells and a detailed groundwater investigation.
- Treatability studies or pilot testing.

If Phase I data suggests that sufficient site characterization information has been collected, a risk assessment may be conducted prior to seeking closure. A technical memorandum presenting the Phase I data and recommendations of the risk assessment will be prepared and submitted to the U.S. Navy. After a review of the technical memorandum, the need for implementing a Phase II investigation will be evaluated in light of the data requirements for the feasibility study.

1.5.1 Specific Objectives and Associated Tasks

For this project, it will be necessary to gather sufficient information to evaluate the nature and extent of releases from the burn areas, pipe trenches, decant ponds, perimeter ditches, and the vicinity of wastewater treatment structures, and also to determine whether unreasonable health risks are present. This could include evaluation of the impact of releases on human health and the environment both within and beyond the facility property boundary, if applicable.

Some field monitoring will be utilized for purposes of screening "hot spot" areas and for worker health and safety. The photoionization detector (PID), an explosimeter, and professional judgement regarding safety concerns will be utilized together with the action levels prescribed in the HASP to determine if PPE should be upgraded during field activities.

1.5.2 Project Target Parameters and Intended Data Usages

The list of target parameters for this project is included in Tables 3-1 through 3-3 of this QAPP. The data will be compared to background soil levels, or to measured detection limits and other health based criteria with the ultimate objective being to protect human health. Data may also be used to assess feasibility of using certain remediation technologies where contamination is found to exist. However, it is understood that a QAPP modification to allow bench scale testing of a remediation process, or simply to allow further evaluation of remediation process feasibility may be required. The intended data usage is summarized in attached Table 1-6.

1.5.3 Quality Objectives and Criteria for Measurement Data

The Data Quality Objective (DQO) Process is a series of planning steps based on the Scientific Method that is designed so that the type, quality, and quantity of environmental data used in decision making are appropriate for intended application. DQOs are qualitative and quantitative statements derived from outputs of each step of the DQO Process that:

- Clarify the study objective.
- Define the most appropriate type of data to collect.
- Determine the most appropriate conditions from which to collect the data.

The steps of DQO process are provided in Figure 1-4. The DQOs are used to develop a scientific and resource-effective sampling design. The DQO Process allows decision makers to define their data requirements and acceptable levels of decision during planning before any data are collected. DQO are based on the seven step process described in EPA QA/G-4 (September 1994).

1.5.3.1 Decisions

Trenching activities will displace soil to the side of the trenches. Field screening using a PID will be used to document field observations. The first 4,000 cubic yards of contaminated soil with PID readings in excess of background concentrations will be remediated on-site with an ex-situ biopile unit.

Following trenching and excavating activities, subsurface samples will be collected and analyzed. The additional samples will be collected using direct push methods. Sample locations will be determined based on the evaluation of laboratory results from pipe demolition activities. The subsurface samples are intended to determine the extent and concentrations of contamination.

1.6 Sample Network Design and Rationale

The sample network design and rationale for soil sample locations during trenching and excavating activities (in respective media) is fully described in detail in section 4.0 of the Field Sampling Plan (Appendix A). The sample locations during the subsurface investigation will be determined after evaluation of the analytical data from the trench sampling and pipe demolition activities.

1.6.1 Sample Network by Task and Matrix

Sample matrices, analytical parameters and frequencies of sample collection are found in Table 1-7.

1.6.2 Site Maps of Sampling Locations

Maps showing the trenching soil sampling locations are included as Figure A-1 in the Field Sampling Plan (Appendix A). It is possible that some of these locations will be changed. The person who will be responsible for making such decisions will be the Site Field Manager, whose responsibilities are described in Section 2 of this QAPP.

1.6.3 Rationale of Selected Sampling Locations

The rationale for the selected sampling locations and depths is fully described in the Field Sampling Plan (Appendix A). A summary of the rationale is provided in Table 1-8.

1.7 Project Schedule

1.7.1 Anticipated Date of Project Mobilization

The earliest date for which samples are planned to be collected is July 28, 1997. However, as indicated in the Task Bar Chart (Figure 1-5), some activities such as removal of aboveground storage tanks and construction of silt and construction fences are scheduled to begin on July 21, 1997.

1.7.2 Task Bar Chart and Associated Timeframes

The dates of projected milestones are indicated in the Task Bar Chart. (Figure 1-5)

TABLE 1-1

DESCRIPTION OF INITIAL CHARACTERIZATION SAMPLES

Page 1 of 1

Sample Number	Sample Media	Sample Description
1	Sludge (Solid)	Sludge collected from concrete vault.
2	Water	Accumulated water collected from the east manhole of the former smothering pit.
3	Water	Accumulated water collected from the west manhole of the former smothering pit.
4	--	UST not found/not sampled.
5	Product & Water	Existing 5,000 gallon underground storage tank.
6	--	UST not found/not sampled.
7	Water	Groundwater accumulated in an excavation made near the north central portion of the site.
8	Solid	Residual material in floor drain of a Christmas tree enclosure.
9	Solid	Biomass collected from accumulated water in a burn pit.
10	Solid	Residual material in floor drain of a carrier compartment.
11	Wipe	Floor surface of a carrier compartment.
12	Wipe	Interior wall surface of a carrier compartment.
13	Solid (Sludge)	Field Duplicate of Sample No. 1.

Notes:

1. Samples were collected August 2 & 9, 1996.
2. Refer to Figure 3, Initial Characterization Sample Location Map, for sample locations.
3. Refer to Beling's Letter Report to Tony Andrews, dated September 16, 1996, for sample location justification and laboratory reports.

TABLE 1-2

SUMMARY OF INITIAL CHARACTERIZATION SAMPLE RESULTS, VOLATILES

Compound	Solid No. 1	Solid No. 13	Solid No. 2	Solid No. 3	Solid No. 5	Solid No. 7	Solid No. 8	Solid No. 9	Solid No. 10
Benzene	--	--	--	--	10KJ	12	--	--	2J
Toluene	--	--	--	--	110KJ	66	0.9BJ	--	7BJ
Ethyl Benzene	--	310J	--	--	120K	28	--	--	--
Xylene	2500JX	1200JX	--	--	3400KX	94	--	--	11X
Methylene Chloride	2500BJ	890BJ	2J	13	--	1J	38J	--	28B
Isopropylbenzene	--	220J	--	--	120K	9	--	--	--
n-Propylbenzene	--	670J	--	--	90K	9	--	--	--
1,2,4-Trimethylbenzene	8600	7600	--	--	630K	34	2BJ	3BJ	21
1,3,5-Trimethylbenzene	5500J	2600	--	--	150K	9	--	7J	6J
1,2-Dibromo-3-Chloropropane	--	--	--	--	--	--	--	3J	--
Sec-Butylbenzene	--	--	--	--	210K	7	--	--	--
p-Isopropyltoluene	--	--	--	--	500K	12	--	--	--
1,2,4-Trichlorobenzene	--	--	--	--	--	--	2BJ	3BJ	--
Trichlorofluoromethane							2J		12

TABLE 1-2

SUMMARY OF INITIAL CHARACTERIZATION
SAMPLE RESULTS, VOLATILES
Page 2 of 2

Notes:

1. Refer to Table 1-1 for Sample Descriptions.
2. Sample No. 13 is a Field Duplicate of Sample No. 1.
3. Table includes analysis of solid and liquids. The results expressed are in parts per billion equivalent (ug/kg or ug/l).
4. Compounds not listed on this table or shown as a value of -- were below method detection limits. Refer to Beling Letter Report to Tony Andrews, dated September 16, 1996 for Laboratory Reports.
5. K = x 1000.
6. J, X, B: Refer to Beling Letter Report to Tony Andrews, dated September 16, 1996.

TABLE 1-3

SUMMARY OF INITIAL CHARACTERIZATION SAMPLE RESULTS, SEMI-VOLATILES

Page 1 of 2

Compound	Solid No. 1	Solid No. 13	Liquid No. 2	Liquid No. 3	Liquid No. 5	Liquid No. 7	Solid No. 8	Solid No. 9	Solid No. 10	Wipe No. 11	Wipe No. 12
Naphthalene	1.1KJ	6500	--	2J	860KJ	260	650J	--	1300J	--	--
2-Methylnaphthalene	100K	47K	--	--	6200K	1900	--	--	--	--	--
Acenaphthene	30K	9100	7J	7J	1900KJ	240	1600J	--	7800J	--	--
Dibenzofuran	27000	51000	--	10	2500K	230	2200	--	11000J	--	--
Diethylphthalate	--	--	--	10	--	210	--	--	--	--	20
Fluorene	--	--	17	16	--	350	3600	--	19000	--	--
4-Nitroaniline	--	--	--	2J	--	--	--	--	--	--	--
Phenanthrene	--	41000	--	--	--	310	3400	--	15000	--	--
Carbazole	--	2900J	--	0.5J	--	--	620J	550J	--	--	--
Pyrene	21KJ	7300	0.8J	0.4J	120KJ	86J	5400	4600J	68000	--	13J
bis (2-Ethylhexyl) phthalate	2900J	960J	1J	1J	--	--	2100J	1700J	15000	--	16J
Di-n-Octylphthalate	--	--	--	0.2J	--	--	2200	83J	--	--	0.3J
4-Methylphenol	--	--	--	--	--	--	--	1500J	--	--	--
2,4-Dimethylphenol	--	460J	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	11000J	6500	--	--	--	--	650J	--	1300J	--	--

TABLE 1-3

SUMMARY OF INITIAL CHARACTERIZATION SAMPLE RESULTS, SEMI-VOLATILES

Page 2 of 2

Compound	Solid No. 1	Solid No. 13	Liquid No. 2	Liquid No. 3	Liquid No. 5	Liquid No. 7	Solid No. 8	Solid No. 9	Solid No. 10	Wipe No. 11	Wipe No. 12
Di-n-Butylphthalate	--	--	--	--	--	--	23K	--	--	--	--
Fluoranthene	--	--	--	--	--	--	3500	--	--	--	--
Butylbenzylphthalate	--	--	--	--	--	--	--	210J	--	--	0.7J
Benzo(a) Anthracene	--	--	--	--	--	--	--	210J	--	--	0.7J
Chrysene	3000J	1500J	--	--	--	--	4000	2600J	21000	--	8J
Benzo(b) Fluoranthene	--	1800J	--	--	--	--	5800	4900J	55000	--	28
Benzo(a) Pyrene	--	1100J	--	--	--	--	3000	2500J	34000	--	16J
Indeno(1,2,3-cd) Pyrene	--	790J	--	--	--	--	2400	1500J	21000	--	13J
Dibenzo(a,h) Anthracene	--	--	--	--	--	--	180J	--	4600J	--	1J
Benzo(g,h,i) Perylene	--	820J	--	--	--	--	--	1800J	18000	--	11J

Notes:

1. Refer to Table 1-1 for Sample Descriptions.
2. Sample No. 13 is a Field Duplicate of Sample No. 1.
3. Table includes analysis of solid and liquids. The results expressed are in parts per billion equivalent (ug/kg or ug/l).
4. Compounds not listed on this table or shown as a value of -- were below method detection limits. Refer to Beling Letter Report to Tony Andrews, dated September 16, 1996 for Laboratory Reports.
5. K = x 1000.
6. J, X, B: Refer to Beling Letter Report to Tony Andrews, dated September 16, 1996.

TABLE 1-4

SUMMARY OF INITIAL CHARACTERIZATION SAMPLE RESULTS, ORGANIC PESTICIDES, HERBICIDES AND PCB'S

Page 1 of 2

Compound	Solid No. 1	Solid No. 13	Liquid No. 2	Liquid No. 3	Liquid No. 5	Liquid No. 7	Solid No. 8	Solid No. 9	Solid No. 10	Wipe No. 11	Wipe No. 12
Gamma-BHC (Lindane)	--	--	--	0.070	--	--	--	--	--	--	--
Heptachlor	27	--	--	--	--	--	--	--	--	--	--
Dieldrin	76	120	--	--	--	--	--	--	--	--	--
4,4-DDD	1.0	--	36	--	--	--	--	--	720	--	--
4,4-DDT	1.0	--	--	--	--	--	--	--	380	--	--
Beta-BHC	--	190	47	--	130	--	37	2.7	390	--	--
Aldrin	0.005	--	--	--	11	--	--	--	--	--	--
Gamma Chloridane	2	54	49	--	--	--	--	--	--	--	--
4,4-DDE	0.5	--	--	--	--	--	--	--	690	--	--
2,4-D	1.7	--	630	--	--	--	--	--	440	--	--
2,4,5-TP (Silvex)	2.7	35	--	--	--	--	--	--	690	--	--
Pentachlorophenol	0.01	--	26	--	--	--	--	--	300	--	--
2,4-DB	--	--	--	--	--	--	--	--	--	--	--
Dibromochloropropane	--	--	--	--	--	--	--	--	770	--	--
Dinoseb	--	--	--	--	--	--	--	--	72	--	--

TABLE 1-4

SUMMARY OF INITIAL CHARACTERIZATION SAMPLE RESULTS, ORGANIC PESTICIDES, HERBICIDES AND PCB'S

Notes:

1. Refer to Table 1-1 for Sample Descriptions.
2. Sample No. 13 is a Field Duplicate of Sample No. 1.
3. Table includes analysis of solid and liquids. The results expressed are in parts per billion equivalent (ug/kg or ug/l).
4. Compounds not listed on this table or shown as a value of -- were below method detection limits. Refer to Beling Letter Report to Tony Andrews, dated September 16, 1996 for Laboratory Reports.

TABLE 1-5

SUMMARY OF INITIAL CHARACTERIZATION
SAMPLE RESULTS, METALS
Page 1 of 1

Compound	Solid No. 1	Solid No. 13	Liquid No. 2	Liquid No. 3	Liquid No. 5	Liquid No. 7	Solid No. 8	Solid No. 9	Solid No. 10	Wipe No. 11	Wipe No. 12
Arsenic	--	--	--	--	--	--	--	--	50.5	--	--
Barium	2450	1020	--	--	--	--	1380	49.2	153	--	--
Cadmium	--	--	--	--	--	--	9.07	3.42	13.7	--	--
Chromium	53.8	24.1	--	--	--	--	254	1250	32.6	--	--
Iron	--	--	366	2460	--	1500	--	--	--	--	--
Lead	--	--	3.12	3.3	--	--	--	--	--	--	--
Manganese	--	--	37	176	--	224	--	--	--	--	--
Selenium	--	--	--	--	--	--	--	--	3.32	--	--
Thallium	0.711	0.841	--	--	--	--	0.667	2.35	0.645	--	--
Zinc	--	--	278	63.1	--	62.6	--	--	--	--	--

Notes:

1. Refer to Table 1-1 for Sample Descriptions.
2. Sample No. 13 is a Field Duplicate of Sample No. 1.
3. Table includes analysis of solid and liquids. The results expressed are in parts per billion equivalent (ug/kg or ug/l).
4. Compounds not listed on this table or shown as a value of -- were below method detection limits. Refer to Beling Letter Report to Tony Andrews, dated September 16, 1996 for Laboratory Reports.

TABLE 1-6
INTENDED DATA USAGE

Activity	Description	Parameters	Intended Data Usage
Initial Characterization Sampling (completed)	Accumulated water Sludge Residual material in drains Biosolids in liquid Surface wipe	TCL/TAL/Chl, Herb TCL/TAL/Chl, Herb TCL/TAL/Chl, Herb TCL/TAL/Chl, Herb SVOC, PCBs, metals	Identify compounds of concern Develop appropriate Health & Safety Plan
Biotreatability Samples	Soil	Treatability	Determine feasibility of treatment in biopile.
Cone Penetrometer	Soil Groundwater	Geotechnical/ physical parameters TCL	Develop soundings, determine water bearing and confining strata, evaluate treatment technologies. Verify horizontal limits of contamination.
Grab Samples during trenching and excavating activities	Soil	TCL	Determine residual concentrations of contaminants of concern in soil following trenching. Identify hot spots.
	Accumulated liquids	Derived waste profiles	Evaluate disposal options: on-site biopile irrigation vs. off-site.
Subsurface Remedial Investigation	Soil Groundwater	TCL TCL	Verify the vertical and horizontal extent of contamination. Identify areas which potentially require remediation.
BioPile Closure	BioPile	BTEX PNAs TCL & TAL	Verify treatment process in accordance with IEPA Requirements & USEPA requirements.

TABLE 1-7
SUMMARY TABLE OF SAMPLING AND ANALYSIS PROGRAM
Page 1 of 2

Sample Matrix	Field Parameters	Laboratory Parameters	Estimated Number of Samples	Number of Duplicates	Number of Field Blanks	Number of MS/MSD	Estimated Matrix Total to Lab(s)
Groundwater	Temperature, conductivity, pH	TCL VOC TCL SVOC TCL Pesticides/PCBs TCL Herbicides	Field Screening Analysis 150 (indicator contaminants only) CLP Lab 20	10%	10% VOCs	5% CLP Samples	30
		BTEX (LUST parameters) PNAs	Field Screening Lab 20	10%	10% VOCs	0	22
Surface Water from wetland ditch	Temperature, conductivity, pH	TCL VOC TCL SVOC TCL Pesticides/PCBs TCL Herbicides	Field Screening Analysis 5 CLP Lab 1	10%	10% VOCs	5% CLP Samples	8
		BTEX (LUST parameters) PNAs	Field Screening and Lab 5	10% Lab	10% VOCs	0	8
Accumulated Water and derived wastes	Temperature, conductivity, pH	TCLP/Waste Characterization	20 (Heritage)	-0-	-0-	0	20 estimated (Heritage)
Soil & Sediment including biopile	Soil gas screening using headspace (PID) VOCs	TCL VOC TCL SVOC TCL Pesticides/PCBs TCL Herbicides	CLP Lab 120	10%	-0-	-0-	132
		BTEX (LUST parameter) PNAs	PID Lab 75	10%	-0-	-0-	83

TABLE 1-7

SUMMARY TABLE OF SAMPLING
AND ANALYSIS PROGRAM
Page 2 of 2

Notes:

1. One trip blank, which consists of two 40-mil glass vials for water samples will be shipped with each shipping cooler of VOA water samples.
2. MS/MSD = Matrix Spike/Matrix Spike Duplicates for organic analysis. Samples designated for MS/MSD analysis will be collected, with extra sample volumes, at a frequency of one per group of 20 or fewer investigative samples. Triple the normal sample volumes will be collected for VOA's, and double the sample volumes will be collected for extractable organics, pesticides and PCBs.
3. The number of samples to be collected for MS/MSD are not included in the matrix total. The number of trip blank samples is also excluded from the matrix total.
4. BTEX and PNAs analysis will be conducted pursuant to IEPA requirements for Leaking Underground Storage Tanks (35 IAC 732.310).

TABLE 1-8

RATIONALE FOR SAMPLE LOCATIONS

Category	Number of Samples and Location	Rationale
Soil TCL	12 samples from 4 Carrier compartments	Evaluate the soils beneath the former slabs of the carrier compartments. 3 or more samples will be collected from the vicinity of each of the 4 former carrier compartments to determine if residual contaminant concentrations pose a threat to human health.
Soil TCL	3 samples - North stormwater pipes	Evaluate stormwater drain pipe trench at 3 locations where trench appears to intersect trenches with dissimilar pipes (fuel delivery, water supply, and wastewater). Insection areas are believed to have the highest probability for pipe breakage.
Soil TCL	3 samples-North burn area	Evaluate soils beneath gate valve drains and former slabs of 1 burn pit and 2 Christmas tree enclosures in the north burn area.
Soil TCL	5 samples-Central burn area	Evaluate soils beneath gate valve drains, and former slabs of 2 burn pits, 2 Christmas tree enclosures and one concrete "inlet" (storm drain) in the central burn area.
Soil TCL	6 samples-South burn area	Evaluate soils beneath gate valve drains and former slabs of 2 burn pits, 2 Christmas tree enclosures, and one concrete inlet as well as cast iron drain pipe trench where it intersects a water supply pipe trench, in the south burn area.

NOTE: Soil excavated from trenches will be used in a pilot biopile remediation project on-site. Trenches will be sampled from the areas believed to have residual contamination on the side or bottom of the trench.

TABLE 1-8

RATIONALE FOR SAMPLE LOCATIONS

Category	Number of Samples and Location	Rationale
Soil TCL	8-"Intersections"	Evaluate intersections of trenches with dissimilar pipes; stormwater/wastewater pipes at southwest portion of site, fuel delivery/stormwater at southeast portion of site, fuel delivery/water supply near former carrier compartment A, wastewater/water supply near former carrier compartment B, water supply/vent/storm water near north UST cluster, stormwater/water supply near former carrier compartment A, fuel distribution/water supply/stormwater near central burn area, and water supply/stormwater west of central burn area.
Soil TCL	8-Wastewater treatment structures	Evaluate the soil beneath the former smothering pit, duplex separator, separator pit, and valve pit. Demolition and removal of these underground structures will be in a common excavation.
Soil TCL	5-Effluent structures	Evaluate the soils beneath the vault, the 5,000 gallon overfill tank and manhole D. Demolition of these structures will be in a common excavation.
Soil TCL	7-Decant ponds	Evaluate the pipe trenches formerly used to delivery wastewater to the decant ponds and to evaluate the sand bed and the soil beneath the decant ponds. One sample will also be collected to evaluate the pipe trench near manhole C.
Soil TCL	1-Former sludge pit	Evaluate the soil in the vicinity of a suspected former drain pipe in the area outside of the FFTU known as the former sludge pit.

TABLE 1-8

RATIONALE FOR SAMPLE LOCATIONS

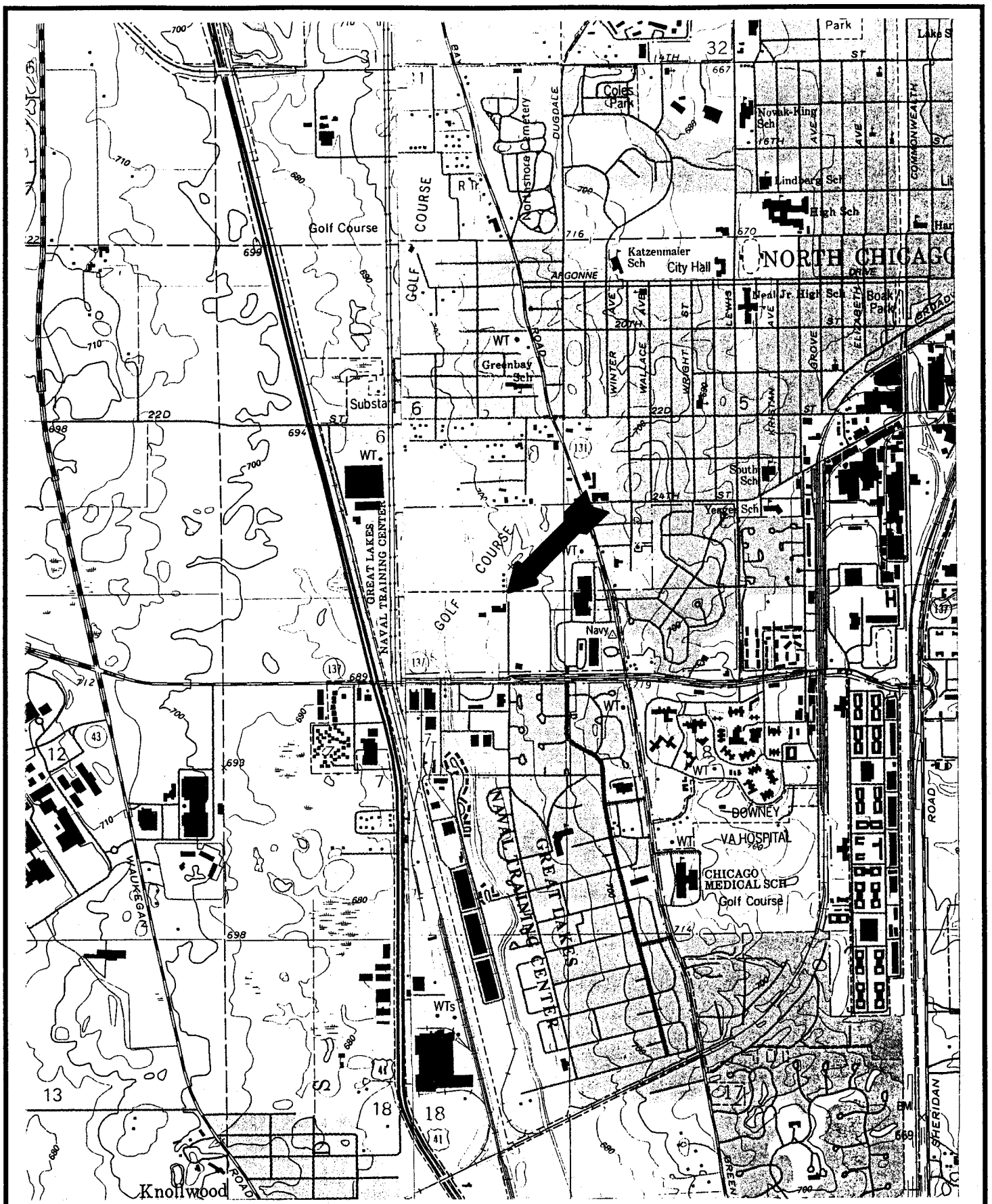
Category	Number of Samples and Location	Rationale
Soil TCL	33-Discretionary	Discretionary samples will be collected during trenching and excavating activities based on field observations.
Soil BTEX/PNAs	4-Near entrance to site	Evaluate pipe trench to Administration Building and around fillbox.
Soil BTEX/PNAs	4-Southeast USTs	Evaluate soils beneath former 5,000 gallon gasoline UST and existing 5,000 gallon diesel UST.
Soil BTEX/PNAs	4-Southeast distribution	Evaluate pipe trenches nearest the location of the former fuel line pumps. Maximum oil pressure would have been along these pipes during pumping.
Soil BTEX/PNAs	11-South UST cluster	Evaluate soils beneath the south cluster of former USTs (2 x 1,500 gasoline and 2 x 2,500 gallon diesel) and the associated trenches occupied by supply and distribution piping.
Soil BTEX/PNAs	5-South burn area	Evaluate soils beneath the former slabs of each burn structure (2 x burn pits and 2 x Christmas tree enclosures) and in the trench occupied by fuel pipes supplying the south burn area.
Soil BTEX/PNAs	5-Central burn area	Evaluate soils beneath the former slabs of each burn structure (2 x burn pits and 2 x Christmas tree enclosures) and in the trench occupied by fuel pipes supplying the central burn area.
Soil BTEX/PNAs	7-North UST cluster	Evaluate soils beneath the south cluster of former USTs (1,500 gasoline and 2,500 gallon diesel) and the associated trenches occupied by fuel supply and distribution piping.

TABLE 1-8

RATIONALE FOR SAMPLE LOCATIONS

Category	Number of Samples and Location	Rationale
Soil BTEX/PNAs	4-North burn area	Evaluate soils beneath the former slabs of each burn structure (2 x burn pits and 2 x Christmas tree enclosures) and in the trench occupied by fuel pipes supplying the burn area.
Soil BTEX/PNAs	3-Vent lines	Evaluate vent pipe trenches on the northern portion of the site.
Soil BTEX/PNAs	3-Carriers' UST	Evaluate soils beneath the former 2,500 gallon diesel UST which once supplied fuel to the carrier compartments.
Soil BTEX/PNAs	18-Discretionary	Discretionary samples will be collected during trenching and excavating activities based on field observations.
Derived Waste		Evaluated by analytical methods -- possibly used for biopile/possibly discharged/possibly treated at TSDF.
Geoprobe Soil	Various	Depends on results of soil analysis from trenching activities.
Geoprobe Groundwater	Various	Depends on results of soil analysis from trenching activities.

NOTE: BTEX/PNAs samples are being collected pursuant to IEPA regulations for Leaking Underground Storage Tanks and are not a USEPA Region V activity. The data proposed to be collected intended to satisfy both USEPA and IEPA.



BELING CONSULTANTS

Professional Engineering
Since 1936

Moline, IL • Joliet, IL • Chicago, IL • Peoria, IL
Davenport, IA • Beloit, WI • Hammond, IN • Columbus, OH

DESIGNED:	M.E.A.
DRAWN:	A.A.B.
CHECKED:	M.E.A.

C:\DEPT\16\679\QAPP\QAPP-F1.DWG

0' 1000' 2000' 4000'
Horizontal Scale: 1":2000'

N

SITE LOCATION MAP

RI/FS, FFTU QA PROJECT PLAN

ENVIRONMENTAL REMEDIATION OF THE FIREFIGHTING TRAINING UNIT
NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

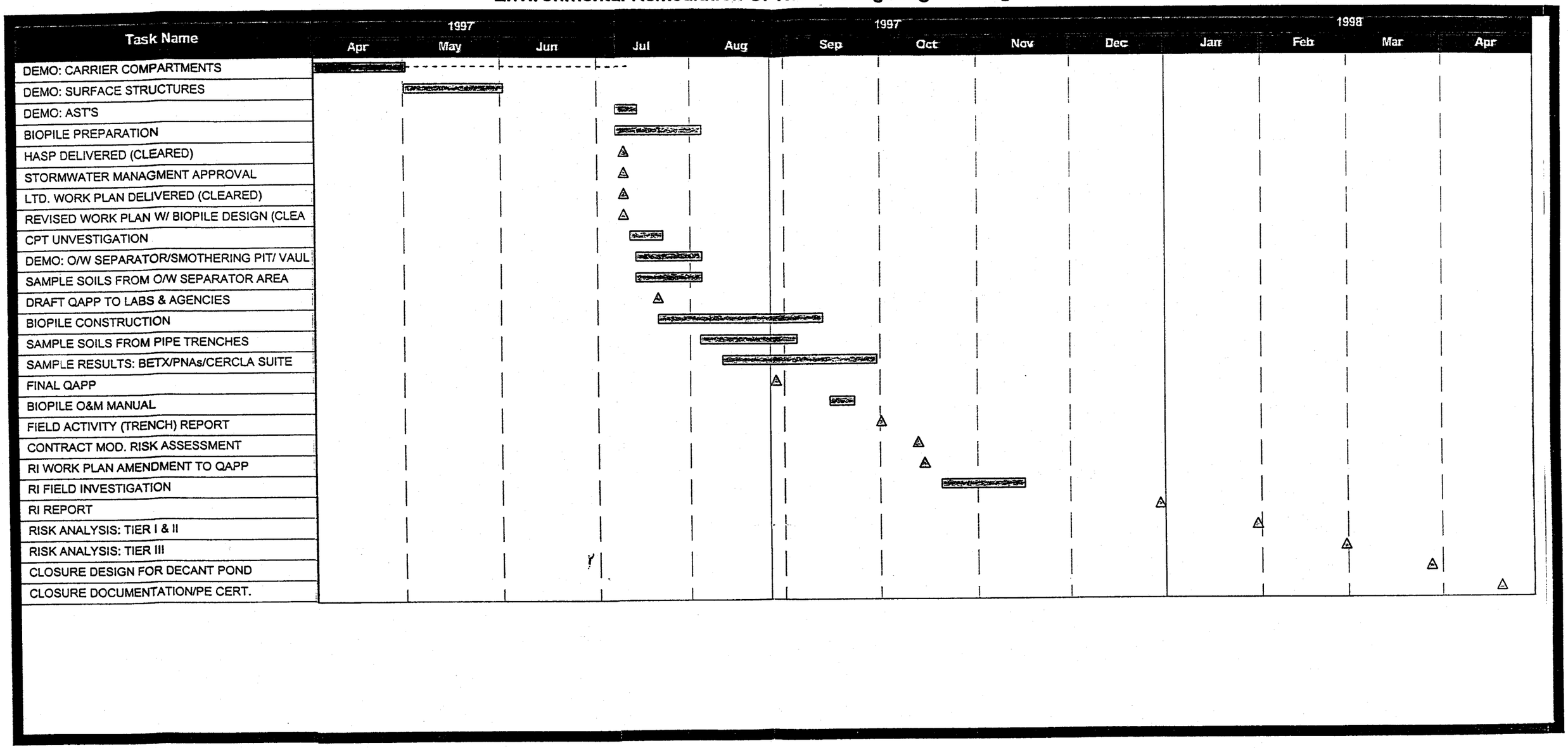
SHEET: **FIGURE 1-1**

JOB NUMBER: **29880**

DATE: **JULY 1997**

PROJECT TIMELINE

Environmental Remediation Of The Fire-Fighting Training Unit

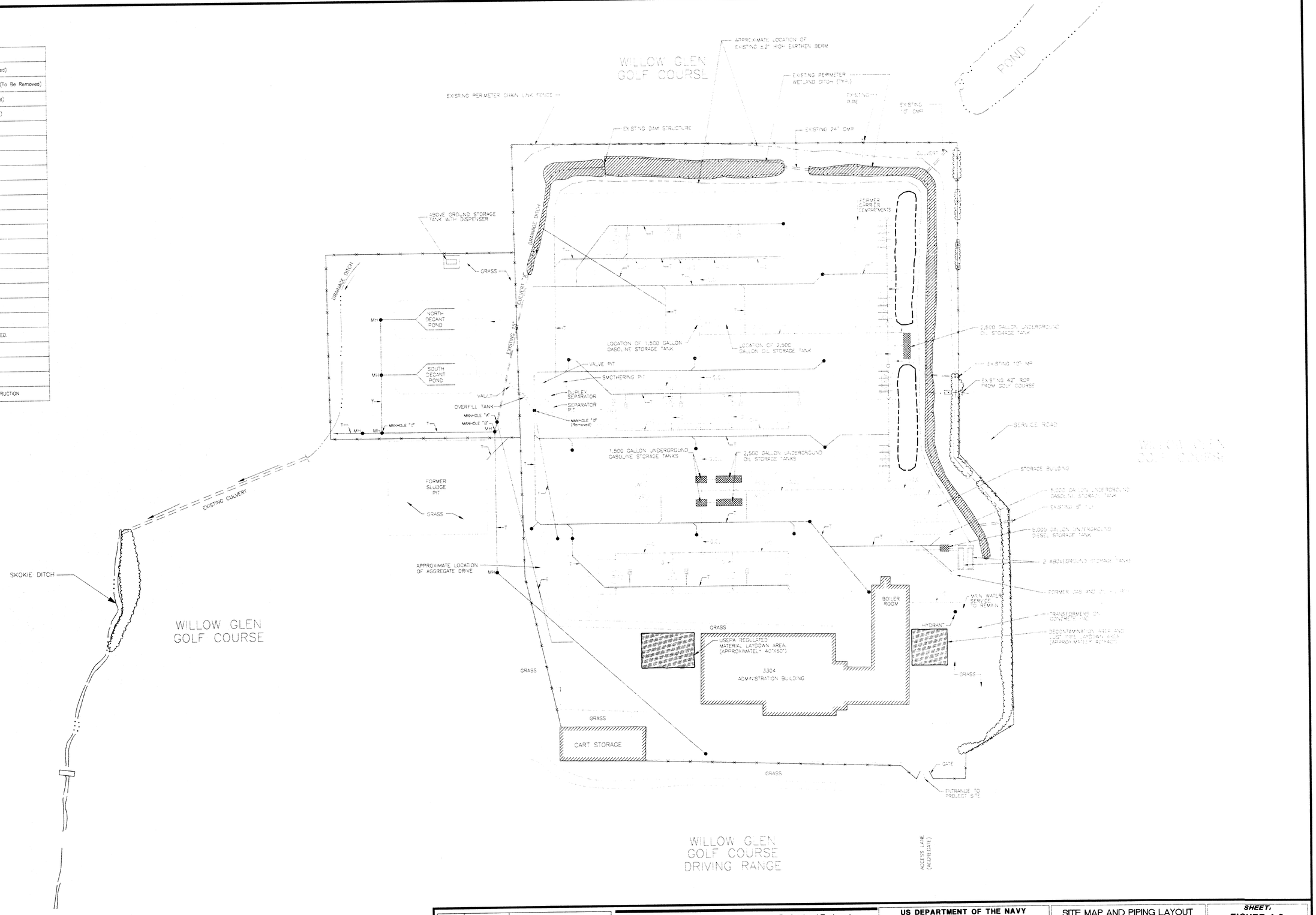


Printed: 8/27/97
Page 1

Beling Consultants

LEGEND

	(To Be Removed)
	(To Be Removed)
T	NON-METALLIC CLAY TILE DRAIN PIPES (To Be Removed)
	(To Be Removed)
	(To Be Removed)
	(To Be Removed)
	BURN PIT (Removed)
	CHRISTMAS TREE ENCLOSURE (Removed)
	WATER SUMP (Removed)
	GATE VALVE (Removed)
	CONTROL TOWER (Removed)
	CONTROL PANEL WITH MULTIPLE CONNECTIONS TO SPRINKLERS
●	CATCH BASIN
○	CLEANOUT
MH●	MANHOLE
	INLET
	UNDERGROUND STORAGE TANKS
	APPROXIMATE AREA OF JURISDICTIONAL WETLANDS.
	CHAIN LINK FENCE
	INDICATES STRUCTURE HAS BEEN REMOVED.
	CORRUGATED METAL PIPE
	SMOOTH METAL PIPE
	REINFORCED CONCRETE PIPE
	PROPOSED LOCATION OF BIOPILE CONSTRUCTION



REV.	DATE	REMARKS
0		

BELING CONSULTANTS

Professional Engineering Since 1936
Moline, IL • Joliet, IL • Chicago, IL • Peoria, IL
Davenport, IA • Beloit, WI • Ingermond, IN • Columbus, OH

DESIGNED: M.E. ARP
DRAWN: A.A. BROWN
CHECKED: M.E. ARP
C:\DEPT\18\979\QAPP\QAPP-F2.DWG

50' 0 25' 50' 100'
Horizontal Scale: 1"=50'

US DEPARTMENT OF THE NAVY
NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

ENVIRONMENTAL REMEDIATION OF THE FIREFIGHTING TRAINING UNIT (FFTU)

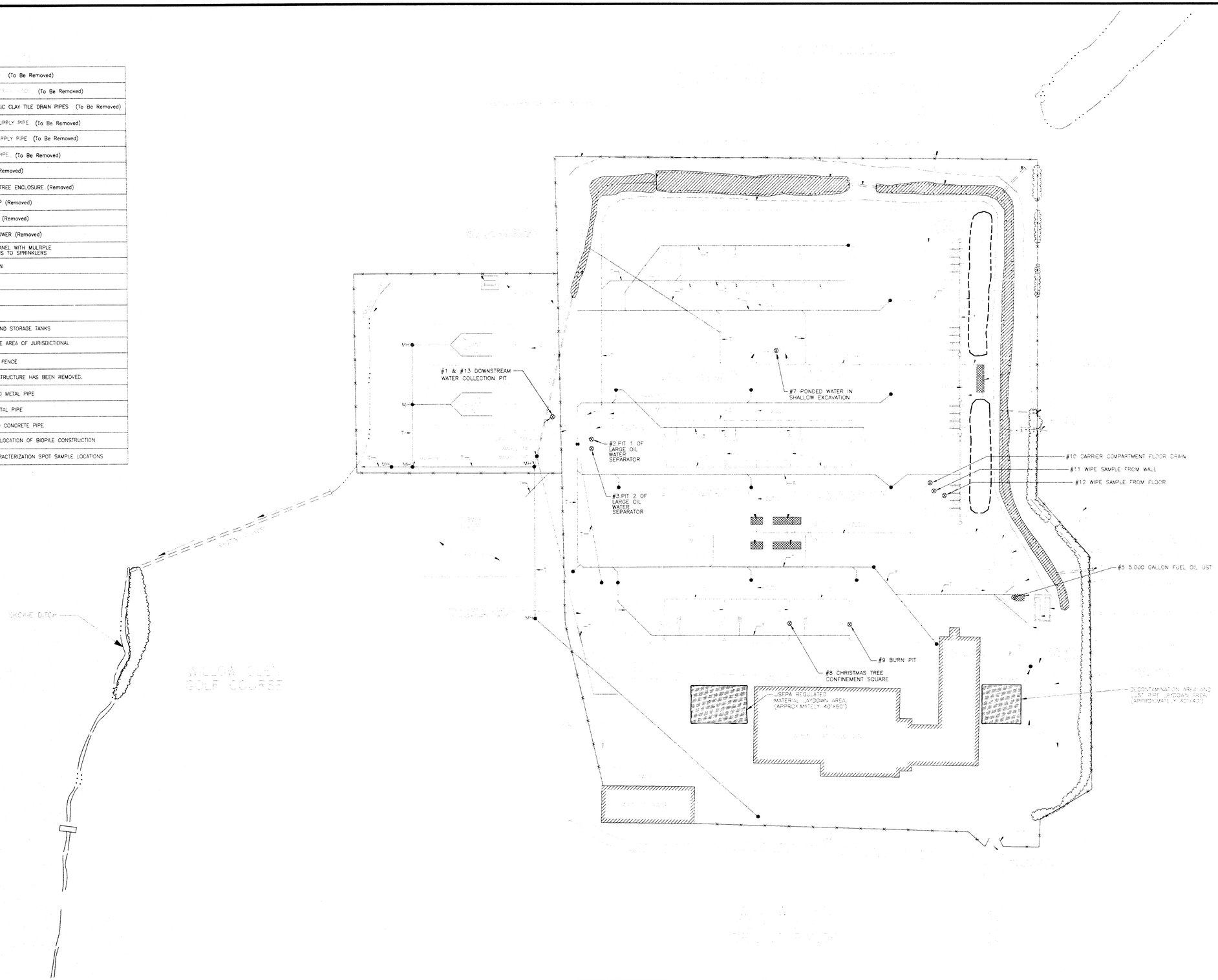
SITE MAP AND PIPING LAYOUT

RI/FS, FFTU QA PROJECT PLAN

SHEET: FIGURE 1-2
JOB NUMBER: 29880
DATE: JULY 23TH, 1997

LEGEND

W	WATER PIPES (To Be Removed)
S	SANITARY SEWER PIPE (To Be Removed)
T	NON-METALLIC CLAY TILE DRAIN PIPES (To Be Removed)
G	G = GAS SUPPLY PIPE (To Be Removed)
O	O = OIL SUPPLY PIPE (To Be Removed)
V	V = VENT PIPE (To Be Removed)
B.P.	BURN PIT (Removed)
CT	CHRISTMAS TREE ENCLOSURE (Removed)
WS/S	WATER SUMP (Removed)
⋈	GATE VALVE (Removed)
◇	CONTROL TOWER (Removed)
CP	CONTROL PANEL WITH MULTIPLE CONNECTIONS TO SPRINKLERS
●	CATCH BASIN
○	CLEANOUT
MH●	MANHOLE
	INLET
	UNDERGROUND STORAGE TANKS
	APPROXIMATE AREA OF JURISDICTIONAL WETLANDS.
—×—×—	CHAIN LINK FENCE
	INDICATES STRUCTURE HAS BEEN REMOVED.
CMP	CORRUGATED METAL PIPE
MP	SMOOTH METAL PIPE
RCP	REINFORCED CONCRETE PIPE
- - - -	PROPOSED LOCATION OF BIOPILE CONSTRUCTION
⊗	INITIAL CHARACTERIZATION SPOT SAMPLE LOCATIONS



REV.	DATE	REMARKS
0		

BELING CONSULTANTS

Professional Engineering Since 1936
Moline, IL • Joliet, IL • Chicago, IL • Peoria, IL
Davenport, IA • Beloit, WI • Hammond, IN • Columbus, OH

DESIGNED: M.E. ARP
DRAWN: A.A. BROWN
CHECKED: M.E. ARP
C:\DEPT\18\8791\QAPP\QAPP-F3.DWG

50' 0 25' 50' 100'
Horizontal Scale: 1":50'

US DEPARTMENT OF THE NAVY
NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

ENVIRONMENTAL REMEDIATION OF THE FIREFIGHTING TRAINING UNIT (FFTU)

INITIAL CHARACTERIZATION SAMPLING MAP

RI/FS, FFTU QA PROJECT PLAN

SHEET: FIGURE 1-3
JOB NUMBER: 29880
DATE: JULY 23TH, 1997

FIGURE 1-4

DATA QUALITY OBJECTIVES PROCESS
Page 1 of 1

Contamination from underground tanks and pressurized pipe lines as well as ruptured drain pipes and surface spills is present in the soils of the FFTU.

↓

Trenches and excavation will be made to remove the underground pipes and structures.

↓

Soil samples will be collected from the trenches and excavation and analyzed for specific compounds.

↓

Following trenching activities, a subsurface investigation will be conducted to attempt to determine the horizontal and vertical limits of contamination.

↓

If hazardous materials are present, they will be hauled off site for disposal at an appropriately permitted TSDF; LUST contamination will be evaluated, and possibly treated on site in a biopile constructed in accordance with IEPA LUST remediation guidelines.

↓

95% laboratory analysis and 90% field measurements will meet the DQOs.

↓

Sampling will start during trenching operations, at locations most likely to be sources of contamination.

FIGURE 1-5 PROJECT SCHEDULE

	June	July	August	September	October	November	December	January
INITIAL CHARACTERIZATION		D						
DEMOLITION OF SURFACE STRUCTURES		D						
CONE PENETROMETER TESTING	D							
LIMITED DEMOLITION OF WASTEWATER TREATMENT STRUCTURES		D						
APPROVAL OF QAPP		C						
TRENCHING AND EXCAVATING		_____	_____	_____D				
SOIL SAMPLING, GRAB		_____	_____	_____D				
SOIL SAMPLING, DIRECT PUSH				_____	_____	_____D		
BIOPILE CONSTRUCTION (IEPA)		_____	_____	_____D				
ADDITIONAL EXCAVATION (HOT SPOTS)						XXX		
DRAFT RI REPORT							_____D	
REVISION RI REPORT							_____D	
REVIEW OF FINAL RI REPORT							_____D	
APPROVAL OF FINAL RI REPORT								X
RISK ASSESSMENT								

D Done
C Critical
R Resource conflict
p Partial dependency
x Tentative

=== Task
+++ Started Task
M Milestone

. Slack time (==...), or
Resource delay (...=±)
> Conflict

TIME LINE Gantt Chart Report

SECTION 2

PROJECT ORGANIZATION AND RESPONSIBILITY

SECTION 2

PROJECT ORGANIZATION AND RESPONSIBILITY

2.1 Introduction

This project is intended to comply with U.S. Navy requirements as well as IEPA requirements for Leaking Underground Storage Tanks. Beling Consultants will perform the field investigation, prepare the RI report, and provide a feasibility study for cleanup and closure. The various quality assurance and management responsibilities of key project personnel are defined below.

2.2 Project Organization Chart

The lines of authority for this specific project are provided in Figure 2-1. This chart includes all individuals discussed below.

2.3 Management Responsibilities

Site/Facility Manager

The Site Manager, Mr. J.P. Messier, Department of the Navy, is responsible for implementing the project, and has the authority to commit the resources necessary to meet project objectives and requirements. The site manager's primary function is to ensure that technical, financial, and scheduling objectives are achieved. The site manager will provide the major point of contact and control for matters concerning the project. The site manager will:

- Ensure quality standards and objectives are met throughout the project.
- Define project objectives and develop a detailed work plan schedule.
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task.
- Acquire and apply technical and government resources as needed to ensure performance within budget and schedule constraints.

- Orient all field leaders and support staff concerning the project's special considerations.
- Monitor and direct the field leaders.
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product.
- Review the work performed on each task for quality, responsiveness, and timeliness.
- Review and analyze overall task performance with respect to planned requirements and authorizations.
- Approve all reports (deliverables).
- Represent the U.S. Navy at meetings and public hearings.

Beling Project Manager

Ms. Molly Arp, Beling's Project Manager, has overall responsibility for ensuring that the project meets U.S. Navy objectives and Beling's quality standards. Ms. Arp will provide assistance to Mr. Messier, in terms of distributing the QAPP, and other deliverables, project coordination, project planning, and implementation. Ms. Arp will report to Mr. Messier.

2.4 Quality Assurance (QA) Responsibilities

QA Manager

The QA manager, Mr. Dale Duffala, Beling Consultants, will remain independent of direct job involvement and day-to-day operations, but remain responsible for auditing the implementation of the QA program. Mr. Duffala will also be responsible for the data validation.

2.5 IEPA Remedial Project Manager

Mr. Donald Harrison will be the IEPA representative for the project.

2.6 Field Responsibilities

Beling Field Leader

The Facility Project Manager, Mr. Messier, will be supported by Beling's Field Operations Coordinator, Mr. Philip A. Ramos. Mr. Ramos is responsible for leading and coordinating the day-to-day activities of the various specialists under his supervision. Mr. Ramos is an experienced environmental professional responsible to Beling's Project Manager. His specific responsibilities include:

- Providing day-to-day coordination with the Project Manager on technical issues.
- Developing and implementing field-related work plans, assuring schedule compliance, and adhering to project requirements.
- Coordinating and managing of field staff during trenching, excavation, sampling, and drilling.
- Acting as field sample custodian.
- Implementing QC for technical data provided by the field staff including field measurement data.
- Adhering to work schedules provided by the project manager.
- Authoring, writing, and approving of text and graphics required for field team efforts
- Coordinating and overseeing of technical efforts of subcontractors assisting the field team.
- Identifying problems at the field team level, resolving difficulties in consultation with the Project Manager, implementing and documenting corrective action procedures, and providing communication between the field team and Beling management.
- Participating in preparation of the final report.

On-Site Laboratory Manager

The subsurface (direct push) soil and groundwater investigation will be supported by a mobile laboratory, capable of quantifying concentrations of indicator contaminants, duplicates, and standards.

Mr. Fred Lawrence, with Beling, will be in charge of implementing field sampling and analysis procedures during the subsurface investigation. Specific on-site laboratory manager responsibilities include:

- Providing day-to-day coordination with the field team leader on technical issues.
- Implementing QC for analytical data.
- Identifying problems at the laboratory level and discussing and documenting resolutions with the laboratory technicians and Project Manager.

Beling's Field Technical Staff

The technical staff (team members) for this project will be drawn from Beling's pool of corporate personnel. The technical staff will be used to gather and analyze data, and to prepare various task reports and support materials. All of the designated technical staff are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

On-Site Laboratory Staff

The on-site laboratory staff will be required to comply with this QAPP. They will also be responsible for notifying Mr. Lawrence if nonconformance is noticed or when corrective action is warranted.

2.7 Laboratory Responsibilities

ARDL Project Manager

Approximately 100 soil samples collected during trenching and excavating activities, and 40 soil samples collected during subsurface direct-push activities will be analyzed by:

ARDL, Inc.
P.O. Box 1566
Mt. Vernon Airport Road
Route 15 East
Mt. Vernon, Illinois 62864
(618) 244-3235 (phone)
(618) 244-1149 (fax)

The ARDL project manager, Mr. Dan Gillespie, will report directly to Ms. Arp and will be responsible for the following:

- Ensuring all resources of the laboratory are available as required.
- Identifying potential problems regarding the requirements of this QAPP, providing solutions for them, and documenting the results.
- Overviewing final analytical reports.

ARDL Operations Manager

The ARDL operations manager, Dr. L.V. Gibbons, will report to Dan Gillespie and will be responsible for:

- Coordinating laboratory analyses.
- Supervising in-house chain-of-custody.
- Scheduling sample analyses.
- Overseeing data review.
- Overseeing preparation of analytical reports.
- Approving final analytical reports prior to submission to the Project Manager.

ARDL Sample Custodian

Ms. Donna Cockrum, ARDL's sample custodian, will report to Dr. Gibbons, ARDL's operations manager. Responsibilities of Ms. Cockrum will include:

- Receiving and inspecting the incoming sample containers.
- Recording the condition of the incoming sample containers.
- Signing appropriate documents.
- Verifying chain-of-custody and its correctness.
- Notifying laboratory manager and laboratory supervisor of sample receipt and inspection.
- Assigning a unique identification number and customer number, and entering each into the sample receiving log.
- With the help of the laboratory manager, initiating transfer of the samples to appropriate lab sections.
- Controlling and monitoring access/storage of samples and extracts.

Final responsibility for project quality rests with Beling's Project Manager, Ms. Arp. Independent quality assurance will be provided by Beling's Quality Assurance Manager prior to release of data to the U.S. Navy.

ARDL Technical Staff

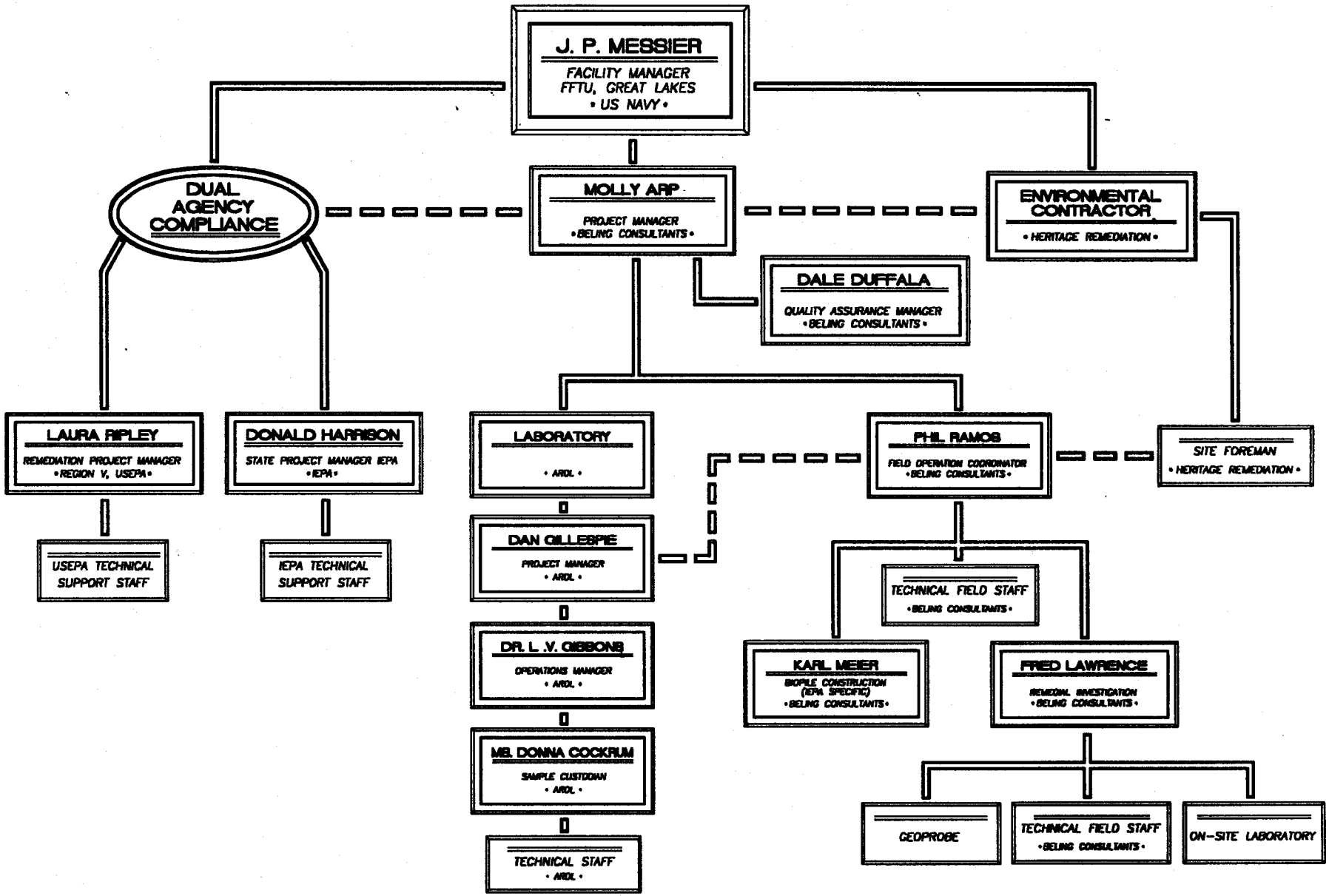
The ARDL technical staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to Dr. Gibbons, the operations manager.

Beling's Laboratory

Approximately 100 soil samples will be analyzed by Beling's Environmental Laboratory for BETX and PNA compounds (only).

Beling Consultants
1001 16th Street
Moline, IL 61265
(309) 757-9800

Beling's Laboratory Manager, Jeff Wasson, will report results documentation to Ms. Arp. Beling's Laboratory Manager will follow SOPs appropriate for IEPA LUST closure under 35 IL Admin. Code, Part 731, 732, and 742.



BELING CONSULTANTS

Professional Engineering
Since 1936
Moline, IL • Joliet, IL • Chicago, IL • Peoria, IL
Davenport, IA • Beloit, WI • Hammond, IN • Columbus, OH

DESIGNED:	M.E.A.
DRAWN:	A.A.B.
CHECKED:	M.E.A.

Q:\DEPT\18\QAPP\ORGCHART.DWG

Horizontal Scale: NO SCALE

ORGANIZATION CHART

RI/FS, FFTU QA PROJECT PLAN

ENVIRONMENTAL REMEDIATION OF THE FIREFIGHTING TRAINING UNIT
NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

SHEET: FIGURE 2-1

JOB NUMBER: 29880

DATE: JULY 1997

SECTION 3

QUALTIY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

SECTION 3

QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall QA objective for this project is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results which are legally defensible in a court of law. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

3.1 Precision

3.1.1. Definition

Precision is a measure of the degree to which two or more measurements are in agreement.

3.1.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicates at a rate of 1 duplicate per 10 analytical samples. The total number of duplicates for this project are found in Summary Table of Sampling and Analysis Program (Table 1-7).

3.1.3 Laboratory Precision Objectives

Precision in the laboratory is assessed through the calculation of relative percent differences (RPD) and relative standard deviations (RSD) for three or more replicate samples. The equations to be used for precision in this project are found in section 12 of this QAPP. Precision control limits are presented in Table 3-6.

3.2 Accuracy

3.2.1 Definition

Accuracy is the degree of agreement between an observed value and an accepted reference value.

3.2.2 Field Accuracy Objectives

Accuracy in the field is assessed through the use of field and trip blanks and through the adherence to all sample handling, preservation and holding times.

3.2.3 Laboratory Accuracy Objectives

Laboratory accuracy is assessed through the analysis of matrix spikes (MS) or standard reference materials (SRM) and the determination of percent recoveries. The equation to be used for accuracy in this project can be found in section 12 of this QAPP. Accuracy control limits are presented in Table 3-6.

The accuracy and precision requirements for RAS from the CLP are specified in the current SOQ/OLM03.1 for organics and SOW/ILM04.0 for inorganic. The sensitivities required for analyses will be the Contract Required Quantitation Limits shown in Tables 3-1, 3-2 and 3-3 of this Section. The accuracy, precision, and sensitivity requirements for SAS are specified in each individual SAS request contained in Appendix B, Special Analytical Services Test Procedures. The Standard Operating Procedures (SOPs) for the field equipment to measure pH, conductivity, and temperature are attached. Accuracy and precision requirement for field screening analyses are included in Table 3-5.

3.3 Completeness

3.3.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

3.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The equation for completeness is presented in section 12 of this QAPP. Field completeness for this project will be greater than 90 percent.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The equation for completeness is presented in section 12 of this QAPP. ARDL Laboratory completeness for this project is expected to be greater than 95 percent.

3.4 Representativeness

3.4.1 Definition

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.

3.4.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by following the field sampling plan (FSP) and using proper sampling techniques.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory will be attained by using the proper analytical procedures, meeting sample holding times and analyzing and assessing field duplicate samples. The sampling network is designed to provide data representative of facility conditions. During development of this network, consideration was given to past waste disposal practices, existing analytical data, physical setting and processes. The rationale of the sampling network is discussed in detail in the Field Sampling Plan (FSP).

3.5 Comparability

3.5.1 Definition

Comparability is an expression of the confidence with which one data set can be compared with another. Comparability is also dependent on similar QA objectives.

3.5.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by following the FSP and using proper sampling techniques.

3.5.3 Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented in the QAPP. Comparability is also dependent on similar QA objectives.

3.6 Level of Quality Control Effort

Trip blank, method blank, duplicate, standard reference materials (SRM) and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

Trip blanks consisting of distilled water, will be submitted to the analytical laboratories to provide means to assess the quality of the data resulting from the field sampling program. Trip blanks are used to asses the potential for contamination of samples due to contaminant migration during sample shipment and storage. Trip blanks generally pertain to volatile organic samples only. Trip blanks are prepared prior to the sampling event in the actual sample containers and are kept with the investigative samples throughout the sampling event. They are then packaged for shipment with other samples and sent for analysis. There should be one trip blank included in each sample shipping container. At no time after their preparation are the sample containers opened before they reach the laboratory.

Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures. Duplicate samples are analyzed to check for sampling and analytical reproductibility. Matrix spikes provide information about the effect of the sample matrix on the digestion and measurement methodology. Matrix spikes are performed in duplicate and are hereinafter referred to as MS/MSD samples. One MS/MSD is prepared for every 20 or fewer investigative samples. MS/MSD samples are designated/collected for organic analyses only.

MS/MSD samples are investigative samples. Soil MS/MSD samples require no extra volume for VOCs or extractable organics. One MS/MSD sample will be prepared for every 20 or fewer investigative samples per sample matrix.

The general level of the QC effort will be one field duplicate for every 10 or fewer investigative samples. One volatile organic analysis (VOA) trip blank consisting of distilled deionized ultra pure water will be included along with each shipment of VOA samples.

The number of duplicate and field blank samples to be collected are listed in Table 1-7. Sampling procedures are specified in the Field Sampling Plan.

TABLE 3-1

TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)
VOLATILES

	Compound	CAS Number	Water ug/L	Low Soil ug/Kg	Med. Soil ug/Kg	On Column (ng)
1.	Chloromethane	74-87-3	10	10	1200	(50)
2.	Bromomethane	74-83-9	10	10	1200	(50)
3.	Vinyl Chloride	75-01-4	10	10	1200	(50)
4.	Chloroethane	75-00-3	10	10	1200	(50)
5.	Methylene Chloride	75-09-2	10	10	1200	(50)
6.	Acetone	67-64-1	10	10	1200	(50)
7.	Carbon Disulfide	75-15-0	10	10	1200	(50)
8.	1,1-Dichloroethene	75-35-4	10	10	1200	(50)
9.	1,1-Dichloroethane	75-34-3	10	10	1200	(50)
10.	1,2-Dichloroethene(total)	540-59-0	10	10	1200	(50)
11.	Chloroform	67-66-3	10	10	1200	(50)
12.	1,2-Dichloroethane	107-06-2	10	10	1200	(50)
13.	2-Butanone	78-93-3	10	10	1200	(50)
14.	1,1,1-Trichloroethane	71-55-6	10	10	1200	(50)
15.	Carbon Tetrachloride	56-23-5	10	10	1200	(50)
16.	Bromodichloromethane	75-27-4	10	10	1200	(50)
17.	1,2-Dichloropropane	78-87-5	10	10	1200	(50)
18.	cis-1,3-Dichloropropene	10061-01-5	10	10	1200	(50)
19.	Trichloroethene	79-01-6	10	10	1200	(50)
20.	Dibromochloromethane	124-48-1	10	10	1200	(50)
21.	1,1,2-Trichloroethane	79-00-5	10	10	1200	(50)
22.	Benzene	71-43-2	10	10	1200	(50)
23.	trans-1,3-Dichloropropene	10061-02-6	10	10	1200	(50)
24.	Bromoform	75-25-2	10	10	1200	(50)
25.	4-Methyl-2-pentanone	108-10-1	10	10	1200	(50)

TABLE 3-1

TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL) VOLATILES

Compound	CAS Number	Water ug/L	Low Soil ug/Kg	Med. Soil ug/Kg	On Column (ng)
26. 2-Hexanone	591-78-6	10	10	1200	(50)
27. Tetrachloroethene	127-18-4	10	10	1200	(50)
28. Toluene	108-88-3	10	10	1200	(50)
29. 1,1,2,2-Tetrachloroethane	79-34-5	10	10	1200	(50)
30. Chlorobenzene	108-90-7	10	10	1200	(50)
31. Ethyl benezene	100-41-4	10	10	1200	(50)
32. Styrene	100-42-5	10	10	1200	(50)
33. Xylenes (total)	1330-20-7	10	10	1200	(50)

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

TABLE 3-2

TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL) SEMI-VOLATILES

	Compound	CAS Number	Quantitation Limits * Water ug/L	Low Soil ug/Kg	Med. Soil ug/Kg	On Column (ng)
34.	Phenol	108-95-2	10	330	10000	(20)
35.	bis(2-Chloroethyl) ether	111-44-4	10	330	10000	(20)
36.	2-Chlorophenol	95-57-8	10	330	10000	(20)
37.	1,3-Dichlorobenzene	541-73-1	10	330	10000	(20)
38.	1,4-Dichlorobenzene	106-46-7	10	330	10000	(20)
39.	1,2-Dichlorobenzene	95-50-1	10	330	10000	(20)
40.	2-Methylphenol	95-48-7	10	330	10000	(20)
41.	2,2-oxybis-(1-Chlororpropane)**	108-60-1	10	330	10000	(20)
42.	4-Methylphenol	106-44-5	10	330	10000	(20)
43.	N-Nitroso-di-n-dipropylamine	621-64-7	10	330	10000	(20)
44.	Hexachloroethane	67-72-1	10	330	10000	(20)
45.	Nitrobenzene	98-95-3	10	330	10000	(20)
46.	Isophorone	78-59-1	10	330	10000	(20)
47.	2-Nitrophenol	88-75-5	10	330	10000	(20)
48.	2,4-Dimethylphenol	105-67-9	10	330	10000	(20)
49.	bis(2-Chloroethoxy) methane	111-91-1	10	330	10000	(20)
50.	2,4-Dichlorophenol	120-83-2	10	330	10000	(20)
51.	1,2,4-Trichlorobenzene	120-82-1	10	330	10000	(20)
52.	Naphthalene	91-20-3	10	330	10000	(20)
53.	4-Chloroaniline	106-47-8	10	330	10000	(20)

TABLE 3-2

TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL) VOLATILES

	Compound	CAS Number	Quantitation Limits * Water ug/L	Low Soil ug/Kg	Med. Soil ug/Kg	On Column (ng)
54.	Hexachlorobutadiene	87-68-3	10	330	10000	(20)
55.	4-Chloro-3-methylphenol	59-50-7	10	330	10000	(20)
56.	2-Methylnaphthalene	91-57-6	10	330	10000	(20)
57.	Hexachlorocyclo pentadiene	77-47-4	10	330	10000	(20)
58.	2,4,6-Trichlorophenol	88-06-2	10	330	10000	(20)
59.	2,4,5-Trichlorophenol	95-95-4	25	830	25000	(50)
60.	2-Chloronaphthalene	91-58-7	10	330	10000	(20)
61.	2-Nitroaniline	88-74-4	25	830	25000	(50)
62.	Dimethylphthalate	131-11-3	10	330	10000	(20)
63.	Acenaphthylene	208-96-8	10	330	10000	(20)
64.	2,6-Dinitrotoluene	606-20-2	10	330	10000	(20)
65.	3-Nitroaniline	99-09-2	25	830	25000	(50)
66.	Acenaphthene	83-32-9	10	330	10000	(20)
67.	2,4-Dinitrophenol	51-28-5	25	830	25000	(50)
68.	4-Nitrophenol	100-02-7	25	830	25000	(50)
69.	Dibenzofuran	132-64-9	10	330	10000	(20)
70.	2,4-Dinitrotoluene	121-14-2	10	330	10000	(20)
71.	Diethylphthalate	84-66-2	10	330	10000	(20)
72.	4-Chlorophenyl-phenyl ether	7005-72-3	10	330	10000	(20)
73.	Fluorene	86-73-7	10	330	10000	(20)
74.	4-Nitroaniline	100-01-6	25	830	25000	(50)

TABLE 3-2

TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)
VOLATILES
Page 3 of 4

			Quantitation Limits *			
	Compound	CAS Number	Water ug/L	Low Soil ug/Kg	Med. Soil ug/Kg	On Column (ng)
75.	4,6-Dinitro-2-methylphenol	534-52-1	25	830	25000	(50)
76.	N-Nitrosodiphenylamine	86-30-6	10	330	10000	(20)
77.	4-Bromophenyl-phenyl ether	101-55-3	10	330	10000	(20)
78.	Hexachlorobenzene	118-74-1	10	330	10000	(20)
79.	Pentachlorophenol	87-86-5	25	830	25000	(50)
80.	Phenanthrene	85-01-8	10	330	10000	(20)
81.	Anthracene	120-12-7	10	330	10000	(20)
82.	Carbazole	86-74-8	10	330	10000	(20)
83.	Di-n-butylphthalate	86-74-2	10	330	10000	(20)
84.	Fluoranthene	206-44-0	10	330	10000	(20)
85.	Pyrene	129-00-0	10	330	10000	(20)
86.	Butylbenzylphthalate	85-68-7	10	330	10000	(20)
87.	3,3-Dichlorobenzidine	91-94-1	10	330	10000	(20)
88.	Benzo(a)anthracene	56-55-3	10	330	10000	(20)
89.	Chrysene	210-81-9	10	330	10000	(20)
90.	bis(2-Ethylhexyl) phthalate	117-81-7	10	330	10000	(20)
91.	Di-n-Octylphthalate	117-84-0	10	330	10000	(20)
92.	Benzo(b)fluoranthene	205-99-2	10	330	10000	(20)
93.	Benzo(k)fluoranthene	207-08-9	10	330	10000	(20)

TABLE 3-2

TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL)
VOLATILES
Page 4 of 4

			Quantitation Limits *			
	Compound	CAS Number	Water ug/L	Low Soil ug/Kg	Med. Soil ug/Kg	On Column (ng)
94.	Benzo(a)pyrene	50-32-8	10	330	10000	(20)
95.	Indeno(1,2,3-cd) pyrene	193-39-5	10	330	10000	(20)
96.	Dibenzo(a,h) anthracene	53-70-3	10	330	10000	(20)
97.	Benzo(g,h,i)perylene	191-24-2	10	330	10000	(20)

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

** Previously known by the name of bis(2-chlorousipropyl) ether.

TABLE 3-3

TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL) PESTICIDES, CHLORINATED HERBICIDES, AND PCBs

		Quantitation Limits *		
Compound	CAS Number	Water ug/L	Soil ug/Kg	On Column (ng)
98. alpha-BHC	319-84-6	0.05	1.7	5
99. beta-BHC	319-85-7	0.05	1.7	5
100. delta-BHC	319-86-8	0.05	1.7	5
101. gamma-BHC (Lindane)	58-89-9	0.05	1.7	5
102. Heptachlor	76-44-8	0.05	1.7	5
103. Aldrin	309-00-2	0.05	1.7	5
104. Heptachlor epoxide	1024-57-3	0.05	1.7	5
105. Endosulfan I	959-98-8	0.05	1.7	5
106. Dieldrin	60-57-1	0.10	3.3	10
107. 4,4 -DDE	72-55-9	0.10	3.3	10
108. Endrin	72-20-8	0.10	3.3	10
109. Endosulfan II	33213-65-9	0.10	3.3	10
110. 4,4 -DDD	72-54-8	0.10	3.3	10
111. Endosulfan sulfate	1031-07-8	0.10	3.3	10
112. 4,4 -DDT	50-29-3	0.10	3.3	10
113. Methoxychlor	72-43-5	0.50	17.0	50
114. Endrin ketone	53494-70-5	0.10	3.3	10
115. Endrin aldehyde	7421-36-3	0.10	3.3	10
116. alpha-chlordane	5103-71-9	0.05	1.7	5
117. gamma-chlordane	5103-74-2	0.05	1.7	5
118. Toxaphene	8001-35-2	5.0	170.0	500
119. Aroclor-1016	12674-11-2	1.0	33.0	100
120. Aroclor-1221	11104-28-2	1.0	67.0	200

TABLE 3-3

TARGET COMPOUND LIST (TCL) AND CONTRACT REQUIRED QUANTITATION LIMITS (CRQL) PESTICIDES, CHLORINATED HERBICIDES, AND PCBs

Compound	CAS Number	Quantitation Limits * Water ug/L	Soil ug/Kg	On Column (ng)
121. Aroclor-1232	11141-16-5	2.0	33.0	100
122. Aroclor-1242	53469-21-9	1.0	33.0	100
123. Aroclor-1248	12672-29-6	1.0	33.0	100
124. Aroclor-1254	11097-69-1	1.0	33.0	100
125. Aroclor-1260	11096-82-5	1.0	33.0	100
126. 2,4-D	94-75-7	0.063	1.24	**
127. 2,4-DB	94-82-6	0.058	1.17	**
128. 2,4,5-TP(silvex)	93-72-1	0.064	1.3	**
129. 2,4,5-T	93-76-5	0.068	1.26	**
130. Dalapon	75-99-0	0.066	1.25	**
131. Dicamba	1918-00-9	0.059	1.3	**
132. Dichlorprop	120-36-5	0.071	1.57	**
133. Dinoseb	88-85-7	0.059	1.36	**
134. MCPA	94-74-6	35.1	638	**
135. MCPP	93-65-2	33	674	**
136.Nitrophenol				
137.Pentachlorophenol				

* Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.
There is no differentiation between the preparation of low and medium soil samples in this method for the analysis of Pesticides/Aroclors.

** Refer to Method S.O.P. in Appendix B for organic herbicides.

TABLE 3-4

FIELD MEASUREMENT
PARAMETER LIST AND REQUIRED DETECTION LIMITS
Page 1 of 1

Parameter	Required Detection Limit
1. pH	0.01 units
2. Conductivity	10 umho/cm
3. Temperature	0.5°C
4. Water Levels	0.01 ft.
5. Lower Explosive Limit	0.1% of LEL
6. Volatile Organic Vapors	0.1 ppm isobutylene equivalent

TABLE 3-5

QA OBJECTIVES FOR FIELD MEASUREMENTS

Parameter	Method[1] Reference	Precision[2]	Accuracy[3]	Completeness
WATER				
Standing Water Levels	Keck Water Level Indicator (model KIR-89)	±0.01 ft.	0.005 ft.	95%
Temperature	E170., Mercury Thermometer or Electronic Temperature Probe	±0.5°C	1.0°C	95%
Conductivity	Corning Checkmate, Electrometric	±25	10 umho/cm[2]	95%
pH	Corning Checkmate, Electrometric	±0.1 pH units	0.05 pH units	95%
Dissolved Oxygen	Corning Checkmate, Electrometric	±0.05 mg/L	±0.1 mg/L	95%
SOIL				
VOCs	Photovac Microtip	±0.1 ppm	0.1 ppm	95%
Soil pH	SW-9045	±0.1 pH units	0.05 ph UNITS	95%

Source: Manufacturer's Specifications

TABLE 3-5

QA OBJECTIVES FOR FIELD MEASUREMENTS

Notes:

1. Methods: E - Method for Chemical Analysis for Water and Wastes (USEPA, 1983).
   SW - Test for the Evaluation of Solid Waste, SW-846, USEPA, September, 1986.
   SM - Standard Methods for Examination of the Water and Wastewater, 18th ed. (APHA, 1992).
   ASTM - Annual Book of ASTM Standards, American Society of Testing and Materials, 1995.
2. Expressed as the acceptable deviation from the Scale.
3. Expected based on equipment manufacturer specifications.

NPM - Not Part of Method.

TABLE 3-6

QA OBJECTIVES FOR LABORATORY PARAMETERS
Page 1 of 1

Matrix Spike Recovery and Relative Percent Difference Limits (RPD)				
Volatile Organic Compounds	%Recovery		%RPD	
	Water	Soil	Water	Soil
1,1-Dichloroethene	61-145	59-173	14	22
Trichloroethene	71-120	62-137	14	23
Benzene	76-127	66-142	11	21
Toluene	76-125	59-139	13	21
Chlorobenzene	75-130	60-133	13	21
Pesticides/PCBs				
y-BHC (Lindane)	56-123	46-127	15	50
Heptachlor	40-131	35-130	20	31
Aldrin	40-120	34-132	22	43
Dieldrin	52-126	31-134	18	38
Endrin	56-121	42-139	21	45
4,4[1]-DDT	38-127	23-134	27	50
Semi-volatile Organic Compounds				
Phenol	12-110	26-90	42	35
2-Chlorophenol	27-123	25-102	40	50
1,4-Dichlorobenzene	36-97	28-104	28	27
N-Nitroso-di-N-propylamine	41-116	41-126	38	38
1,2,4-Trichlorobenzene	39-98	38-107	28	23
4-Chloro-3-Methylphenol	23-97	26-103	42	33
Acenapthene	46-118	31-137	31	19
4-Nitrophenol	10-80	11-114	50	50
2,4-Dinitrotoluene	24-96	28-89	38	47
Pentachloropheneol	9-103	17-109	50	47
Pyrene	26-127	35-142	31	36

Source: U.S. EPA Region V Model QAPP

SECTION 4

SAMPLING PROCEDURES

SECTION 4

SAMPLING PROCEDURES

Sampling at this site will occur in two phases. The first phase will be during trenching and pipe removal activities. The second phase will be a subsurface investigation using direct push (soil probe) technology and drilling equipment.

The sampling procedures to be used throughout this site investigation will be consistent with the purpose of this project. The appended Field Sampling Plan outlines the sampling procedures to be employed during trenching activities. The subsurface investigation (RI/FS Work Plan) will be finalized to amend the FSP attached. It will include the procedures to be employed during the second phase of sampling

Refer to Appendix A, Field Sampling Plan for the following FSP:

1. Introduction

2. Summary of Sampling Activity.

3. Sampling Network Design and Rationale.

4. Sample Custody Procedure

   4.1 Sample Identification System.
   4.2 Initiation of Field Custody Procedure.
   4.3 Field Activity Documentation/Logbook.
   4.4 Sample Shipment and Transfer of Custody.

5. Sample Containers, Sample Preservation, and Maximum holding time.

6. Sample handling, Packaging and Shipment.

7. Decontamination Procedures.

8. Sampling Equipment and Procedures.

9. QC Sample Procedures.

10. Field Duplicate Sample Collection.

11. Trip Blank Sample Preparation.

12. Field Measurement/Screening.

13. Preventative Maintenance Procedure/Schedule.

14. Sample Disposal.

15. Storage and disposal of Investigative Derived Waste (IDW).

TABLE 4-1

SAMPLE CONTAINER, PRESERVATION AND HOLDING TIME REQUIREMENTS
Page 1 of 1

Matrix	Analysis	Container	Preservation	Holding Time
Soil/Sediment	Volatiles	4 oz. Wide-Mouth Glass Jars	Cool to 4°C No Headspace	14 Days
	Semivolatiles	1-32 oz. Glass Jar	Cool to 4°C	14 Days Until Extraction, 40 Days After Extraction
	Pest/PCBs/Herbicides	1-32 oz. Glass Jar	Cool to 4°C	14 Days Until Extraction, 40 Days After Extraction

A single wide-mouth glass jar with a teflon lid will be used to store samples for semi-volatiles, and pesticides/PCBs/Herbicides.

Source: U.S. EPA Region V Model QAPP

SECTION 5

CUSTODY PROCEDURES

SECTION 5

CUSTODY PROCEDURES

Custody is one of several factors which is necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts including field sample collection, laboratory analysis, and final files. Final files, including all originals of laboratory reports and purged files, will be maintained under document control in a secure area.

A sample or evidence file is in custody if:

- the item is in actual possession of a person; or
- the item is in the view of the person after being in actual possession of the person; or
- the item was in actual physical possession but is locked up to prevent tampering; or
- the item is in a designated and identified secure area.

5.1 Field Custody Procedures

Field logbooks will provide the means for recording data collection activities. As such, entries will be described in as much detail as possible so that persons going to the facility could reconstruct a particular situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel and identified by the project-specific document number.

The title page of each logbook will contain the following:

- Person to whom the logbook is assigned, along with address and phone numbers.
- Logbook number.

- Project name.
- Project start date.
- Project end date.

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

Measurements and sample information will be recorded. All entries will be made in ink, signed, and dated. No erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark which is signed and dated by the sampler. The number of the photographs taken will also be noted. All equipment used to make measurements will be identified, along with the date and results of calibration.

Samples will be collected following the sampling procedures documented in Appendix A of this QAPP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, depth at which the sample was collected, volume and number of containers. The specific identification number will be assigned prior to sample collection. Refer to Section 4.1 for the sample numbering system.

The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain-of-custody intact. Examples of field custody documents and instructions for completion are attached to this QAPP. The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

Refer to Attachment 1, Chain-of-Custody Example, Attachment II, Sample Tag Example, and Attachment III, Sample Label and Custody Seal Example.

All bottles will be identified by use of sample tags with sample numbers, sampling locations, date/time of collection, and type of analysis.

Sample tags will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was

used to fill out the sample tag because the ballpoint pen would not function in freezing weather.

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

Samples will be properly packaged on ice at 4°C for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be covered with clear plastic tape. The cooler will be strapped shut with strapping tape in at least two locations.

All shipments will be accompanied by the Chain-of-Custody Record identifying the contents. The original record will accompany the shipment, and the pink and yellow copies will be retained by the sampler.

Receipts of bills of lading will be retained as part of the permanent documentation. Commercial carriers are not required to sign the custody form as long as the custody forms are sealed inside the sample cooler and the custody seals remain intact.

Samples will be transported directly to the laboratory by the carrier.

5.2 Laboratory Custody Procedures

The chain-of-custody procedures for the Contract Laboratory Program (CLP) laboratory are described in the Statements of Work (SOWs) for Routine Analytical Services (RASs). These custody procedures, along with the holding time requirements for CLP samples, are described in the appropriate SOW (OLM03.1 for organics and ILM04.0 for inorganics).

5.3 Final Files

The final file will be the central repository for all documents which constitute documentation relevant to sampling and analysis activities as described in this QAPP. Beling Consultants is the custodian of the file and maintains the contents of files for the site, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports and data reviews in a secured, limited access area.

The final file will include at a minimum:

- field logbooks
- field data and data deliverables
- photographs
- drawings
- soil boring logs
- laboratory data deliverables
- data validation reports
- data assessment reports
- progress reports, QA reports, interim project reports, etc.
- all custody documentation (tags, forms, airbills, etc.)
- variance or deviation reports submitted by project personnel

SECTION 6

CALIBRATION PROCEDURES AND FREQUENCY

SECTION 6

CALIBRATION PROCEDURES AND FREQUENCY

This section describes the calibration procedures and the frequency at which these procedures will be performed for both field and laboratory instruments.

6.1 Field Instrument Calibration

The field instruments will be calibrated as described in field SOPs. Field instruments include a pH meter, Lower Explosive Limit meter (LEL), water level meter, conductivity meter, and organic vapor photoionization detector (PID). As a rule, instruments will be recalibrated daily prior to use. For specific instructions on the calibration frequency, the acceptance criteria and the conditions that will require more frequent recalibration, refer to the specific SOPs for each field analysis.

The linearity of the instrument will be checked by using a 2-point calibration with reference standards bracketing the expected measurement, or in accordance with manufacturer's recommendations. All the calibration procedures performed will be documented in the field logbook and will include the date/time of calibration, name of person performing the calibration, reference standard used, temperature at which readings were taken and the readings. Multiple readings on one sample or standard, as well as readings on replicate samples, will also be documented.

6.1.1 pH Meter Calibration

The pH meter will be calibrated with standard buffer solutions before being taken to the field. In the field, the meter will be calibrated daily with two buffer solutions before use. The range of the buffer solutions will be at least three or more pH units apart and will bracket the expected pH of the sample being measured. The calibration procedure includes the following:

- Ensure that the temperature of sample and buffer are the same.
- Connect pH electrode into pH meter and turn on pH meter.
- Set temperature based on the temperature of buffer, and place electrode in first buffer solution.

- After reading has stabilized, adjust "CALIB" knob to display correct value.
- Repeat procedure for second buffer solution.
- Place pH electrode in the sample and record the pH as displayed.
- Remove pH electrode from sample and rinse off with distilled water.
- Recalibrate the pH meter every time it is turned off and turned back on, or if it starts giving erratic results.

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

6.1.2 PID Meter

The MicroTIP PID meter must be calibrated in order to display concentration in units equivalent to ppm. First a supply of "Zero Gas" which contains no ionizable gases of vapors is used to set MicroTIP's zero point. Then, "Span Gas" containing a known concentration of an ionizable gas or vapor, is used to set the response factor.

Isobutylene at 100 ppm in air is recommended as Span Gas. To calibrate the instrument complete process as follows:

- Connect the supplied regulator to the Span Gas cylinder. Hand tighten the fittings.
- Open the valve on the gas bag by turning the valve stem fully counterclockwise.
- Attach the gas bag adapter nut to the regulator. Hand lighten the fittings.
- Turn the regulator knob counterclockwise about half a turn to start the flow of gas.
- Fill the gas bag about half full and then close the regulator fully clockwise to turn off the flow of gas.

- Disconnect the bag from the adapter and empty it. Flush the bag a few times with the Span Gas and then fill it.
- Close the gas bag by turning the valve clockwise.
- Press SETUP and select the desired Cal Memory with the arrow keys and press ENTER. Press EXIT to leave Setup.
- Press CAL and expose MicroTIP to Zero Gas. Press ENTER and MicroTIP sets its zero point.
- MicroTIP then asks for the Span Gas concentration. Enter the known Span Gas concentration and then connect the Span Gas bag adapter to the inlet.
- Press ENTER and MicroTIP sets its response factor.
- When MicroTIP's display reverts to normal, MicroTIP is calibrated and ready for use. Remove the Span Gas bag from the inlet.

6.1.3 Conductivity Meter Calibration

The conductivity cells of the specific conductivity meter will be cleaned and checked against known conductivity standards before being taken to the field. In the field, the instrument will be checked daily with National Bureau of Standards (NBS) traceable reference standards. The calibration procedure is described below.

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

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

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

All readings and calibrations will be recorded in the field notebook.

6.1.4 Lower Explosive Level Meter

The following calibration check will be performed before each day's use. The calibration procedure is described below:

- Attach the pump module or calibration cap to the Passport Alarm, orienting the inlet fitting to point toward the battery pack.

- Attach the calibration adapter to the calibration cap or pump module.

- Attach the regulator supplied with the calibration kit to the cylinder.

- Connect the black tubing supplied with the calibration kit to the regulator.

- Open the valve on the regulator, and connect the other end of the tubing to the inlet fitting.

Turn the unit's Alarm ON in clean fresh air, and verify that the readings indicate no gas present.

The flow rate of the regulator is 0.25 lpm. Note the readings on the unit's display; they should be within the limits stated on the calibration cylinder.

If the readings are not within these limits, the unit's Alarm requires recalibration by the manufacturer.

6.1.5 Water Level Meter

The water level meter will be calibrated prior to being taken into the field. The calibration procedure is described below.

Replace the battery when the audible signal and light become reduced in their intensity, as follows:

- While grasping the tape above the probe's top cap, lower the probe into the water until the unit is activated. Observe where the tip of the Adjustable Contact (4) is relative to the surface of the water when the unit is activated.

  The unit does not need calibration if the Adjustable Contact just touched the water surface when the unit was activated.

- If the unit needs calibration, loosen the nut on the Adjustable Contact shaft with the 11/32" open-end wrench.

- If the Adjustable Contact did not touch the water surface, screw the shaft out with the 5/64" hex wrench. Repeat step 1.

- If the Adjustable Contact went below the surface of the water, screw the shaft in with the 5/64" hex wrench. Repeat step 1.

- Once the unit is satisfactorily calibrated, tighten the nut on the Adjustable Contact shaft against the bottom of the probe body.

6.2 Laboratory Instrument Calibration

6.2.1 Calibration Procedures and Frequency for RAS and SAS Analysis

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

Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing quality control activities. These records will be filed at the location where the work is performed and will be subject to QA audit. For all instruments, the laboratory will maintain a factory-trained repair staff with in-house spare parts or will maintain service contracts with vendors.

The records of calibration will be kept as follows:

- Each instrument will have record of calibration permanently affixed with an assigned record number.

- A label will be affixed to each instrument showing description, manufacturer, model numbers, date of last calibration, by who calibrated (signature), and due date of next calibration reports and compensation or correction figures will be maintained with instrument.

- A written stepwise calibration procedure will be available for each piece of test and measurement equipment.

- Any instrument that is not calibrated to within the manufacturer's original specification will display a warning tag to alert that analyst that the device carrier only a "Limited Calibration".

6.2.2 Organic Analyses

Prior to calibration, the instrument(s) used for Gas Chromatograph/Mass Spectrometer (GC/MS) analyses are tuned by analysis of a p-bromofluorobenzene (BFB) for volatile analyses and decafluorotriphenyl phosphine (DFTPP) for semi-volatile analyses. Once the tuning criteria for these reference compounds are met, the instrument should be initially calibrated by using a five point calibration curve. The instrument tune will be verified each 12 hours of operation.

After the tuning criteria are met, the instrument is initially calibrated using a five point calibration curve. Continuing calibration is verified as specified in the method, or at least each working day, using criteria specified by the method. The calibration standards will be NBS-traceable and are spiked with internal standards and surrogate compounds. Whereas, calibration and continuing calibration verification of instruments will be performed at approved intervals as specified by the manufacturer or the analytical method (whichever is more frequent). Calibration standards used as reference standards will be traceable to the NBS.

SECTION 7

ANALYTICAL PROCEDURES

SECTION 7

ANALYTICAL PROCEDURES

Soil samples collected will be analyzed by ARDL, Inc., P.O. Box 1566, Mt. Vernon Airport Road, Route 15 East, Mt. Vernon, Illinois 62864, (618) 244-3235.

7.1 Field Analytical Procedures

The standardization and QA information for field measurements of pH, specific conductivity, and temperature are described in Section 3 of this QAPP. A copy of the Field Sampling Plan has been submitted with the QAPP as Appendix A to expedite review and approval of these methods.

7.2 Routine Analytical Services Laboratory Procedures (RAS)

All samples for VOAs and semi-volatiles will be analyzed according to analytical procedures set forth in the USEPA CLP RAS SOW (OLM03.1) for organics analysis.

7.3 Special Analytical Services Laboratory Procedures (SAS)

The analytical procedures to be used for performing the SAS analyses are described in the SAS requests attached to this QAPP as Appendix B for organic herbicides. The SAS requests specified calibration procedures, frequency of calibration, and the internal quality control checks required for each analysis.

SECTION 8

INTERNAL QUALITY CONTROL CHECKS

SECTION 8

INTERNAL QUALITY CONTROL CHECKS

8.1 Field Quality Control Checks

The QC information for field equipment is stated in section 3.0 of this QAPP. Assessment of field sampling precision and bias will be made by collecting field duplicates for laboratory analysis. Collection of the samples will be in accordance with the applicable procedures in section 8.0 of the Field Sampling Plan (FSP) at the frequency indicated on Table 1-7.

8.2 Laboratory Quality Control Checks

8.2.1 RAS Internal Quality Control Checks

Internal quality control procedures for RAS from the CLP are specified in the Statement of Works (SOWs) for organics and inorganics, or in the method description of SOPs in Appendix B. These specifications include the types of QC checks required (method blanks, reagent/preparation blanks, matrix spike and matrix spike duplicates, calibration standards, internal standards, surrogate standards, the frequency of each audit, the specific calibration check standards, laboratory duplicate/replicate analysis), compounds and concentrations to be used, and the quality control acceptance criteria for these audits.

8.2.2 SAS Internal Quality Control Checks

Quality control checks for SAS are identified in the QC requirements Section of the SAS requests in Appendix B.

All data obtained will be properly recorded. The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria. Any samples analyzed in nonconformance with the QC criteria will be reanalyzed by the laboratory, if sufficient volume is available. It is expected that sufficient volumes/weights of samples will be collected to allow for reanalysis when necessary.

SECTION 9

DATA REDUCTION, VALIDATION, AND REPORTING

SECTION 9

DATA REDUCTION, VALIDATION, AND REPORTING

All data generated through field activities, or by laboratory operations will be reduced and validated prior to reporting. No data will be disseminated by the laboratory until it has been subjected to the procedures which are summarized below.

9.1 Data Reduction

9.1.1 Field Data Reduction Procedures

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory setting. Only direct read instrumentation will be employed in the field. The use of pH meters, a PID, and a probe to measure specific conductance will generate measurements directly read from the meters following calibration per manufacturer's recommendations as outlined in section 6 of this QAPP. Such data will be written into field log books immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed and dated by the field team member, and corrected in a space adjacent to the original (erroneous) entry. Later, when the results forms required for this study are being filled out, the Field Operations Coordinator, identified in Section 2 of this QAPP, will proof the forms to determine whether any transcription errors have been made by the field crew.

Field instrumentation such as a mobile gas chromatograph will be used. Refer to Appendix C for mobile laboratory SOPs.

9.1.2 Laboratory Data Reduction Procedures

All samples collected at the FFTU will be sent to a laboratory. Data reduction, evaluation, and reporting for samples analyzed by the CLP performed according to specifications outlined in the CLP RAS SOW (OLM03.1) or the most current revision for the organics.

Data resulting form SAS request will be reduced, evaluated and reported as described In Appendix B.

For this project, the equations that will be employed in reducing data are those specified in the CLP SOW/ILM04.0. All calculations are checked by the Organic Section supervisor at the conclusion of each operating day. Errors will be noted, corrections will be made, but the original notations will be crossed out legibly. Analytical results for soil samples will be calculated and reported on a dry weight basis.

Quality control data (e.g., laboratory duplicates, surrogates, matrix spikes, and matrix spike duplicates) will be compared to the method acceptance criteria. Data considered to be acceptable will be entered into the laboratory computer system. Data summaries will be sent to the Laboratory QA Manager for review. If approved, data are logged into the project database format. Unacceptable data will be appropriately qualified in the project report. Case narratives will be prepared which will include information concerning data that fell outside acceptance limits, and any other anomalous conditions encountered during sample analysis. After the Lab QA Manager approved these data, they are considered ready for third party data validation.

9.2 Data Validation

Data validation procedures shall be performed for both field and laboratory operations as described below.

9.2.1 Procedures Used to Evaluate Field Data

Procedures to evaluate field data for this project primarily include checking for transcription errors and review of field log books, on the part of field crew members. This task will be the responsibility of the Quality Assurance Manager, who will otherwise not participate in making any of the field measurements, or in adding notes, data or other information to the log book.

9.2.2 Procedures Used to Validate Laboratory Data

USEPA Contract Laboratory Program National Functional Guidelines for Organic and Inorganic Data Review, February, 1994, procedures will be followed to validate laboratory data.

Assessment will be accomplished by the joint efforts of the Data Reviewer and Project Manager. The data assessment by the Project Manager will be based on

the criteria that the sample was properly collected and handled according to the Field Sampling Plan and Section 5 of this QAPP.

The Data Reviewer will conduct a systematic review of the data for compliance with the established QC criteria based on the spike, duplicate and blank results provided by the laboratory. Essentially, all technical holding times will be reviewed, the GC/MS instrument performance check sample results will be evaluated, results of initial and continuing calibration will be reviewed and evaluated by trained reviewers independent of the laboratory. Also, results of all blanks, surrogate spikes, matrix spikes/matrix spike duplicates, laboratory control samples, internal standards, target compound identification and quantitation, tentatively identified compounds, system performance checks will be performed for volatile organic compounds by the Data Validator. One hundred percent of the data shall be validated.

The Data Reviewer will identify any out-of-control data points and data omissions and interact with the laboratory to correct data deficiencies. Decisions to repeat sample collection and analyses will be made by the Project Manager based on the extent of the deficiencies and their importance in the overall context of the project.

All data generated for the FFTU will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include the data flags provided by ARDL, Inc. [in accordance with the Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses (February, 1994) and Inorganic Analyses (February, 1994), as well as additional comments of the Data Reviewer.] The laboratory-provided data flags will include such items as: 1) concentration below required detection limit, 2) estimated concentration due to poor spike recovery, and 3) concentration of chemical also found in laboratory bank. The Data Reviewer comments will indicate that the data are: 1) usable as a quantitative concentration, 2) usable with caution as an estimated concentration, or 3) unusable due to out-of-control QC results.

All CLP forms summarizing this information will be checked as well. The overall completeness of the data package will also be evaluated by the Data Validator. Completeness checks will be administered on all data to determine whether deliverables specified in the Workplan and QAPP are present. At a minimum, deliverables will include sample chain-of-custody forms, analytical results, QC summaries, and supporting raw data from instrument printouts. The reviewer will

determine whether all required items are present and request copies of missing deliverables.

9.3 Data Reporting

Data reporting procedures shall be carried out for field and laboratory operations as indicated below:

9.3.1 Field Data Reporting

Field data reporting shall be conducted principally through the transmission of report sheets containing tabulated results of all measurements made in the field, and documentation of all field calibration activities.

9.3.2 Laboratory Data Reporting

The task of reporting laboratory data begins after the validation activity has been concluded. The Laboratory QA Manager must perform a final review of the report summaries and case narratives to determine whether the report meets project requirements. In addition to the record of chain-of-custody, the report format shall consist of the following:

9.3.2.1 Case Narrative

- Date of issuance.
- Laboratory analysis performed.
- Any deviations from intended analytical strategy.
- Laboratory batch number.
- Numbers of samples and respective matrices.
- Quality control procedures utilized and also references to the acceptance criteria.
- Laboratory report contents.
- Project name and number.
- Condition of samples as received.
- Discussion of whether or not sample holding times were met.

- Discussion of technical problems or other observations which may have created analytical difficulties.
- Discussion of any laboratory quality control checks which failed to meet project criteria.
- Signature of the Laboratory QA Manager.

9.3.2.2 Chemistry Data Package

- Case narrative for each analyzed batch of samples.
- Summary page indicating dates of analyses for samples and laboratory quality control checks.
- Cross referencing of laboratory samples to project sample identification numbers.
- Data qualifiers to be used should be adequately described.
- Sample preparation and analyses for samples.
- Sample results.
- Raw data for sample results and laboratory quality control samples.
- Results of dated initial and continuing calibration checks, and GC/MS tuning results.
- Matrix spike and matrix spike duplicate recoveries, laboratory control samples, method blank results, calibration check compounds, and system performance check compound results.
- Labeled and dated chromatograms/spectra of sample results and laboratory quality control checks.
- Results of tentatively identified compounds.
- Quality control procedures utilized and also references to the acceptance criteria.

SECTION 10

PERFORMANCE AND SYSTEM AUDITS

SECTION 10

PERFORMANCE AND SYSTEM AUDITS

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

10.1 Field Performance and System Audits

10.1.1 Internal Field Audits

10.1.1.1 Internal Field Audit Responsibilities

Internal audits of field activities including sampling and field measurements will be conducted by the QA Manager.

10.1.1.2 Internal Field Audit Frequency

These audits will verify that all established procedures are being followed. Internal field audits will be conducted at least once at the beginning of the sample collection activities.

10.1.1.3 Internal Field Audit Procedures

The audits will include examination of field sampling records, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain-of-custody, etc. Follow up audits will be conducted to correct deficiencies, and to verify that QA procedures are maintained throughout the remediation. The audits will involve review of field measurement records, instrumentation calibration records, and sample documentation. The field audit checklist to be used for this project is submitted with this QAPP.

10.1.2 External Field Audits

10.1.2.1 External Field Audit Responsibilities

External field audits may be conducted by the U.S. Navy.

10.1.2.2 External Field Audit Frequency

External field audits may be conducted any time during the field operations. These audits may or may not be announced and are at the discretion of the U.S. Navy.

10.1.2.3 Overview of the External Field Audit Process

External field audits will be conducted according to the field activity information presented in the QAPP.

10.2 Laboratory Performance and Systems Audits

10.2.1 Internal Laboratory Audits

10.2.1.1 Internal Lab Audit Responsibilities

The internal laboratory audit will be conducted by the Laboratory Project Manager.

10.2.1.2 Internal Lab Audit Frequency

The internal lab system audits will be done on an annual basis while the internal lab performance audits will be conducted on a quarterly basis.

10.2.1.3 Internal Lab Audit Procedures

The internal lab system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation and analysis, and instrument operating records. The performance audits will involve preparing blind QC samples and submitting them along with project samples to the laboratory for analysis throughout the project. The Laboratory Project Manager will evaluate the analytical

results of these blind performance samples to ensure the laboratory maintains acceptable QC performance.

10.2.2 External Laboratory Audits

10.2.2.1 External Lab Audit Responsibilities

An external audit may be conducted by U.S. Navy.

10.2.2.2 External Lab Audit Frequency

An external lab audit may be conducted at least once prior to the initiation of the sampling and analysis activities. These audits may or may not be announced and are at the discretion of the U.S. Navy.

10.2.1.3 Overview of the External Lab Audit Process

External lab audits will include (but not be limited to) review of laboratory analytical procedures, laboratory on-site audits, and/or submission of performance evaluation samples to the laboratory for analysis.

SECTION 11

PREVENTATIVE MAINTENANCE

SECTION 11

PREVENTATIVE MAINTENANCE

11.1 Field Instrument Preventative Maintenance

The field equipment for this project includes pH meter, water level meter, PID, LEL meter, and conductivity meter. Specific preventative maintenance procedures to be followed for field equipment are those recommended by the manufacturer. Field instruments will be checked and calibrated daily before use. Calibration checks will be documented on the Field Meter/calibration log sheets. The maintenance schedule and troubleshooting procedures for field instruments are indicated on Table 11-2. Critical spare parts such as tape, pH probes, and batteries will be kept on-site to reduce downtime. Backup instruments and equipment will be available on-site or within 1 day shipment to avoid delays in the field schedule.

11.2 Laboratory Instrument Preventative Maintenance

As part of their QA/QC Program, a routine preventative maintenance program is conducted by ARDL, Inc. to minimize the occurrence of instrument failure and other system malfunctions. ARDL, Inc. has an internal group to perform routine scheduled maintenance, and to repair of all instruments. All laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument service logbook for each instrument. Emergency repair or scheduled manufacturer's maintenance is provided under a repair and maintenance contract with factory representatives.

Table 11-1 provides an example of preventive maintenance for laboratory equipment.

TABLE 11-1

PREVENTATIVE MAINTENANCE FOR ANALYTICAL INSTRUMENTS
Page 1 of 2

Instrument	Activity	Frequency
Gas Chromatograph/ Mass Spectrometer	Change septum	Monthly/as needed
	Check Carrier gas	Daily
	Change carrier gas	When pressure reaches 100 psi
	Change gas filters	Semi-annually/as needed
	Change trap on Tekmar	As needed/poor sensitivity
	Change GC column	As needed/poor sensitivity
	Clean MS source	As needed/poor sensitivity
	Check pump of leaks	Monthly
	Leak check septum	As needed/when leak suspected
	Check gas flow	As needed
	Clean VOA purge glassware	As needed
	Cut capillary column	As needed
	Replace liner	As needed/contamination susp.
	Replace BNA seal	As needed/contamination susp.
TOC	Replace water in IC chamber	Weekly
	Clean IC chamber	As needed
	Clean underside of IC inlet valve	As needed
	Check combustion tube	Daily
	Replace quartz wool in comb. tube	
	Check TC inlet valve	As needed
	Clean TC inlet valve	Daily
	Refill acid bottle	As needed When 2/3 empty
GPC	Change seals and oil motor on positive	Every 150-200 hours of use
	Repack column	When column flow is restricted or operating pressure increases
	Check system pressure	Check daily when operating
	Replace mesh at column	Replace if torn or wrinkled
	Check calibration, pressure and solvent flow	Check weekly
Atomic Absorption Furnace	Clean furnace windows	Daily
	Check plumbing connections	Daily
	Change graphite tube	As needed
	Check gases	Daily
	Check autosampler and tubing	Daily

Source: Manufacturer's Specifications

TABLE 11-1

PREVENTATIVE MAINTENANCE FOR ANALYTICAL INSTRUMENTS
Page 2 of 2

Instrument	Activity	Frequency
ICAP	Clean filters	Monthly
	Check gas flow	Daily
	Change tubing	Weekly
	Clean nebulizer	As needed
	Check autosampler and tubing	Daily
Gas Chromatograph-Volatiles	Check hall propanol flow	Daily
	Check hall furnace temp.	Daily
	Check PID sensitivity	Daily
	Change lamp	As needed
	Rinse purge devices	Daily
	Bake purge devices	Daily
	Check carrier gases	Daily
	Change carrier gases	As needed
	Check column flows	Daily
	Check for gas leaks	At each column change
	Replenish electrolytic conductivity detector solvents	As needed
	Clean transfer lines	As needed
Gas Chromatograph-Semi-volatiles	Change septum	Every 100 shots or as needed
	Check carrier gas	Daily
	Change carrier gas	When pressure reaches 250 psi
	Change in-line filters	Every 6 mos. or as needed
	Remove first foot of capillary column	As needed
	Clean ECD	As needed
	Clean Nitrogen-Phosphorous Detector	As needed
	Check system for gas leaks	At each column change
	Replace column	As needed
	Clean FID	As needed
	Replace capillary injection port liner	At column change or as needed
	Replace capillary injection port seal	At column change or as needed
	Measure gas flow	After changing column
	Check syringe	Daily
	Change syringe	As needed

TABLE 11-2

PREVENTATIVE MAINTENANCE FOR FIELD INSTRUMENTS
Page 1 of 1

Instruments	Maintenance Procedures/Schedule	Spare Parts in Stock
Photovac MicroTIP Photoionization Detector (PID)	1. Calibrate beginning and end of each day and as necessary during use. 2. Check battery, and recharge when low. 3. Clean lamp window every 24 hours of operation. 4. Replace dust filter every 240 hours of operation. 5. Replace sample pump every 5000 hours of operation.	1. Battery charger. 2. Spare lamps. 3. Spare filter cartridges.
Water Level Meter	1. Calibrate beginning and end of each day, and as necessary during use. 2. Check battery, and recharge when low. 3. Clean probe after every use.	1. Batteries.
pH Meter	1. Calibrate beginning and end of each day, and as necessary during use. 2. Replace electrodes as needed.	1. pH buffers. 2. Batteries. 3. Spare electrodes.
Conductivity Meter	1. Calibrate beginning and end of each day, and as necessary during use. 2. Check redline and replace batteries if does not calibrate.	1. Conductivity standard. 2. Batteries.
LEL Meter	1. Calibrate beginning and end of each day, and as necessary during use. 2. Check battery, and recharge when low.	1. Batteries.

Source: Manufacturer's Specifications

SECTION 12

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

SECTION 12

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

12.1 Accuracy Assessment

In order to assure the accuracy of the analytical procedures, an environmental sample will be randomly selected from each sample shipment received at the laboratory, and spiked with a known amount of the analyte or analytes to be evaluated. In general, a sample spike will be included in every set of 20 samples tested on each instrument. The spike sample will be then analyzed. The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample determines the percent recovery. Daily control charts will be plotted for each commonly analyzed compound and kept on instrument - specific, matrix - specific, and analyte - specific bases. The percent recovery for a spiked sample is calculated according to the following formula:

$$\%R = \frac{\text{Amount in Spiked Sample} - \text{Amount in Sample}}{\text{Known Amount Added}} \times 100$$

12.2 Precision Assessment

Spiked samples are prepared by choosing a sample at random from each sample shipment received at the laboratory, dividing the sample into equal aliquots, and then spiking each of the aliquots with a known amount of analyte. The duplicate samples will be then included in the analytical sample set. The splitting of the sample allows the analyst to determine the precision of the preparation and analytical techniques associated with the duplicate sample. The relative percent difference (RPD) between the spike and duplicate spike will be calculated and plotted. The RPD is calculated according to the following formula:

$$RDP = \frac{\text{Amount in Spike 1} - \text{Amount in Spike 2}}{0.5\,(\text{Amount in Spike 1} + \text{Amount in Spike 2})} \times 100$$

12.3 Completeness Assessment

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{Completeness} = \frac{\text{(number of valid measurements)}}{\text{(number of measurements planned)}} \times 100$$

SECTION 13

CORRECTIVE ACTION

SECTION 13

CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or out of quality control performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation and data assessment. All corrective action proposed and implemented will be documented in the regular quality assurance reports to management. Corrective action should only be implemented after approval by the project manager, or his designee, the field operations manager. If immediate corrective action is required, approvals secured by telephone from the project manager should be documented in an additional memorandum.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem will be responsible for notifying the project manager, who in turn will notify the U.S. Navy Project Manager. Implementation of corrective action will be confirmed in writing through the same channels.

Any nonconformance with the established quality control procedures in the QAPP or Field Sampling Plan will be identified and corrected in accordance with the QAPP. The U.S. Navy Project Manager, or his designees, will issue a nonconformance report for each nonconformance condition.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels.

13.1 Field Corrective Action

Corrective action in the field can be needed when the sample network is changed (i.e., more/less samples, sampling locations other than those specified in the QAPP, etc.), sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the Field Operations Coordinator or designee. This manager will be responsible for assessing the suspected

problems in consultation with the QA Manager on making a decision based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable nonconformance requiring corrective action, then a nonconformance report will be initiated by the manager.

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

- evaluating all reported nonconformances.
- controlling additional work on nonconforming items.
- determining disposition or action to be taken.
- maintaining a log of nonconformances.
- reviewing nonconformance reports and corrective actions taken.
- ensuring nonconformance reports and corrective actions taken.

If appropriate, the Field Operations Coordinator will ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed. Corrective action for field measurements may include:

- Repeating the measurement to check the error.
- Checking for all proper adjustments for ambient conditions such as temperature.
- Checking the batteries.
- Re-calibration.
- Checking the calibration.
- Replacing the instrument or measurement devices.
- Stopping work if necessary.

The Field Operations Coordinator or his designee is responsible for site activities. In this role, the RI Coordinator at times is required to adjust the site programs to accommodate site specific needs. When it becomes necessary to modify a program, the responsible person notifies the Field Operations Coordinator of the anticipated change and implements the necessary changes after obtaining the approval of the Field Operations Coordinator.

The Field Operations Coordinator for the FFTU is responsible for the controlling, tracking, and implementation of the identified changes. Reports on all changes will be distributed to all affected parties. The U.S. Navy will be notified whenever program changes in the field are made.

Corrective action resulting from internal field audits will be implemented immediately. The Quality Assurance Manager will identify deficiencies and recommended corrective action to the Project Manager. Implementation of corrective actions will be performed by the Field Operations Manager and field team. Corrective action will be documented in quality assurance reports.

Corrective actions will be implemented and documented in the field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels.

13.2 Laboratory Corrective Action

Corrective action in the laboratory may occur prior to, during and after initial analyses. A number of conditions such as broken sample containers, multiple phases, low/high pH readings, potentially high concentration samples may be identified during sample log-in or just prior to analysis. Following consultation with lab analysts and section leaders, it may be necessary for the laboratory Quality Control Coordinator to approve the implementation of corrective action. The submitted standard operating procedures (SOPs) specify some conditions during or after analysis that may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract cleanup, automatic reinjection, or reanalysis when quality control criteria are not met. A summary of method-specific corrective actions are found in this QAPP.

For the CLP Routine Analytical Services (RASs), corrective action is implemented at several different levels. The laboratories participating in the CLP are required to have a written SOP specifying corrective action to be taken when an analytical error is discovered

or the analytical system is determined to be out of control. The SOP requires documentation of the corrective action and notification by the analyst about the errors and corrective procedures. Corrective action may include:

- Re-analyzing the samples, if holding time criteria permits;
- Resampling and analyzing, and/or;
- Evaluating and amending sampling procedures, and/or;
- Evaluating and amending analytical procedures, and/or;
- Accepting data and acknowledging the level of uncertainty.

If resampling is deemed necessary due to laboratory problems, the Facility Manager must identify the necessary approach including cost recovery from the laboratory for the additional sampling effort.

13.3 Corrective Action During Data Validation and Data Assessment

Potential types of corrective action during either the data validation or data assessment may include resampling by the field team or reinjection, reanalysis of samples by the laboratory.

These actions are dependent upon the ability to mobilize the field team, whether the data to be collected is necessary to meet the required quality assurance objectives (e.g., the holding time for samples is not exceeded). When the data assessor identifies a corrective action situation, the Project Manager will be responsible for approving the implementation of corrective action, including resampling, during data assessment. All corrective actions of this type will be documented by the QA Manager.

SECTION 14

QUALITY ASSURANCE REPORTS TO MANAGEMENT

SECTION 14

QUALITY ASSURANCE REPORTS TO MANAGEMENT

The deliverable associated with the tasks identified in the Workplan and monthly progress reports will contain separate QA sections in which data quality information collected during the task is summarized. Those reports will be the responsibility of the Project Manager and will include the Quality Assurance Manager report on the accuracy, precision, and completeness of the data as well as the results of the performance and system audits, and any corrective action needed or taken during the project.

14.1 Contents of Project QA Reports

The QA reports will contain on a routine basis results of field and laboratory audits, information generated during the past month reflecting on the achievement of specific data quality objectives, a summary of corrective action that was implemented, and its immediate results on the project. The status of the project with respect to the Project Schedule included in the QAPP will be determined. Whenever necessary, updates on training provided, changes in key personnel, anticipated problems in the field or lab for the coming month that could bear on data quality along with proposed solutions, will be reported. Detailed references to QAPP modifications will also be highlighted. QA reports will be prepared in written, final format by the Project Manager. In the even of an emergency, or in case it is essential to implement corrective action immediately, QA reports can be made by telephone to the appropriate individuals, as identified in the Project Organization or Corrective Action sections of this QAPP. However, these events and their resolution will be addressed thoroughly in the following monthly QA report.

14.2 Frequency of QA Reports

The QA reports will be prepared on a monthly basis, and will be delivered to all recipients by the end of the first full week of the month. The reports will continue without interruption, until the project has been completed. The frequency of any emergency reports that must be delivered verbally cannot be estimated at the present time.

14.3 Individuals Receiving/Reviewing QA Reports

All individuals identified in the Project Organization chart will receive copies of the monthly QA report.

APPENDIX A

FIELD SAMPLING PLAN

APPENDIX A

FIELD SAMPLING PLAN FOR REMEDIAL INVESTIGATION ACTIVITIES NAVAL TRAINING CENTER FFTU GREAT LAKES, ILLINOIS

1.0 Introduction

This Field Sampling Plan is incorporated by reference into the Quality Assurance Project Plan (QAPP) and describes field sampling procedures to be used for sampling soil, groundwaters, and investigation derived wastes.

2.0 Summary of Sampling Activity

Sampling will occur in two steps. The first step will involve soil sampling during the trenching and excavation to remove underground piping and structures. The results of this step of investigation will be used to identify contaminant source areas. The constituents of concern relative to the contamination identified will also be refined. The second step of sampling will include a subsurface investigation to define the horizontal and vertical extent of soil and groundwater contamination identified during trenching and excavation. Wastes derived from the trenching and excavation, subsurface investigation, or on-site treatment will also be sampled for waste characterization analysis purposes.

2.1 Trenching and Excavating

An environmental contractor will expose the underground pipes and structures using a backhoe. Excavated soils will be placed on the side of the newly created trench. It is anticipated that the pipes are within 4 feet of the surface. The pipes will be cut in the trench into manageable sections and lifted out of the trench. The contractor will demolish catch basins using the back hoe and will excavate around the underground structures. After the sides of the underground structures are exposed, the structures will be demolished by the backhoe and removed from the excavation. Trenching and excavating is fully described in the Work Plan for Limited Demolition

and depicted in the Work Plan's Maps. Soil samples will be collected from the walls and floors of the pipe trenches and excavations. Soil samples collected will be submitted to a laboratory for analysis.

2.2 Direct-Push Subsurface Investigation

Following evaluation of the trenching and excavation sampling results, a subsurface investigation utilizing direct-push methods will be performed. Piezometers will be installed to allow measurement of static water levels to evaluate the direction of groundwater flow and gradients in the shallow groundwater system. Continuous soil cores will be collected to described the strata encountered as well as to obtain soil samples for field screening analysis and soil sample splits for laboratory analysis. Soil samples from the soil cores will be selected for field screening analysis based on sensory observation (staining, odor, etc.) and the presence of organic vapors as detected with a photoionization detector (PID). The field screening analysis will include on-site analysis of indicator organic constituents utilizing a gas chromatograph.

3.0 Sample Network and Rationale

3.1 Trenching and Excavation

Trenching will occur in known locations of underground pipes. A total of 175 soil samples will be taken during this project. One hundred of the soil samples will be analyzed for the USEPA Target Compound List for Organic Constituents and 75 of the samples will be analyzed for the Illinois EPA Leaking Underground Storage Tank parameters (BETX and PNAs). Figure 2 shows the proposed sampling locations. Table 1 lists the Rationale for Sample Locations. Discretionary soil samples will be collected as follows:

- Hot Spots A PID will be used to screen for organic vapors during excavation. Soils which have a consistent indicated reading above background will be sampled as a hot spot.

- Intersections Soil samples will be collected in areas at the site where trenches with dissimilar pipes intersect.

- Accidental Spills If, during pipe and underground structure removal, liquid is observed spilling out of the pipe/component, the affected soil will be sampled and analyzed.

- Pits/Wastewater Treatment Structures Soil samples will be collected from the excavations of the concrete underground structures once they have been removed.

- Catch Basins and Gate Valve Drain Boxes Representative soil samples will be collected from beneath catch basins and gate valve drain boxes.

- As Needed Additional samples will be collected from soil around broken pipes or from truncated pipes as well as from areas showing visible contamination or having noticeable odors.

3.2 Direct-Push Subsurface Investigation

The exact number and locations of sampling points for the subsurface investigation will not be established until the results of the trenching and excavation sampling have been evaluated. This field sampling plan will be amended following evaluation of the analytical data from the trenching and excavation sampling. The amendment will include a map of proposed sampling locations. The results of field screening analysis will be used to guide the selection of sample locations. The sample locations will therefore, be adjusted by the field manager on site.

4.0 Sample Custody Procedures

4.1 Sample Identification System.

Samples will be uniquely numbered. Soil samples collected during trenching will start with the letter "T" followed by a three digit sequential number. Sequential numbers 001 through 075 will be reserved for samples from suspected petroleum contamination areas. Sequential numbers 101 through 200 will be reserved for areas where the potential source of contamination is uncertain or is believed to be related to the storm drainage system. Soil samples collected during the subsurface investigation will start with the letters "DP" followed by a three digit sequential number. Groundwater samples collected during the subsurface investigation at soil

boring locations will share the deepest soil sample number followed by the letter "G" suffix.

A survey grid will be established at the site. The grid will be described in terms of eastings and northings. Wooden lath markers indicating known locations will be set on the site. Measurements to the nearest marker will be made with a measuring tape. Sample locations will be noted as feet east and feet north from the grid base and recorded in the field log book and on the sample tags and labels.

4.2 Initiation of Field Custody Procedures.

After each sample jar is filled and given a unique sample number, a sample label will be completed and placed on each jar. Refer to Attachment III for Sample Label Example. The sample label will include the following information:

- Sample Number
- Name of Sampler
- Sample Location
- Type of Analysis
- Date and Time of Sampling
- Preservative (if applicable)

A sample tag will be completed and placed on the sample jar. Refer to Attachment II for Sample Tag Example. The sample tag will include the following information:

- Beling Project Number
- Sample Number.
- Date of Sampling.
- Time of Sampling.
- Type of sample (grab or composite).
- Sample location [relative to the survey grid (feet east and feet north of base) and depth below ground].
- Signature of sampling team leader.
- Type of preservative (if applicable).
- Type of analysis.

- Sample matrix.
- Designation remarks (duplicate, trip blank).

4.3 Field Authority Documentation/Log Book.

Field documentation will consist of field notes kept in a bound field log book and associated field forms (i.e., sampling logs, PID readings, sketches, or marked up drawings). The information contained in the log book will include the following:

- Weather conditions
- Number of workers and equipment used
- General work performed
- Instructions and directions given to the contractor
- Location and number of samples collected
- Accidents, injuries, or incidents
- Significant site visitors
- Field measurements
- Date
- Time of sampling
- Calibration information
- Onsite personnel

During excavation activities, the trench and the removed soil will be continuously monitored using a hand-held photo ionizing detector (PID). All areas where PID readings exceed 50 parts per million will be noted on the field drawings and in the Log Book.

The trench will also be monitored for signs of contamination such as discoloration, petroleum sheen, pipe liquid, odors and broken pipes. The location of notable observations will be recorded on the field drawings and in the Log Book.

Each soil sample collected will be described in the log book in the following order:

- Lithology (clay, silt, gravel, etc.).
- Color.
- Sorting or distinguishing characteristic.
- Saturation.
- Odor
- Other remarkable quality.

4.4 Sample Shipment and Transfer of Custody.

Sample jars will be packed so as to avoid breakage and placed in coolers. Samples will be chilled with ice to 4°C. Each cooler will be sealed and tagged and shipped the laboratory. A chain-of-custody form will be completed and sent with the samples to the laboratory. Refer to Attachment I for Chain-of-Custody Example. Information to be entered on the chain-of-custody includes the following:

- Project location and number
- Name and signature of sampler
- Sample number
- Sampling date
- Sampling time
- Type of sample, grab or composite
- Number of containers
- Type of analysis
- Tag number
- Designation (field blank, trip blank)
- Iced
- Preservation
- Name and signature of person packing and shipping sample
- Packing date
- Time of packing
- Shipping ticket number

5.0 Sample Containers, Sample Preservation, and Maximum Holding Times

The Sample Container, Preservation and Holding Time Requirements are listed in Table 4-1 of the QAPP.

6.0 Sample Handling, Packaging and Shipment

Samples will be packed so as to avoid breakage and placed in coolers. Each cooler will be taped shut and sealed. Refer to Attachment III for Custody Seal Example. Each seal will bear the date and a unique number with the Sampler's Signature. Coolers will be shipped each day from a location near the site to laboratory.

7.0 Decontamination Procedures

Disposables such as protection clothing, polyvinyl sheeting, bailers, tubing, acetate liners, and gloves will be placed into closed plastic bags for proper disposal. Sampling tools and sample bottles will be cleaned with an alconox solution and triple rinsed. The direct-push sampling tools will be pressure washed prior to use and after each sample. The entire unit will be decontaminated prior to entering or leaving the site. The backhoe's bucket will be washed using high pressure water every day and as necessary. If oily waste is present, the sampling equipment will be steamcleaned using a high pressure unit. Liquids generated by decontamination procedures will be collected in on-site containers. These liquids will be treated in the proposed bioreactor during the remediation phase.

8.0 Sampling Equipment and Procedures

8.1 Trenching and Excavation Sampling

Soil samples will be collected from beneath the pipes once they are removed from a trench. Each sample will be collected from an undisturbed section using a hand auger or coring device. In the event that the bottom of the trench/pit has standing water, the soil sample will be collected from the trench/pitwall.

8.2 Piezometer Installation

At least four (4) temporary piezometers will be installed in order to determine the direction of groundwater flow. All four piezometers will be completed into target strata that are believed to be hydraulically continuous. The proposed locations for the piezometers are shown in Figure A-1. Piezometer depths and screen and riser lengths will be determined by the geologist on site during installation based on the soil conditions encountered.

The piezometers will be constructed of one-inch Schedule 40 PVC with flush-thread connections and O-ring seals. The PVC screens will be five feet in length with 0.01 inch slot screens. A filter fabric will be placed over the screen if necessary, with a sand pack installed opposite the screen and a bentonite seal installed above the screen and sand pack. Piezometer surface completions will be protected utilizing steel covers until the temporary piezometers are no longer needed and can be properly plugged.

The temporary PVC piezometers will be installed using either of two direct-push techniques. The simplest installation is to lower the PVC screen and riser into the open hole left after retrieval of the direct-push probe. Installation and material costs are very low for this technique. A limitation to this open-hole installation technique is that caving sands or squeezing clays can limit the depth to which the PVC pipe can be lowered. If those conditions are anticipated, a steel casing with a sacrificial aluminum tip will be pushed to the target depth. The casing is then withdrawn leaving the sacrificial tip and the PVC screen and risers in place.

8.3 Direct-Push Soil Sampling

Soil samples will be collected with a hollow tube sampling device with a plastic liner. The sampling device will be hydraulically driven to the desired depth, opened from the surface, driven an additional four feet to obtain the sample, and withdrawn to the surface. After retrieval, the plastic liner will be cut open and the soils will be described. The soil cores will be initially screened as described in Section 12.0. Samples extracted will be split into at least two appropriate portions. One portion will be collected for on-site field screening analysis. The second portion will be retained for potential laboratory confirmation.

8.4 Direct-Push Groundwater Sampling

Groundwater samples will be collected in order to determine the horizontal and vertical extent of groundwater contamination. The location of the direct-push sampling points will be determined following evaluation of the analytical data from trench sampling. Following installation of the temporary piezometers and the measurement of groundwater level elevations, the pattern of sampling points will be adjusted in order to concentrate in the downgradient direction. Since the suspected contaminant products are light, non-aqueous liquids (LNAPLs) they will tend to float on the top of transmissive zones depending upon geologic structure. The sampling pattern will be shifted in order to account for geologic structure on

persistent clay or sand layers. The target depths will be selected by the geologist on site based on the soil conditions encountered and field screening results.

A direct-push sampler, also referred to as a screened point sampler, will be used to sample groundwater. This closed sampler is sealed with 'O' rings and driven below the groundwater's surface approximately 2 feet. As the sampler is pulled back approximately 18", the expendable drive point is disengaged allowing a 0.006" stainless steel screen to extend out the bottom of the sampler providing a sample filtered of most sands and silts. The sample will be pumped to the surface using an inertial pump. This method is more cost effective than paying for standby time for the direct push crew while waiting for groundwater recovery.

9.0 QC Sample Procedures

One field duplicate sample will be collected for each 10 soil samples. The field duplicate will be numbered uniquely and the sample will not be marked as a duplicate. The laboratory will not know which samples are the duplicates.

10.0 Field Duplicate Sample Collection

Field duplicates will be collected in the same fashion as all of the soil samples. The jars for the soil sample and its duplicate will be filled with blended portions of soil from the same sample.

11.0 Trip Blank Sample Preparations

The laboratory will prepare trip blanks and deliver them, one per cooler, to the site. On site, the field sampling team will tag the trip blank and return it to the lab, unopened, in the cooler with the samples.

12.0 Field Measurement/Screening

For each soil sample collected a portion of the sample will be placed in an air-tight disposable plastic bag after noting any contamination within the sample by observation A corresponding yet undisturbed portion of each soil sample will be placed directly into the appropriate glass sample jars for potential future analytical evaluation. The sample jars will be labeled and placed on ice in the sample shipment container pending future use. . Hydrocarbon vapors, if present in the soil samples, will be allowed to volatilize in the bag for approximately 15 minutes. Then

a Photoionization Detector (PID) will be used to measure the organic vapor levels in the headspace above the samples. The values will be recorded in the Field Log Book.

Soil cores taken during the subsurface investigation will be sampled in two (2) foot intervals. Each two (2) foot sample will be screened for organic vapors as described above. The soil sample from each boring that exhibited the highest field screening value, and samples selected at the discretion of the Field Supervisor, will be selected for laboratory analysis.

13.0 Preventive Maintenance Procedures/Schedule

Preventative maintenance procedures and schedules are listed in Table 11-3 of the QAPP for the project.

14.0 Sample Disposal

The laboratory, ARDL, will be responsible to dispose of the samples.

15.0 Storage and Disposal of IDW

At the end of each day all IDW will be poured into the on-site holding tanks for treatment in the biopiles.

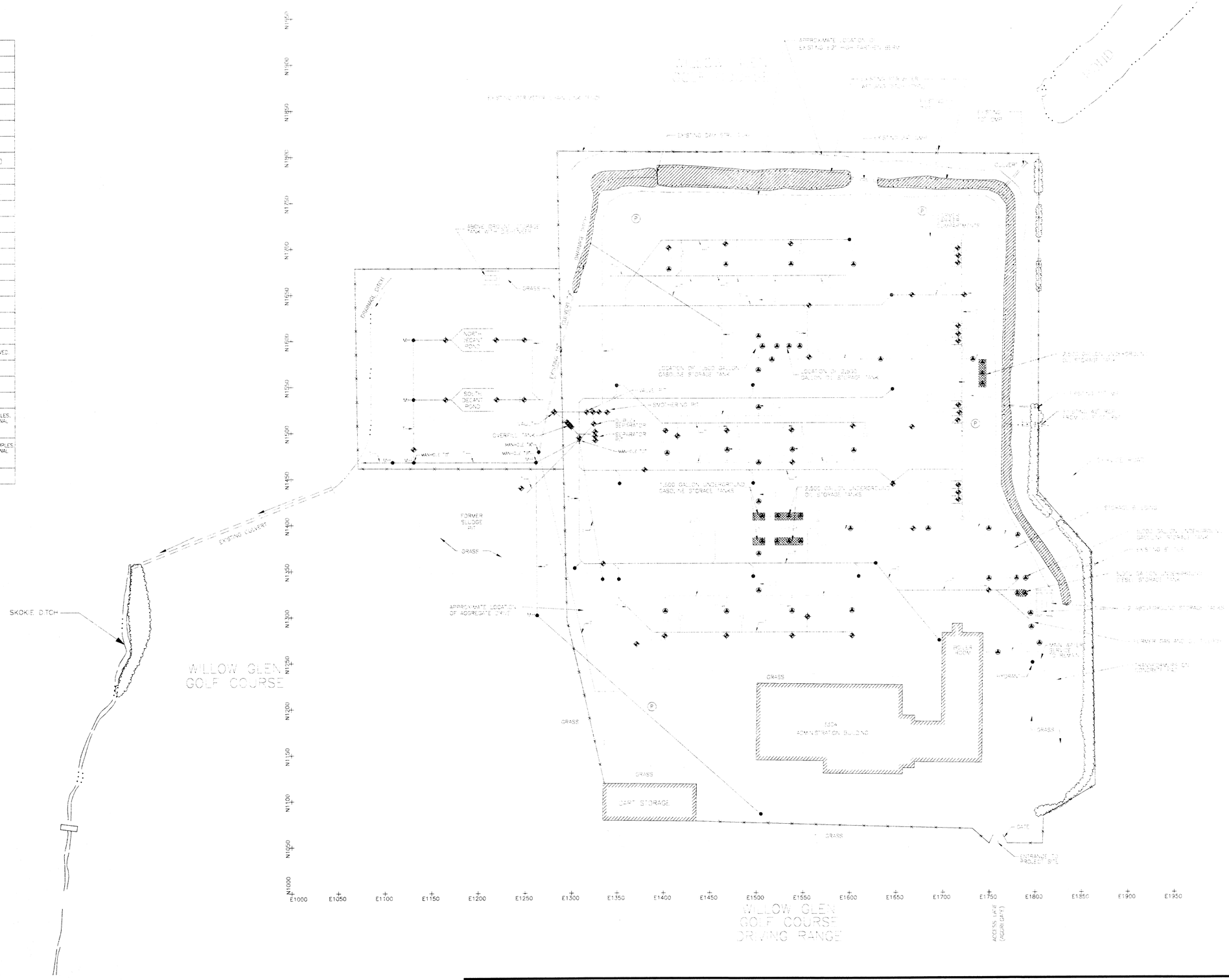
FIGURE

A-1

SAMPLE LOCATION MAP

LEGEND

T	NON-METALLIC CLAY TILE DRAIN PIPES
	BURN PIT (Removed)
	CHRISTMAS TREE ENCLOSURE (Removed)
	WATER SUMP (Removed)
	GATE VALVE (Removed)
	CONTROL TOWER (Removed)
	CONTROL PANEL WITH MULTIPLE CONNECTIONS TO SPRINKLERS
●	CATCH BASIN
○	CLEANOUT
MH ●	MANHOLE
	INLET
	UNDERGROUND STORAGE TANKS
	APPROXIMATE AREA OF JURISDICTIONAL WETLANDS
	CHAIN LINK FENCE
	INDICATES STRUCTURE HAS BEEN REMOVED
	CORRUGATED METAL PIPE
	SMOOTH METAL PIPE
	REINFORCED CONCRETE PIPE
	PROPOSED LUST REGULATED SOIL SAMPLES. 50 LOCATIONS ARE SHOWN. 25 ADDITIONAL SAMPLES WILL BE COLLECTED AS FIELD CONDITIONS WARRENT.
	PROPOSED USEPA REGULATED SOIL SAMPLES. 50 LOCATIONS ARE SHOWN. 40 ADDITIONAL SAMPLES WILL BE COLLECTED AS FIELD CONDITIONS WARRENT.
(P)	TEMPORARY PIEZOMETER LOCATIONS



REV.	DATE	REMARKS
0		

BELING CONSULTANTS

Professional Engineering Since 1936

Moline, IL • Joliet, IL • Chicago, IL • Peoria, IL
Davenport, IA • Beloit, WI • Hammond, IN • Columbus, OH

DESIGNED: M.E. ARP
DRAWN: A.A. BROWN
CHECKED: M.E. ARP
C:\DEPT\16\879\QAPP\QAPP-A 1.DWG

50' 0 25' 50' 100'
Horizontal Scale: 1" 50'

US DEPARTMENT OF THE NAVY
NAVAL TRAINING CENTER
GREAT LAKES, ILLINOIS

ENVIRONMENTAL REMEDIATION OF THE FIREFIGHTING TRAINING UNIT (FFTU)

PROPOSED SAMPLING LOCATIONS

RI/FS, FFTU QA PROJECT PLAN

SHEET: A-1

JOB NUMBER: 29880

DATE: JULY 23TH, 1997

ATTACHMENT I

CHAIN-OF-CUSTODY FORM

ARDL, Inc.

P.O. BOX 1566, MT. VERNON AIRPORT, RT. 15E, MT. VERNON, IL 62864

CHAIN OF CUSTODY RECORD

PROJECT (1)

SAMPLERS: (Signature) (2)

SAMPLE NUMBER	DATE	TIME	COMP	GRAB	NO. OF CONTAINERS																		REMARKS OR SAMPLE LOCATION	PRESERVATION: ICED	PRESERVATION: SPECIFY CHEMICALS ADDED AND FINAL pH IF KNOWN
(3)	(4)	(5)	(6)		(7)	(8)																	(9), (10)	(11)	(12)

	Date	Time		
Relinquished by: (Signature) (13)	Date (14)	Time (15)	Received by: (Signature)	REMARKS/SPECIAL INSTRUCTIONS:
Relinquished by: (Signature)	Date	Time	Received by: (Signature)	
Received for Laboratory by: (Signature)	Date	Time	Shipping Ticket No. (16)	

COPIES: White & Yellow copies accompany sample shipment to laboratory. Pink copy retained by sampler.

PURCHASE ORDER NO: _____

01-10-01 03:11PM FROM ARDL, INC. TO 10260131280001 P002

ATTACHMENT I
CHAIN-OF-CUSTODY

Instructions		Example
1.	(Project Location and Number)	FFTU, 29XXX
2.	(Printed Name and Signature of Sampler)	J.T. Smith
3.	(Sample Number)	797-033-B
4.	(Sampling Date)	7-10-97
5.	(Sampling Time, in Military Units)	0840
6.	(Type of Sample, Check One)	X
7.	(Number of Containers)	1
8.	(Type of Analysis) P/P/H, Metals, PNAs	BTEX, VOA, SVOA,
9.	(Tag Number)	033-B
10.	(Designation, if Applicable)	Trip blank
11.	(Iced?)	Yes
12.	(Preservative, if Applicable)	None
13.	(Name and Signature of Person Packaging and Shipping Sample)	J.T. Smith
14.	(Packaging Date)	7-10-97
15.	(Time of Packaging)	2100
16.	(Shipping Ticket Number)	To be completed by the laboratory

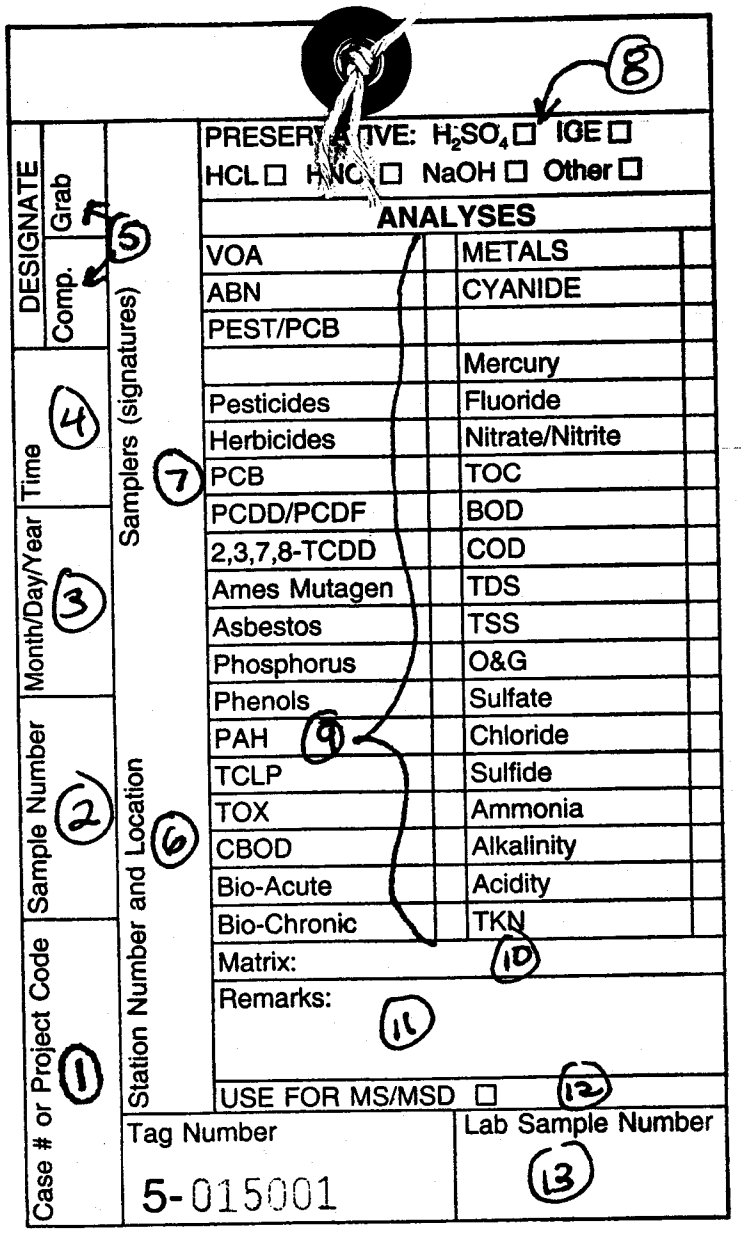
ATTACHMENT II

SAMPLE TAG EXAMPLE

ATTACHMENT II

SAMPLE TAG EXAMPLE

Page 1 of 2



ATTACHMENT II

SAMPLE TAG EXAMPLE

Instructions		Example
1.	Project Number	29101
2.	Sample Number	797-080-B
3.	Sampling Date	7-10-97
4.	Sampling Time (Military)	1430
5.	Specify Grab or Composite	X
6.	Sample Location	E1050, N1400-6.5'
7.	Sampling Team Leader Signature	--
8.	Preservative	X
9.	Check Analysis Required	X
10.	Sample Matrix	Soil
11.	Designation	Field Duplicate
12.	Indicate MS/MDS Applicability	X
13.	Lab Number	--

ATTACHMENT III

SAMPLE LABEL AND CUSTODY SEAL EXAMPLE

ATTACHMENT III
SAMPLE LABLE AND CUSTODY
SEAL EXAMPLES
PAGE 1 of 2

RI/FS, FFTU
QA PROJECT PLAN
REVISION: 0
~~Date~~
DATE: July 1997

ENVIRONMENTAL SAMPLING SUPPLY

LOT # 043097

SAMPLE ID (1)

SAMPLED BY (2)

DATE (5)

TIME

LOCATION (3)

PRESERVATIVE (6)

ANALYSIS (4)

CLIENT

9601 San Leandro Street, Oakland, California 94603
(510) 562-1983 (800) 233-8425

CUSTODY SEAL

Date (1) _____

Signature (2) _____

ATTACHMENT III

SAMPLE LABEL AND CUSTODY SEAL EXAMPLES

SAMPLE LABEL

Instructions	Example
1. (Sample Number)	797-044-P
2. (Name of Sampler)	T.J. Smith
3. (Sample Location)	E-950, N-1050-4.0
4. (Type of Analysis)	TCL VOA
5. (Date and Time of Sampling)	7-10-97, 1220
6. (Preservatives, if Applicable)	N/A

CUSTODY SEAL

Instructions	Example
1. (Date and Number)	7-10-97:1
2. (Name and Signature of Preparer)	T.J. Smith

APPENDIX B

SPECIAL ANALYTICAL

SERVICES TEST PROCEDURES

HERBICIDE ANALYSIS

Using Gas Chromatography - Method 8151

QA/QC Approval	Revision	Section(s) Revised	Date
	1.0	ALL	July 1995
	1.1	ALL	Dec 1996

HERBICIDE ANALYSIS, METHOD 8151
Using Gas Chromatography-Electron Capture Detector

1.0 SCOPE AND APPLICATION

This method is applicable to the quantitative determination of the chlorinated acid herbicides in environmental water, soil, and waste type samples. The target analytes for the method are listed below.

Analyte	CAS Registry Number
2,4-D	94-75-7
2,4-DB	94-82-6
2,4,5-T	93-76-5
2,4,5-TP (Silvex)	93-72-1
Dalapon	75-99-0
Dicamba	1918-00-9
Dichloroprop	120-36-5
Dinoseb	88-85-7
MCPA	94-74-6
MCPP	93-65-2
4-Nitrophenol*	100-02-1
Pentachlorophenol*	87-86-5

*Analyzed at customer request

2.0 SUMMARY OF THE METHOD

Herbicide analyses are performed in accordance with SW-846, Method 8151. After derivatization, the esters are quantitated by gas chromatography employing an electron capture detector. The results are reported as the acid equivalents.

The sensitivity of this method usually depends on the level of interferences rather than on instrumental limitations.

3.0 INTERFERENCES

3.1 Organic acids, especially chlorinated acids, cause the most direct interference with the determination. Phenols, including chlorophenols, may also interfere with this procedure.

3.2 Alkaline hydrolysis and subsequent extraction of the basic solution removes many chlorinated hydrocarbons and phthalate esters that might otherwise interfere with the electron capture analysis.

3.3 The herbicides, being strong organic acids, react readily with alkaline substances and may be lost during analysis. Therefore, glassware and glass wool must be acid-rinsed, and sodium sulfate must be acidified with sulfuric acid prior to use to avoid this possibility.

4.0 APPARATUS AND MATERIALS

4.1 SAFETY

Two materials utilized in the subject method, ethyl ether and diazomethane, represent significant hazards and extra precautions are required in handling.

4.1.1 ETHYL ETHER

Ethyl ether is a mobile, extremely volatile, highly flammable solvent with a low boiling point (34.6° C) and an extremely low flash point (-45° C). Air-ether mixtures of more than 1.85% ether by volume are explosive hazards. Inhalation of high concentrations of the vapor causes narcosis and unconsciousness. All work with the reagent must be performed in an adequately ventilated, hooded area free of open flames and/or equipment which may produce sparking or electric arcs.

Since the solvent tends to form explosive peroxides when stored in the presence of air and light, the number of containers opened for use at any one time must be kept to a minimum. Where ever possible, use only freshly opened reagent for the procedures described in this document and dispose of all unused portions of the reagent in accordance with applicable regulations when work with it is finished.

If it becomes necessary to store opened containers of the reagent, they must be held in an explosion proof refrigerator. Since the material tends to form peroxides in the presence of air and light, add 20 mL ethanol as a stabilizer to each liter of ether being stored for later use. Before next use, test the stored reagent for peroxides (test strips, Fisher Scientific 09-876-23). If the test is positive, remove the peroxides by shaking three volumes of ether with one volume of 5% aqueous ferrous sulfate.

4.1.2 DIAZOMETHANE

In pure form diazomethane is a carcinogenic, extremely toxic, irritant gas which may explode when heated or when exposed to rough glass surfaces. Equipment with ground glass joints should never be used for containing or handling this material. Concentrated aqueous solutions may explode, especially in the presence of impurities.

The overt dangers associated with concentrated forms of the reagent are minimized by the bubbler method of generation described in this document. Nonetheless, personnel using this procedure must exercise appropriate precautions. The compound is an insidious poison. Hypersensitivity to the material may develop which can lead to inflammatory reactions and pulmonary attacks on subsequent exposure to the substance. All work with the material must be performed in a well-ventilated, hooded area.

4.1.3 OTHER CONSIDERATIONS

Except in the instances described above, no precautions or protective measures aside from standard laboratory practices are required as part of performance of this method.

Standard laboratory procedures and practices relative to safety in handling sample materials as well as diluted and working standards are fully discussed in the current revision of ARDL's Chemical Hygiene Plan. Do not undertake performance of this method without reading and understanding the relevant portions of that reference.

4.2 DOCUMENTATION

As indicated in various sections of this document, written records relative to preparation of standards, instrument calibration, instrument maintenance, identification of samples in analytical runs and other data are required. Standard laboratory practices regarding these records must be followed scrupulously. Complete details regarding the requirements for these records as well as exemplars of

such records appear in Appendix A of the most recent revision of ARDL's Quality Assurance Program Plan.

4.3 GLASSWARE AND MISCELLANEOUS ITEMS

4.3.1 SPECIFIC ITEMS

Microsyringes - 10, 50, 100, 500, and 1000 uL for standard preparation and/or dilutions (Hamilton 700 series or equivalent)
Volumetric Flasks - 1, 10, 100 and 200 mL Class A with Teflon stopper for standard preparation (Fisher 10-210 series or equivalent).
Separatory Funnels - 60, 125 and 2000 mL with Teflon stopper and stopcock (Fisher 10-437 series or equivalent)
Volumetric Pipettes - 1, 2, 5, 10 and 25 mL, Class A (Fisher 13-660 series or equivalent)
Graduated Pipettes - 5, 10 and 25 mL, Class B (Fisher 13-664 series or equivalent)
Kuderna-Danish Apparatus - 10 mL concentrator tubes, 500 mL evaporation flask, 3 ball macro Snyder column, clamps (Fisher K570035-0250 or equivalent) and 2 ball micro Snyder column (Kontes K-569001-0219 or equivalent)
Erlenmeyer Flask - 125 mL (Fisher 10-047 series or equivalent)
Graduated Cylinders - 50, 100, 500 and 1000 mL Class A (Fisher 08-557 series or equivalent)
Beakers - 100, 250 and 400 mL (Fisher 05-239 series or equivalent)
Balance - Sensitivity 0.1 mg. (Denver Model AB250D, or equivalent)
Balance - Top-loading, sensitivity 0.01 mg (Denver S-110G, or equivalent)

4.3.2 MISCELLANEOUS

Materials for diazomethane bubbler apparatus (see Figure 1)
2 mL autosampler vials
Crimp-top Teflon septa caps
Disposable glass pipettes for sample and standard transfer
Glass and polypropylene reagent bottles, 250 and 50 mL with screw caps
Boiling chips (Fisher No. B365-250 or equivalent)

4.3.3 GLASSWARE PREPARATION

All glassware for use with this method is prepared by scrupulously following laboratory standard practices. Details of standard cleaning procedures appear in the current revision of ARDL's SOP entitled Glassware Cleaning Procedures. That document is also included as part of Appendix A of the most recent revision of ARDL's Quality Assurance Program Plan. Do not attempt to prepare glassware for use with this method until the relevant sections of the referenced SOP have been read and understood.

4.4 INSTRUMENTATION

4.4.1 GAS CHROMATOGRAPHS

Hewlett-Packard (HP) Model 5890 gas chromatographs equipped with an HP 7673 auto sampler interfaced to an HP Model 3396 integrator and either: 1) a single Nickel 63 electron capture detector; or 2) dual Nickel 63 electron capture detectors.

In all cases, injection volume is constant at 2.0 uL. On dual detector instruments the injection volume is split between two dissimilar columns so that both primary and confirmational analyses are performed concurrently. Splitting is achieved using a universal Y connector (Catalog No. 20405, Restek, Inc.). All other analytical

conditions also remain constant throughout calibration and analysis o field and QC samples.

The autosamplers are programmed to solvent rinse a total of three times and sample rinse a total of two times before injecting sample.

Dependent on detector configuration, the columns employed may be any one or a combination of two of the following:

1) 30-meter (m) x 0.53-millimeter (mm) internal diameter DB-5 fused-silica capillary column with 0.5-micron (u) film thickness, or equivalent item;
2) 30 meter (m) x 0.53-millimeter (mm) internal diameter DB-608 fused-silica capillary column with 0.83-micron (u) film thickness, or equivalent item; or
3) 30-meter (m) x 0.53-millimeter (mm) internal diameter DB-1701 fused-silica capillary column with 0.5 micron (u) film thickness, or equivalent item.

The carrier gas is ultra high purity helium. A flow rate of 6 to 8 mL/min is typically used. The auxiliary makeup gas is ultra high purity nitrogen. Typical flow rate for that gas is 30-40 mL/min.

The temperature of the injector is 250 degrees °C. The temperature of the detector is 300°C. Oven temperatures during analysis are described in Section 7.5.

4.5 DATA ACQUISITION SYSTEM

Chromperfect software (Justice Innovations, Inc.) is used for data acquisition and evaluation. The software is resident on a networked, IBM compatible 486 computer and is employed for peak detection, integration, construction of overlays to aid in analyte pattern recognition, calibration, plotting, reporting, and other data management functions. Complete instructions for operation of Chromperfect are given in the vendor's manuals.

Data storage is achieved by direct transfer of MS-DOS files to magnetic tape. The tapes are archived indefinitely.

5.0 REAGENTS AND SOLVENTS

5.1 SOLVENTS

Reagent Water - Organic free, ASTM Type II water generated by a Model 2002AL (Solutions, Inc.) purification system.

Resistivity is monitored continuously by a system meter. Corrective action(s) are taken if the resistivity drops below 15 megOhms/cm.

The water from this system is utilized as a blank for total organic carbon analysis by SW-846 Method 9060 on at least a weekly basis. Corrective action(s) are taken if the level of TOC exceeds 1 ppm.

On a monthly basis the water is also tested for discrete organic contaminants. One liter aliquots of the reagent water and HPLC grade water (Fisher Scientific WS-1) are extracted with methylene chloride. After solvent exchange into hexane (Section 7.1.2, SW-846 Method 8080) the extracts are concentrated to 1 mL and analyzed by GC/ECD. Corrective actions are taken if the chromatogram of reagent water does not

compare favorably with the chromatogram of the HPLC grade water.

Toluene, Reagent grade
Methanol, Pesticide Grade
Acetone, Pesticide Grade
Ethyl Ether, Reagent Grade (see section 4.1.1 for handling precautions)
Hexane, Pesticide grade
Isooctane, Pesticide grade
Diethyl Ether, Reagent grade

5.2. REAGENTS

5.2.1 Sulfuric Acid Solutions

1:1 (v/v) Sulfuric Acid. Using a graduated cylinder add 100 mL of reagent water to a 400 mL beaker. Add a magnetic stirbar and place on a stirring plate. Using a graduated cylinder, measure 100 mL of reagent grade, concentrated sulfuric acid (36N). Begin stirring the water and slowly add the acid. Allow the mixture to cool and transfer to a properly labeled glass reagent bottle.

1:3 (v/v) Sulfuric Acid. Using a graduated cylinder add 150 mL of reagent water to a 400 mL beaker. Add a magnetic stirbar and place on a stirring plate. Using a graduated cylinder, measure 50 mL of reagent grade, concentrated sulfuric acid (36N). Begin stirring the water and slowly add the acid. Allow the mixture to cool and transfer to a properly labeled glass reagent bottle.

5.2.2 1:9 (v/v) Hydrochloric Acid. Using a graduated cylinder add 180 mL of reagent water to a 400 mL beaker. Add a magnetic stirbar and place on a stirring plate. Using a graduated cylinder, measure 20 mL of reagent grade, concentrated hydrochloric acid (38%). Begin stirring the water and slowly add the acid. Allow the mixture to cool and transfer to a properly labeled glass reagent bottle.

5.2.3 Potassium Hydroxide Solution. Using a graduated cylinder measure 200 mL of reagent water. Transfer approximately 150 mL of the water to a 400 mL beaker. Add a magnetic stirbar and place on a stirring plate. Weigh 37 g of reagent grade potassium hydroxide pellets to the nearest 0.1 g. Begin stirring the water and slowly add the potassium hydroxide to the water. Stir until the solid has dissolved. Allow to cool and transfer to a properly labeled polypropylene reagent bottle.

5.2.4 Carbitol, 99% (Aldrich E-455-0 or equivalent)

5.2.5 Sodium Sulfate, reagent grade, anhydrous, granular. Before use purify by heating at 400° C for four hours in a shallow Pyrex tray

5.2.6 Diazald (Aldrich D2,800-0, or equivalent)

5.2.7 Silicic Acid, 100 mesh, chromatographic grade. Store reagent at 130° C

5.3 STOCK STANDARDS

The sections below describe the various stocks of standards employed in the laboratory.

Each standard stock is assigned a specific ID number. A dated, signed entry in separate standard preparation logbook annotates how

the standard was prepared. That logbook is kept in the laboratory for reference.

After any preparative steps, the solutions are transferred into individual Teflon-sealed screw-cap bottles. The bottles are labeled with the name of the solution, ID number, date of preparation, expiration date and analyst initials, All standard stocks are stored in the dark at 4 ± 2°C.

5.3.1 VENDOR SUPPLIED STANDARDS

Stock concentrates for use as standards for the target analytes and the surrogate (2,4 dichlorophenylacetic acid) are obtained from commercial sources in sealed glass ampoules as certified solutions of the methyl esters. The concentrates are certified by the vendor to contain 0.5% of the labeled value. The concentrates are dated on arrival and are stored unopened at 4 ± 2°C. After one year they are discarded.

The concentrates currently used in the laboratory are identified in Table 1. The concentration of the analytes in these preparations also appears in the table.

5.3.2 COMPOSITE STOCK SOLUTIONS

Two composite stock solutions are prepared from the vendor supplied stock concentrates.

COMPOSITE 1

Using separate microsyringes add 500 uL of HERB Mix 1 and 1000 uL of HERB-surrogate to a 10 mL volumetric flask. Bring the flask to volume with hexane. Mix by inversion. The concentration of each component in the solution is 10.0 ug/mL. The solution is stable for 6 months when stored in the dark at 4 ± 2°C.

COMPOSITE 2

Using separate volumetric pipettes combine equal volumes (1.0 mL each) of Herb Mix 2 and Herb Mix 3 in suitable container. Mix by stirring. The concentration of each component in the mix is 5000 ug/mL.

After preparation transfer the solution to separate, properly labeled Teflon sealed screw vials. The solution is stable for 6 months when stored in the dark at 4 ± 2°C.

5.3.3 CALIBRATION STANDARDS

A series of seven calibration standards encompassing the working range of the analytical system are prepared from each of the composites described in Section 5.3.2. Using a series of microsyringes, transfer the indicated volumes of the composites to separate 10 mL volumetric flasks. Bring the flasks to volume with hexane and mix by inversion.

After preparation, transfer the standards to properly labeled individual vials fitted with Teflon lined screw caps. Store in the dark at 4 ± 2°C until needed for use. Replace within six months or earlier if acquired data so indicates.

5.3.4 SURROGATE SPIKE SOLUTION

As noted in Section 5.3.1, the surrogate for this method is 2,4-dichlorophenylacetic acid. A working solution for spiking field and QC samples prior to sample preparation is prepared and maintained by the Organic Sample Preparation Laboratory.

Using a microsyringe transfer 1000 uL of concentrate (HERB-Surrogate) to a 10 mL volumetric flask. Bring the flask to volume with methanol or acetone and mix by inversion. The concentration of the solution is 10 ug/mL.

After preparation, transfer the solution to a properly labeled vial fitted with a Teflon lined screw cap. Store in the dark at 4 ± 2°C until needed for use. Replace within six months or earlier if acquired data so indicates.

5.3.5 MATRIX SPIKE SOLUTION

The target analytes 2,4-D, 2,4,5-T and Silvex are used in the spiking solution. A working solution of the three spike compounds each at a concentration of 10 ug/mL in acetone is prepared from the neat compounds and maintained by the Organic Sample Preparation Laboratory. Using an analytical balance, quantitatively transfer 250 mg of each spiking compound to a 10 mL volumetric cylinder. Bring the flask to volume with acetone and mix by inversion until the solids are dissolved. Transfer the spiking solution to a properly labeled vial fitted with a Teflon lined screw cap and store at 4 ± 2°C. The solution is replaced every six months or sooner is acquired data indicates the need.

Prior to beginning sample preparation, use a microsyringe to spike each sample with 200 uL of the spike working solution. The concentration of the spike in the final sample extract will be 2.5 ug/mL.

6.0 **SAMPLE COLLECTION, PRESERVATION AND HANDLING**

6.1 Standard protocols outlined in SW-846, Organic Analytes, Section 4.1 should be followed for sample collection, preservation and handling.

6.2 Sample holding times is the interval between sample collection and the initiation of sample extraction. For water matrices sample holding time is 7 days. For soil matrices sample holding time is 14 days.

6.3 Extract holding time is the interval between completion of sample extraction and instrumental analysis. Extracts prepared by this method must be stored in the dark at 4 ± 2°C. Although all organic extracts may be held 40 days before analysis, the extracts prepared by this method should be evaluated as soon as possible, preferably within one to two days.

7.0 **PROCEDURE**

7.1 EXTRACTION

7.1.1 WASTE SAMPLES

Follow SW-846 Method 3580 substituting ethyl ether as the dilution solvent and using acidified glass wool and sodium sulfate. Using a

microsyringe, transfer 1000 uL of the diluted sample to a ground glass stoppered Erlenmeyer flask and proceed to Section 7.2.

7.1.2 SOIL, SEDIMENT SAMPLES

7.1.2.1 SUBSAMPLING

Subsamples of soils and sediments are removed from containers exercising best efforts to obtain a representative portion. Most samples are compatible with the preferred procedure of physically extracting a vertical "core" from the approximate center of the container. Vegetable matter, pebbles, aggregates and similar artifacts are avoided unless they comprise the bulk of the sample material. When the sample contains two or more obviously different soil types the sample is mixed by hand to obtain the best possible blend.

7.1.2.2 SOLIDS DETERMINATION

When sample results are to be reported on a dry substance basis (dsb) the percent solids in the sample is determined as specified in SW-846 Method 8240, Section 7.4.3.1.5.

7.1.2.3 EXTRACTION

Weigh approximately 50 g of sample (as is basis) to the nearest 0.1 g and place in a 500 mL, wide mouth Erlenmeyer flask. Spike the sample with surrogate and/or spike compounds. Add concentrated hydrochloric acid to the sample in approximately 1 mL increments, stirring between additions and checking the pH with test strips. Stop the addition of acid when the pH reaches 2. Continue monitoring the pH for 15 minutes with occasional stirring, and if necessary, add additional acid to keep the pH at the required level.

Using a graduated cylinder add 20 mL acetone to the flask and agitate the suspension by hand or by mechanical means for 20 minutes. Using a graduated cylinder add 80 mL ether to the same flask and shake again for 20 minutes. Decant the extract and measure and record the volume of solvent recovered.

Extract the sample twice more using graduated cylinders to add 20 mL of acetone and 80 mL of ether. After addition of each solvent, agitate the mixture for 10 minutes. Decant the extract and measure and record the volume of solvent recovered.

After the third extraction, the volume of extract recovered must be at least 75% of the volume of added solvent. If this is not the case, additional extractions may be necessary. Combine the extracts in a 2 liter separatory funnel containing 250 mL of 5% acidified sodium sulfate. If an emulsion forms, slowly add 5 g of acidified sodium sulfate (anhydrous) until the solvent-water mixture separates. A quantity of acidified sodium sulfate equal to the weight of the sample may be added, if necessary.

Check the pH of the extract with pH test strips. If it is not at or below pH 2, add more concentrated hydrochloric acid until pH is stabilized at the desired value. Gently mix the contents of the separatory funnel for 1 minute and allow the layers to separate.

Collect the aqueous phase in a clean beaker and the extract phase (top layer) in a 500 mL ground glass-stoppered Erlenmeyer flask. Place the aqueous phase back into the separatory funnel and reextract using 25 mL of ether. Allow the layers to separate and discard the

aqueous layer. Combine the ether extracts in the 500 mL Erlenmeyer flask.

7.2.2 HYDROLYSIS

Using graduated cylinders add 30 mL of reagent water, 5 mL of 37% KOH and one or two clean boiling chips to the flask. Place a three ball Snyder column on the flask, evaporate the ether on a water bath, and continue to heat for a total of 90 minutes to completely hydrolyze the target esters which may be present. After hydrolysis, the phenoxy-acid targets are converted to their potassium salts in the basic solution. Remove the flask from the water bath and allow to cool.

Quantitatively transfer the water solution to a 125 mL separatory funnel by rinsing the flask with small portions of reagent water. Using a graduated cylinder add 40 mL of ether to the funnel and extract by shaking for 1 - 2 minutes. The phenoxy-acid potassium salts are soluble in the water and insoluble in the ether. Allow the layers to separate and collect the aqueous (lower) phase in a clean beaker.

Discard the ether and transfer the aqueous phase back to the separatory funnel. Using the procedure above, extract the water two more times with 20 mL portions of ether.

7.2.3 SOLVENT CLEANUP/DRYING

Adjust the pH of the water to 2 by adding 5 mL cold (4o C) 1:3 sulfuric acid to the separatory funnel using a graduated cylinder. Check the pH of the funnel contents with pH paper. Add additional acid as required if the pH is not at the desired level.

Using a graduated cylinder add 40 mL of ether to the funnel and shake for 1 - 2 minutes. The target analytes have been converted to their acid form and are now insoluble in the water and soluble in the ether. Draw off the aqueous (lower) phase into a clean beaker. Draw off the organic phase into a clean 125 mL Erlenmeyer flask containing 5-7 g of acidified anhydrous sodium sulfate (see note following the next paragraph regarding the quantity of sulfate required).

Replace the water phase in the funnel and repeat the extraction procedure twice using 20 mL portions of ether. Combine all of the ether extracts in the Erlenmeyer flask. Contact with the acidified sodium sulfate will dry the combined. Overnight contact is preferred to obtain maximum drying. Two hours contact time is the minimum allowed. If held overnight, the ether extract must be stored at 4 $\pm$ 2° C in an explosion proof refrigerator.

NOTE - The drying step is extremely critical to ensuring complete esterification of target analytes during subsequent processing. Residual moisture in the ether will result in poor yield of the esters and resultant low herbicide recoveries. The amount of sodium sulfate specified above is adequate if some free flowing crystals are visible when swirling the flask. If all the sodium sulfate solidifies in a cake, however, it is a good indication that all of the water has not been removed from the ether extract. When such a condition is observed add a few additional grams of acidified sodium sulfate and again test by swirling.

7.2.4 CONCENTRATION

Transfer the ether extract through a funnel plugged with acid washed glass wool into a 500 mL K-D flask equipped with a 10 mL concentrator

tube. Use a glass rod to crush caked sodium sulfate during the transfer. Rinse the Erlenmeyer flask and column with 20-30 mL of ether to complete the quantitative transfer.

Add one or two clean boiling chips to the flask and attach a three ball Snyder column. Prewet the Snyder column by adding about 1 mL of ether to the top. Place the K-D apparatus on a hot water bath (60-65-C) so that the concentrator tube is partially immersed in the hot water and the entire lower rounded surface of the flask is bathed in vapor. Adjust the vertical position of the apparatus and the water temperature, as required, to complete the concentration in 15-20 minutes. At the proper rate of distillation the balls of the column will actively chatter, but the chambers will not flood.

When the apparent volume of liquid reaches 1 mL, remove the K-D apparatus from the water bath and allow it to drain and cool for at least 10 minutes. Remove the Snyder column and rinse the flask and its lower joints into the concentrator tube with 1-2 mL of ether, preferably using a 5 mL syringe. Add a fresh boiling chip, attach a micro Snyder column to the concentrator tube, and prewet the column by adding 0.5 mL of ethyl ether to the top.

Place the micro K-D apparatus on the water bath so that the concentrator tube is partially immersed in the hot water. Adjust the vertical position of the apparatus and the water temperature as required to complete concentration in 5-10 minutes. When the apparent volume of the liquid reaches 0.5 mL, remove the micro K-D from the bath and allow it to drain and cool. Rinse the walls of the concentrator tube while adjusting the extract volume to 1.0 mL with ether. Proceed to Section 7.4 for esterification.

7.3 PREPARATION OF AQUEOUS SAMPLES

7.3.1 EXTRACTION

Using a graduated cylinder measure 1 liter of sample to the nearest 5 mL. Record the sample volume and transfer it to a 2000 mL separatory funnel. If high concentrations are anticipated, a smaller volume may be used and then diluted with organic-free reagent water to 1 liter. Adjust the pH to less than 2 with 1:1 sulfuric acid using pH test strips to monitor the pH.

If the entire contents of the sample bottle were used, rinse the bottle by adding 150 mL of ether with a graduated cylinder and shaking for 30 seconds to rinse the walls. Transfer the solvent wash to the separatory funnel.

If it is not necessary to rinse the sample bottle, add 150 mL of ether to the separatory funnel using a graduated cylinder. Extract the sample by shaking the funnel for 2 minutes with periodic venting to release excess pressure. Allow the organic layer to separate from the water layer for a minimum of 10 minutes.

If an emulsion forms and the interface between layers is more than one third the size of the solvent layer, the analyst must employ mechanical techniques to complete the phase separation. The optimum technique depends upon the sample and may include stirring, filtration of the emulsion through glass wool, centrifugation, or other procedure methods.

Drain the aqueous (lower) phase into a 1 liter Erlenmeyer flask. Collect the solvent extract in a 250 mL ground glass Erlenmeyer flask containing 2 mL of 37% KOH. Approximately 80 mL of ether will remain dissolved in the aqueous phase. Repeat the extraction procedure

twice by returning the aqueous phase to the separatory funnel, rinsing the flask with 50 mL of ether and transfer the rinsate to the separatory funnel.

7.3.2 CONCENTRATION

Add one or two clean boiling chips and 15 mL of reagent water to the ether extract in the 250 mL flask and attach a three ball Snyder column. Prewet the Snyder column by adding about 1 mL of ether to the top of the column. Place the apparatus on a hot water bath (60-65° C) so that the bottom of the flask is bathed with hot water vapor. Although the ether will evaporate in about 15 minutes, continue heating for a total of 60 minutes from the time the flask is placed in the water bath. The action of the hot alkali will hydrolyze any target analyte esters present and convert the freed acids to their potassium salts. Remove the apparatus from the water bath and allow to cool to room temperature.

When cool quantitatively transfer the solution to a 125 mL separatory funnel, rinsing the flask repeatedly with small portions of reagent water. The total volume of the rinses should not exceed 10 mL.

Using a graduated cylinder add 20 mL of ether to the funnel and shake for 1 - 2 minutes. After the layers to separate, draw off the aqueous (lower) phase into a clean beaker. The potassium salts of the analytes will be in this solution. Discard the ether layer. Return to aqueous phase to the separatory funnel and rinse the beaker with a 20 mL portion of ether. Add the ether rinse to the funnel and repeat the extraction procedure.

7.3.3 SOLVENT CLEANUP

Acidify the contents of the separatory funnel to pH 2 by adding 2 mL of cold (4°C) 1:3 sulfuric acid. Test the pH of the funnel content using pH paper. If the pH is not the desired value, add additional acid as required.

Using a graduated cylinder add 20 mL of ether and shake vigorously for 1 - 2 minutes. Allow the layers to seperate, draw off the aqueous (lower) layer into a beaker and retain. Pour the organic layer into a 125 mL Erlenmeyer flask containing about 5-7 g of acidified sodium sulfate (see discussion in subsequent text in this section regarding the optimum quantity of sulfate required).

Return the contents of the beaker to the separatory funnel and rinse with 10 mL of ether. Add the ether to the separatory funnel and repeat the extraction procedure. After the layers have separated, draw off the water into the beaker and add the ether to the flask containing the acidified sodium sulfate. Return the water layer to the separatory funnel again and repeat the procedure described in this paragraph once more with an additional 10 mL of ether.

Contact between the ether and the acidified sodium sulfate dries the solvent. Contact overnight is preferable but the interval may be shortened to as little as 2 hours. The drying step is extremely critical to ensuring complete esterification of target analytes during subsequent processing. Residual moisture in the ether will result in poor yield of the esters and resultant low herbicide recoveries. The amount of sodium sulfate specified above is adequate if some free flowing crystals are visible when swirling the flask. If all the sodium sulfate solidifies in a cake, however, it is a good indication that all of the water has not been removed from the ether extract. When such a condition is observed add a few additional grams of acidified sodium sulfate and again test by swirling.

7.3.4 CONCENTRATION

Transfer the ether extract through a funnel plugged with acid washed glass wool into a 500 mL K-D flask equipped with a 10 mL concentrator tube. Use a glass rod to crush caked sodium sulfate during the transfer. Rinse the Erlenmeyer flask and column with 20-30 mL of ether to complete the quantitative transfer.

Add one or two clean boiling chips to the flask and attach a three ball Snyder column. Prewet the Snyder column by adding about 1 mL of ether to the top. Place the K-D apparatus on a hot water bath (60-65-C) so that the concentrator tube is partially immersed in the hot water and the entire lower rounded surface of the flask is bathed in vapor. Adjust the vertical position of the apparatus and the water temperature, as required, to complete the concentration in 15-20 minutes. At the proper rate of distillation the balls of the column will actively chatter, but the chambers will not flood.

When the apparent volume of liquid reaches 1 mL, remove the K-D apparatus from the water bath and allow it to drain and cool for at least 10 minutes. Remove the Snyder column and rinse the flask and its lower joints into the concentrator tube with 1-2 mL of ether using a 5 mL syringe. Add a fresh boiling chip, attach a micro Snyder column to the concentrator tube, and prewet the column by adding 0.5 mL of ethyl ether to the top.

Place the micro K-D apparatus on the water bath so that the concentrator tube is partially immersed in the hot water. Adjust the vertical position of the apparatus and the water temperature as required to complete concentration in 5-10 minutes. When the apparent volume of the liquid reaches 0.5 mL, remove the micro K-D from the bath and allow it to drain and cool. Rinse the walls of the concentrator tube while adjusting the extract volume to 1.0 mL with ether. Proceed to Section 7.4 for esterification.

7.4 ESTERIFICATION

The bubbler method for generation of diazomethane is ideal for use with small batches (10-15) of samples containing environmental concentrations of the target analytes and this procedure is employed in the laboratory. Set up the apparatus shown in Figure 1 in a well-ventilated, hooded area. Due to the potential hazards associated with diazomethane (see Section 4.1, Safety), however, the procedure should not be attempted unless the analyst is experienced in handling the equipment and is thoroughly aware of applicable safety precautions.

Assemble the diazomethane bubbler (see Figure 1) in a well-ventilated, hooded area. Based on the number of field and QC samples being processed, determine the number of 0.1-0.2 g quantities of Diazald required, assuming that 3 sample extracts can be treated with that amount of reagent. Weigh out the desired number of 0.1 to 0.2 g quantities of Diazald and place them in a remote section of the work area.

Using graduated cylinders add 5 mL of ether to the first test tube and combine 5 mL of ether, 4 mL of carbitol and 7.5 mL of 37% KOH in the second tube. Add a preweighed charge of Diazald to the second tube, close the tube and immediately place the exit tube of the bubbler into a concentrator tube containing a sample extract. Apply nitrogen flow (10 mL/min) to the generator and bubble the nascent diazomethane through the extract for 10 minutes or until the typical yellow color of the gas persists.

As noted, the amount of Diazald added to the apparatus is sufficient for esterification of approximately three sample extracts. Additional quantities (0.1-0.2 g) of Diazald may be added after the initial charge is consumed to extend the generation of the diazomethane. There is sufficient KOH present in the original solution to perform a maximum of approximately 20 minutes of total esterification. Clean and recharge the bubbler apparatus as required.

Remove the concentrator tube and seal it with a Neoprene or Teflon stopper. Store the sealed tube at room temperature in the hood for 20 minutes. After that interval, destroy any residual diazomethane by adding 0.1-0.2 g silicic acid to the concentrator tube. After addition of the silicic acid, allow the solution to stand until the evolution of nitrogen gas has stopped.

Adjust the sample volume to 2.0 mL with hexane and transfer the extract to a crimp top vial. The extract is now ready for analysis. As already noted (Section 6.0), timely analysis of methylated extracts is recommended to minimize the transesterification and other potential reactions that may occur. If immediate analysis is not possible, store in the dark at 4 $\pm$ 2° C.

7.5 GAS CHROMATOGRAPHIC CONDITIONS

The gas chromatographic conditions given below are suitable for analysis of targets for this method. Details of the actual GC programs are recorded on sample chromatograms.

For DB-5 columns hold the initial temperature of 80° C for 2 minutes. Ramp to 205° C at a rate of 4° C/minute and hold until all target compounds have eluted.

For a DB608 or DB1701 column hold the initial temperature 80° C for 1 minute. Ramp to 160° C at a rate of 40° C/minute and hold until all target compounds have eluted.

7.6 CALIBRATION

7.6.1 INITIAL CALIBRATION

A minimum of 5 calibration standards (Section 5.3) for the target compounds are analyzed for instrument calibration. An injection volume of 2.0 uL is used throughout calibration and sample analysis.

Tabulate the instrument response (peak area) against the concentration injected (ug/mL) and calculate the ratio of the response to the concentration injected for each analyte at each concentration. This value (calibration factor or CF) is calculated as shown below

$$\text{Calibration factor} = \frac{\text{Total area of peak}}{\text{Concentration injected (ug/mL)}}$$

The mean and standard deviation of the calibration factors obtained for each analyte are calculated using standard statistical formulae.

The percent relative standard deviation (%RSD) of the data for each analyte is calculated using the relationship:

$$\% \text{ RSD} = \frac{SD}{CF} (100)$$

where: % RSD = Percent Relative Standard Deviation
SD = Standard Deviation
CF = Mean Calibration Factor

The calibration is valid and sample extract analysis may begin if % RSD as calculated above is less than 20% over the working range. In this case linearity of the calibration through the origin is assumed and the mean calibration factor may be employed in calculating analyte concentrations in sample extracts. To meet linearity requirements, responses for any two of the middle five standards may be dropped, provided that they are not contiguous (e.g.; the 0.1 and 0.5 standards may be dropped, but if the 0.1 standard is dropped, the 0.25 may not be). The correlation curve generated must pass through the y intercept at an absolute value of ± 10% of the low standard, used in the intital calibration, to be deemed acceptable.

If the %RSD criterion is not satisfied, a calibration curve (concentration injected vs. peak area) is prepared for the analyte. The linear correlation coefficient (r) is determined using the standard statistical formula. If r is 0.990 or higher the calibration curve is assumed to be linear and analyte concentrations in sample extracts are calculated using the linear regression equation.

If the initial calibration criteria are not satisfied, corrective action(s) is required. Once the action(s) is completed and proper function of the analytical system has been restored, the system must be recalibrated.

7.6.2 CALIBRATION VERIFICATION

An existing working calibration curve may be verified by injecting one or more mid-level calibration standards and evaluating the results observed as noted below. This verification is required as follows: 1) at the beginning of each working day (see below); 2) after analysis of 10 field or QC samples (see Section 7.8.1.2); and 3) at the completion of sample analysis (see Section 7.8.3).

The response of the instrument is compared with the response observed during initial calibration as follows:

$$\%D = \frac{CF - CF_c}{CF} \times 100$$

where %D = Percent Difference
CF = Average Calibration Factor
CF_c = Continuing Calibration Factor

If the absolute value of %D is 15% or less, sample analysis may proceed.

If the response is greater than 15% for any analyte the chromatographic system must be inspected and corrective action taken to restore proper function. When corrective actions are complete the system must be recalibrated for the analyte which failed the criterion before sample analysis may proceed.

7.7 RETENTION TIMES

7.7.1 ABSOLUTE WINDOWS

Absolute retention time windows for all analytes are developed by making three injections of a mid range standard throughout the course of a 72-hour period. Serial injections made over less than a 72-hour period result in retention time windows that are too narrow.

Calculate the standard deviation of the three retention times (measured in minutes) observed for the each analyte. The retention time window for the analyte is plus or minus three times that standard deviation.

In cases where the standard deviation is zero a window of 0.05 minutes will be applied.

Retention time windows are reestablished for all analytes whenever a new GC column is installed in the instrument. Retention time data are retained on file for review as required.

7.7.2 DAILY RETENTION TIME WINDOWS

Daily retention time windows are established for each analyte based on the retention time observed for either; 1) the last standard analyzed during initial calibration (Section 7.8.1.1); or 2) the daily verification standard (Section 7.8.1.2). The daily retention time window is equal to the observed retention time in the standard ± the absolute window determined as described in Section 7.7.1.

7.8 SAMPLE ANALYSIS

7.8.1 CALIBRATION

7.8.1.1 INITIAL CALIBRATION

Before sample analysis may begin, the instrument must be fully calibrated for the analytes of interest as outlined in Section 7.6.1 or, alternatively, the last acceptable initial calibration may be verified by a daily calibration procedure. The daily calibration requires analysis of mid-level standard of target analytes of interest as described in Section 7.6.2.

When the latter option is selected to begin a new analytical run, routine maintenance (e.g., septum change, insert change, etc.) may be performed as required prior to injection of the daily standard.

The calibration factor for each analyte must agree within 15% (Section 7.6.2) of the mean calibration factor for that analyte found in the applicable initial calibration. If the system fails to meet these requirements, the system must be recalibrated as described in Section 7.6.1.

7.8.1.2 CONTINUING CALIBRATION VERIFICATION

After analysis of every ten field or QC samples, calibration of the instrument system must be verified. This verification consists of analysis of mid-level calibration standards (CCV's) for the analytes of interest as described in Section 7.6.2.

If the observed retention times for the analytes are not within the established windows or the 15% criterion is violated, corrective action is required before recalibrating and proceeding with sample

analysis. Any repair or maintenance is recorded in the run log and the maintenance log for the instrument.

All samples that were injected after the standard exceeding the response criterion must be reinjected if the initial analysis indicated the presence of the specific target analytes that exceeded the criterion to avoid errors in quantitation. All samples that were injected after the standard exceeding the retention time criterion must be reinjected to avoid false negatives and possibly false positives.

7.8.2 OVER RANGE SAMPLES

Sample extracts containing analyte concentrations higher then the high standard must be diluted appropriately and reanalyzed. When sample extracts of high concentration are encountered the carryover check procedures described in Section 8.6.2 must be performed.

7.8.3 CLOSEOUT

When sample analysis is complete, mid-level standards containing the analytes of interest are evaluated. The criteria of: 1) 15% agreement with the responses for those analytes in the applicable initial calibration; and 2) agreement with daily retention time windows are evaluated as described in Section 7.8.1.2.

7.8.4 DOCUMENTATION

When possible, samples are assigned to analytical runs dependent on the criteria outlined in Section 8.7. Many times, however, priorities associated with holding time, delivery date and other considerations may require different practices. After making those assignments, identifiers for the selected samples are entered into the software identified in Section 4.5. A hardcopy of the data entered is prepared and affixed to an appropriate page in a logbook. The page in the logbook is dated and signed by the analyst.

7.9 ANALYTE IDENTIFICATION AND QUANTITATION

7.9.1 IDENTIFICATION

Tentative identification of an analyte occurs when a peak from a sample extract falls within the daily retention time window for that analyte. Procedures for establishing retention time windows are described in Sections 7.7.1 and 7.7.2.

Confirmation is required by analysis of the extract on a second column of differing polarity unless customer specifications dictate otherwise.

7.9.2 ANALYTE QUANTITATION

Sample concentrations are calculated based on the levels of analyte found in the extracts evaluated. (NOTE: If calibration is performed using standards made from methyl ester compounds, then the calculation of concentration must include a correction factor for the molecular weight of the methyl ester versus the acid herbicide. (See Table 5). Dependent on the initial calibration procedure (see Section 7.6.1) extract levels (ug/mL) are calculated for each analyte based in one of two ways. When the initial calibration is based on calibration factors, the calibration factor equation in 7.6.1 is solved for extract concentration and it becomes:

(1) ug analyte/mL = (peak area)/(calibration factor)

If the linear regression equation is used for initial calibration, extract concentration is calculated using the relationship:

(2) ug analyte/mL = slope(peak area) + y intercept

Using extract concentration values, the concentrations of each analyte in the original samples are then calculated as follows:

Aqueous Samples:

$$\text{ug analyte/L of sample} = \frac{(A)(V_f)(DF)(CF)}{V_i}$$

Where: A = Concentration of the analyte found in the sample extract using the calculations in 1) or 2) above;
V_f = Volume of final extract of sample (mL);
V_i = Initial sample volume (L); and
DF = Dilution Factor
CF = Correction Factor

Soil Samples:

$$\text{ug analyte/Kg of sample} = \frac{(A)(V_f)(DF)(CF)}{Wi}$$

Where: A = Concentration of the analyte found in the sample extract using the calculations in 1) or 2) above;
V_f = Volume of final extract of sample (mL);
DF = Dilution Factor; and
Wi = Initial sample weight (as is) in kilograms. When results are to be reported on a dry substance basis, the concentration calculated by the relationship above is corrected by dividing that value by the total solids in the sample expressed as a decimal fraction.
CF = Correction factor

7.9.3 SURROGATE RECOVERY

Surrogate recovery is calculated as follows:

$$\% \text{ Recovery} = \frac{\text{Amount Found}}{\text{Amount Added}} \times 100$$

7.9.4 SPIKE RECOVERY

Spike recoveries are calculated as follows:

$$\% \text{ Recovery} = \frac{A_{ss} - A_s}{A_{spk}} \times 100$$

where: A_{ss} = amount found in spiked sample
A_s = amount found in unspiked sample
A_{spk} = amount of spike added

7.9.5 LCS RECOVERY

LCS recoveries are calculated as follows:

$$\% \text{ Recovery} = \frac{\text{Amount Found}}{\text{True Value}} \times 100$$

8.0 QUALITY CONTROL

8.1 ANALYTICAL SEQUENCE

An analytical sequence consists of:

1 System calibration (Section 7.8.1.1)
2 Analysis of 10 field and/or QC sample extracts
3 Calibration verification (Section 7.8.1.2)
4 Repetition of steps 2 and 3 until all samples are analyzed (or the sequence is interrupted by QC sample failure)
5 Run closeout (Section 7.8.3)

To simplify data reduction and reporting an effort is made to analyze samples from the same sample group (see 8.7 for definition) in the same sequence. This practice is not a requirement, however, and it may be overturned dependent on considerations relative to holding time, reporting due date, sample load, etc.

8.2 INSTRUMENT QC

Each working day, the system is checked to determine if it is functioning properly.

Gauge readings on the gas cylinders are evaluated to determine if there is a sufficient supply to complete the analytical sequence contemplated.

The bottles on the autosampler are inspected to determine if there is an adequate supply of solvent for rinsing the syringe and whether the waste bottles need to be emptied.

The condition of the septum is evaluated and replacement made if required.

The preparation date on the standards is checked to be certain that they have not expired.

After the analysis of a blank and first standard the overall performance of the analytical system is evaluated by inspection of the chromatograms obtained. The traces are evaluated with regard to such matters as: the appearance and amplitude of the analyte peaks; the resolution obtained; the stability of the baseline; etc.

If, in the technical judgment of the analyst, there is a problem with the chromatographic system, it must be corrected before attempting calibration and sample analysis. The extent of the corrective actions to be taken will be determined by the analyst and the group supervisor.

Any time major maintenance is performed on the system (e.g., column replacement, repair or replacement of the detector, etc.) or a

different temperature program is employed, the system must be recalibrated.

8.3 CALIBRATION

The analytical system must be calibrated as described in Section 7.8.1.1 or 7.8.1.2.

8.4 RETENTION TIMES

Section 7.7 outlines the requirements for establishing retention time windows

8.5 SURROGATE QC

The surrogate recovery for each method blank, environmental sample and batch QC sample must be determined. Once a minimum of thirty samples of the same matrix have been analyzed, the average percent recovery (p) and standard deviation (s) are calculated for the surrogate using standard statistical formulae. The limits are established as follows:

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

Surrogate limits are updated at least annually. QC charts of all surrogate recoveries are maintained in the laboratory. Unless otherwise required by the customer, the experimentally established windows calculated as above are the absolute UCL and LCL for surrogate recovery.

The failure of any sample to satisfy surrogate recovery limits shall be investigated and, if warranted, reextraction and reanalysis shall be initiated. In all cases, recoveries shall be documented in the raw data package.

8.6 BLANK QC

8.6.1 METHOD (REAGENT) BLANK

A method blank is extracted with each sample group (defined in Section 8.7). Target analyte concentrations observed in the method blank may not exceed either: 1) the values listed in Table 4; or 2) other limits specified by the customer.

Failure to meet this criteria must be investigated. If warranted, all samples within the batch will be reextracted and reanalyzed. In all cases, method blank analysis and results shall be documented in the raw data package.

8.6.2 CARRYOVER CHECKS

After a sample that contains a target compound at a level exceeding the initial calibration range, corrective action must be taken. Corrective action must be either:

* Analyze an instrument blank immediately after the contaminated sample. The instrument blank must meet method blank criteria as described in Section 8.6.1.
* Monitor the sample analyzed immediately after the contaminated sample for all compounds that were in the contaminated sample and that exceeded the calibration range. The sample must not contain a concentration above the PQL/EQL for the target compounds that exceeded the limits in the contaminated sample. If the criteria are exceeded, the affected sample(s) must be reanalyzed.

8.6.3 SPIKE BLANK

A spike blank is prepared from reagent water for each sample group (see Section 8.7 for definition) by adding 250 uL of matrix spike working solution (Section 5.3.5) to 1 liter of reagent water. The spiked water is then extracted in parallel with the samples in the batch.

Spike blank results are utilized: 1) to verify that the matrix spike working solution is in acceptable condition; 2) as a guide to verify potential matrix effects indicated by MS/MSD results; 3) as a means of verifying precision and accuracy when insufficient sample is available for preparation of MS/MSD.

8.7 SAMPLE GROUP QC

ARDL defines a lot or group of samples as:

- No more than 20 field samples of similar matrix prepared for analysis at the same time with the same reagents.

8.7.1 MS/MSD

The laboratory must prepare and analyze a matrix spike and matrix spike duplicate along with a spiked blank prepared from reagent water for each sample group. If inadequate sample volume is available for preparation of the spiked samples, a spiked blank and a spiked blank duplicate (Section 8.6.3) will be evaluated to satisfy precision and accuracy requirements.

When the concentration of specific analyte is not being checked against a regulatory limit specific for that analyte, MS/MSD samples are prepared as described in Section 5.5. When other specific spiking levels are required working solutions at other concentrations are prepared using the techniques described in Section 5.5.

Method accuracy for each matrix and for spike blanks is assessed and charted on plotting software. After the analysis of five spiked samples (of the same matrix type), the average percent recovery (F) and the standard deviation of the percent recovery (sp) are calculated using standard statistical formulae. Accuracy assessment is expressed as a percent recovery interval of $F \pm 2sp$. The accuracy assessments are updated automatically by the plotting software (Sigmaplot 5.0) as new data are entered. Until laboratory limits have been established, the limits given of 50-150% are employed as upper and lower control limits.

The failure of any of the spiked samples to meet recovery criteria shall be investigated and if warranted, reextraction and reanalysis shall be initiated. At a minimum, in the event of a spike sample failure, system calibration will be verified by analysis of a check standard. In all cases, recoveries shall be documented in the raw data package.

8.7.2 LABORATORY CONTROL SAMPLE

Laboratory control samples (LCS) are prepared by spiking reagent water with a certified LCS preparation obtained commercially. QC charts of accuracy and precision for each analyte in the LCS are maintained.

9.0 METHOD PERFORMANCE

The method detection limit (MDL) is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the concentration is greater than zero. This value is determined experimentally on at least an annual basis using the guidance appearing in Chapter One, pp. 25-26 of SW-846, Revision 1, July 1992.

Typically the experimentally determined values are equal to or slightly less than those given in Reference 2.

10.0 REFERENCES

1. SW-846, Method 8000A, Revision 1, July 1992
2. SW-846, Method 8150A, Revision 1, July 1992
3. SW-846, Method 8150B, Revision 2, September 1994

11.0 LOCATION

The text of this document is stored as an AMIPRO word processor file in K:\ORG\ROB\SOP8151.SAM.

Table 1 - Stock Standard Concentrates

Mix	Analyte	Concentration of Each Analyte (ug/mL)
HERB Mix 1	2,4-D 2,4-DB 2,4,5-T Silvex Dalapon Dicamba Dichloroprop Dinoseb	200
HERB Mix 2	MCPP	50,000
HERB Mix 3	MCPA	50,000
HERB-Surrogate	2,4-dichlorophenylacetic acid	100

Table 2 - Preparation of Calibration Standards
Volume of Composite Required for Indicated Concentration

Standard 1 Final Concentration (ug/mL) (1)	0.25	0.40	0.50	0.75	1.0	1.5	2.0
Volume Composite 1	250 uL	400 uL	500 uL	750 uL	1000 uL	1500 uL	2000 uL
Standard 2 Final Concentration (ug/mL) (1)	100	200	400	500	700	800	1000
Volume Composite 2	200 uL	400 uL	800 uL	1000 uL	1400 uL	1600 uL	2000 uL

(1) When diluted to final volume of 10.0 mL

Table 3 - Typical Retention Times (minutes)

Analyte	DB-5	DB-1701	DB-608
2,4-D	9.01	9.56	11.51
2,4-DB	15.07	14.12	15.05
2,4,5-T	12.88	12.88	14.13
2,4,5-TP (Silvex)	11.83	11.54	12.99
Dalapon	0.86	1.33	1.61
Dicamba	6.69	6.61	9.25
Dichloroprop	8.54	8.54	10.52
Dinoseb	14.16	15.86	14.35
MCPP	8.63	5.44	8.43
MCPA	8.98	6.02	9.24
4-Nitrophenol	NE	NE	NE
Pentachlorophenol	NE	NE	NE

Table 4 - Method Detection Limits

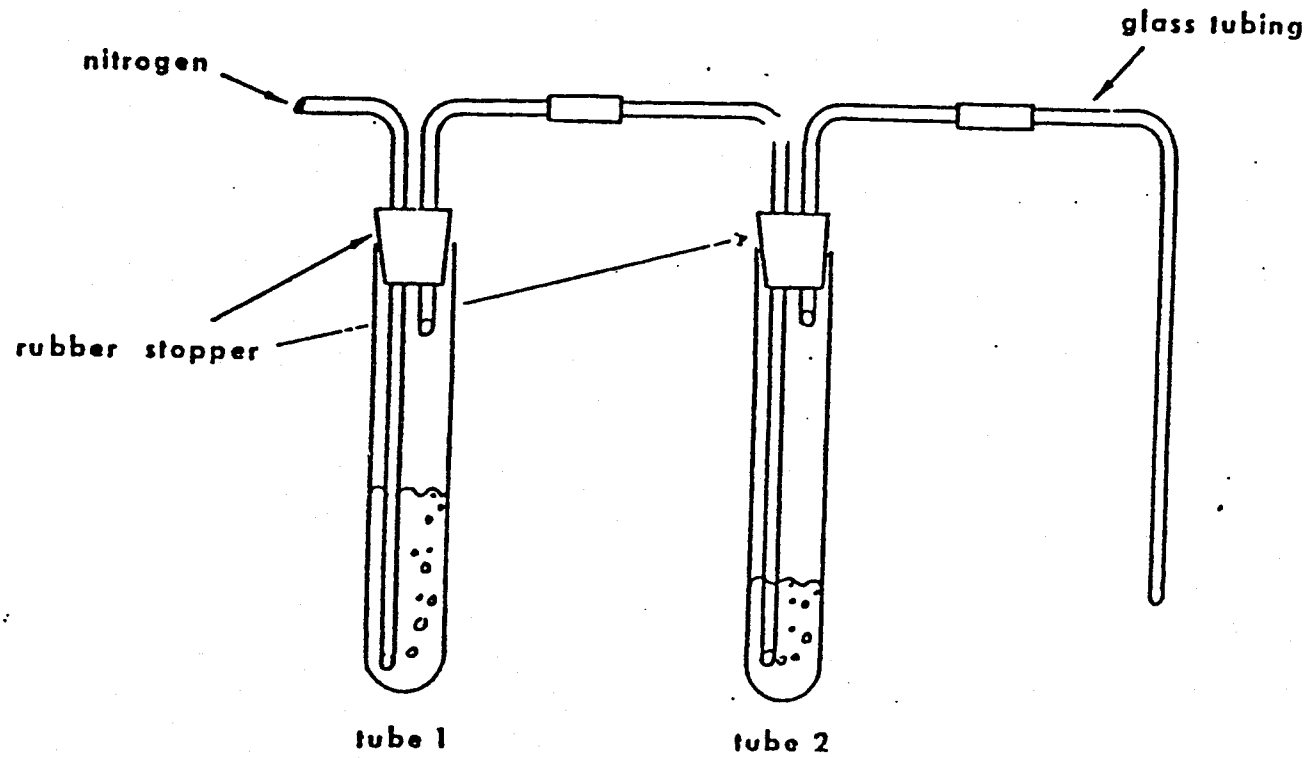
Analyte	Water (ug/L)	Soil (ug/kg)
2,4-D	0.06	1.2
2,4-DB	0.06	1.2
2,4,5-T	0.07	1.3
2,4,5-TP (Silvex)	0.06	1.3
Dalapon	0.07	1.2
Dicamba	0.06	1.3
Dichloroprop	0.07	1.6
Dinoseb	0.06	1.4
MCPA	35.1	640
MCPP	33.0	670
4-Nitrophenol	NE	NE
Pentachlorophenol	NE	NE

NE = Not Established

TABLE 5 - HERBICIDE CORRECTION FACTORS

COMPOUND	CORRECTION FACTOR
2,4-D	0.940
Dalapon	0.917
2,4-DB	0.947
Dicamba	0.940
Dichlorprop	0.944
Dinoseb	0.945
MCPA	0.935
MCPP	0.939
Silvex (2,4,5-TP)	0.950
2,4,5-T	0.948

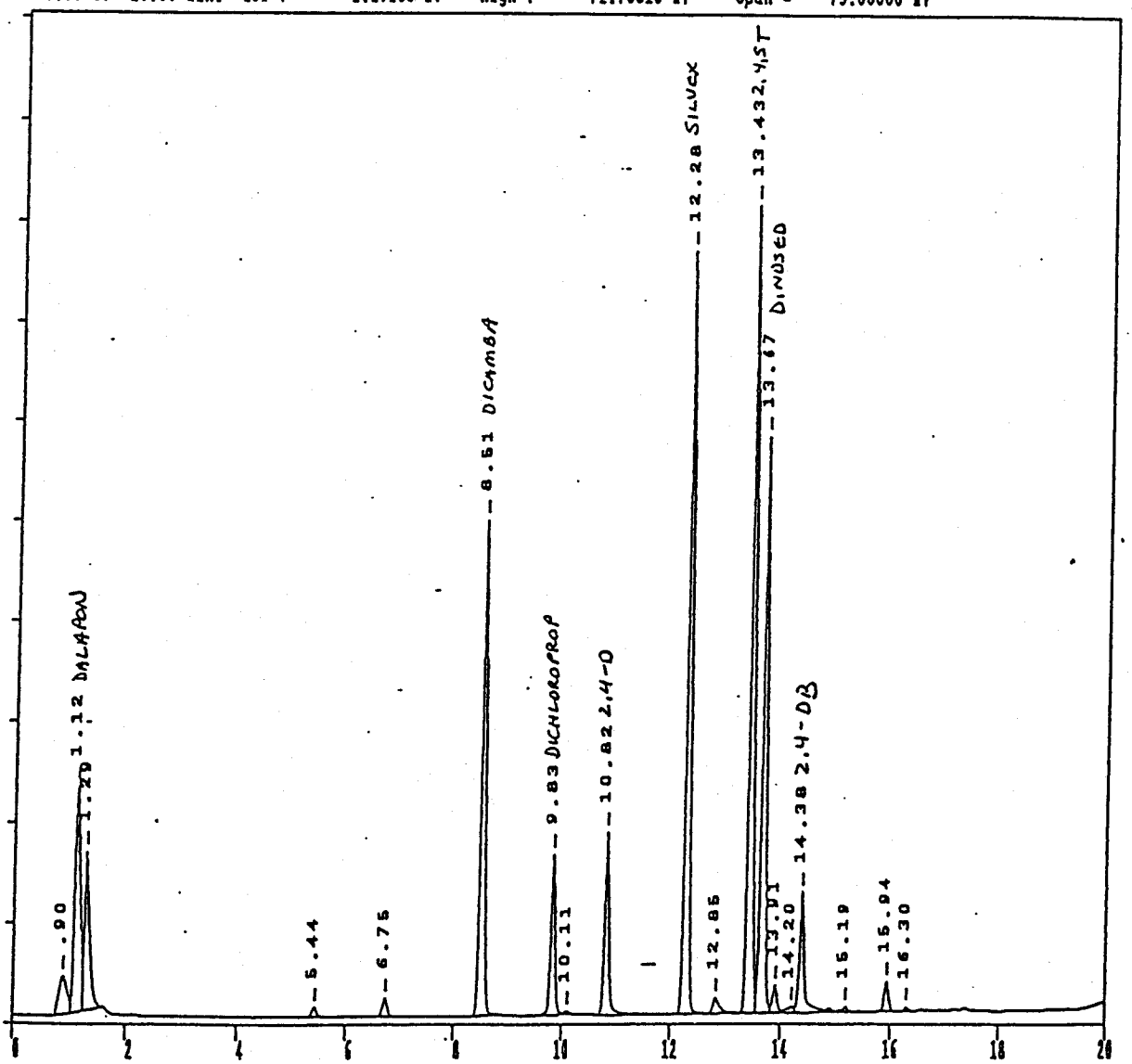
FIGURE 1 - DIAZOMETHANE BUBBLER ASSEMBLY



ATTACHMENT 1

Typical Herbicide Standard on DB608 Column
(except MCPP & MCPA)

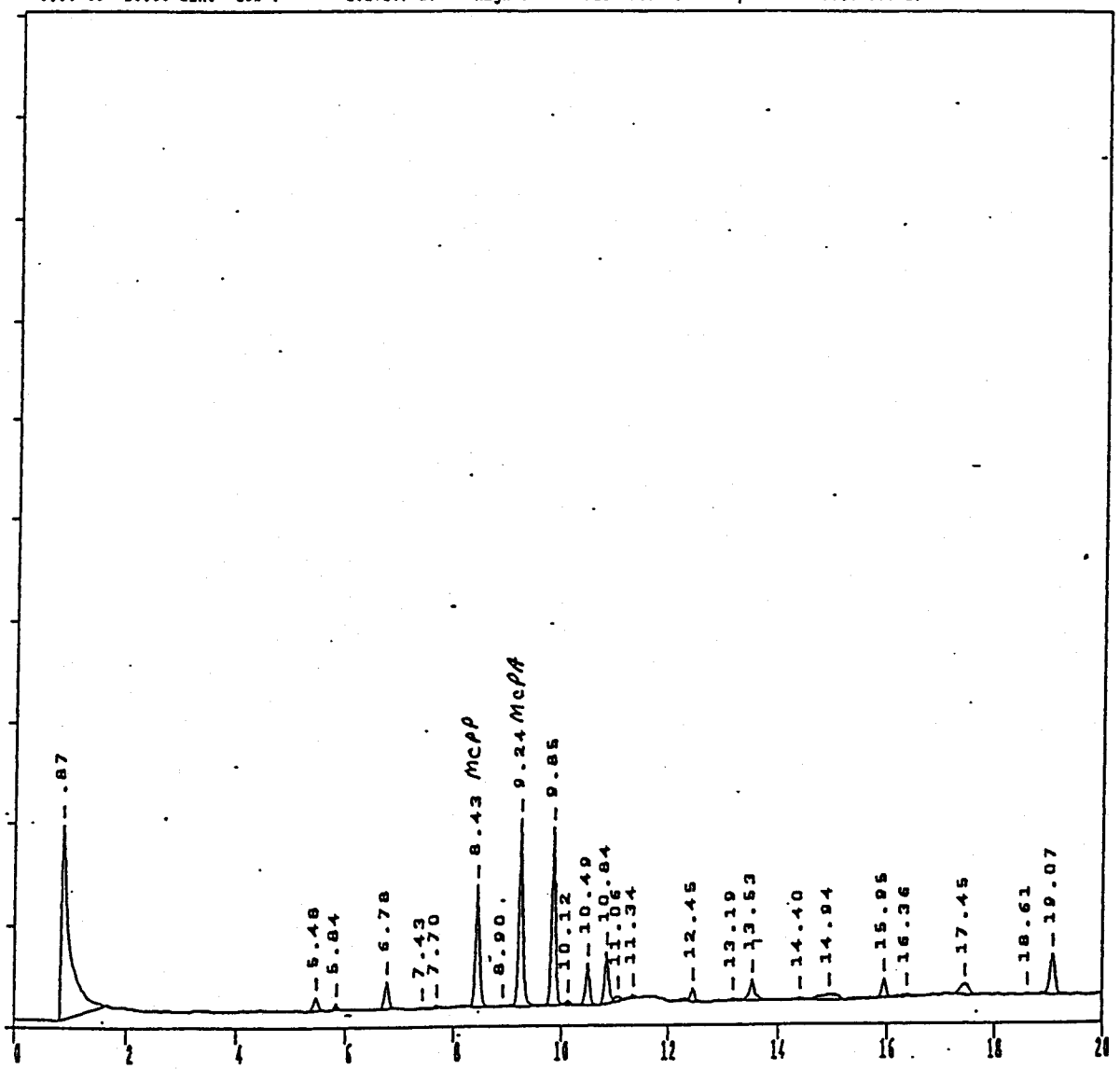
File=h:\cp2\hp2\HP209.75R Sample name=.10 PPM HERB Date printed= 12-30-1992 Time= 15:34:44
0.00 to 20.00 min. Low Y = -2.29185 mv High Y = 72.70816 mv Span = 75.00000 mv



ATTACHMENT 2

Typical Herbicides MCPP & MCPA on DB608 Column

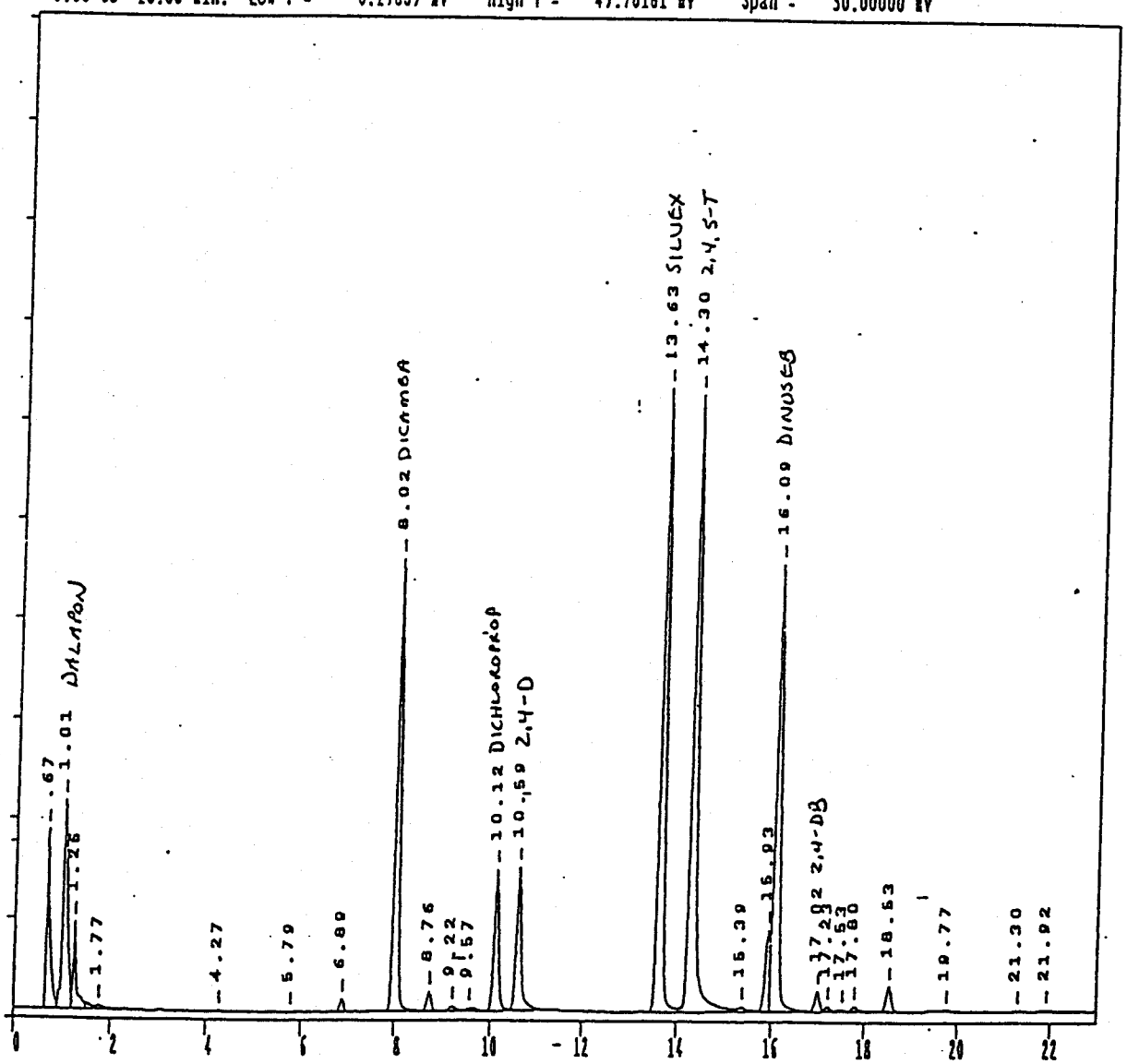
File=h:\cp2\hp2\HP209.78R Sample name=30 PPM MCPP & MCPA Date printed= 12-30-1992 Time= 16:45:33
0.00 to 20.00 min. Low Y = -2.19247 mv High Y = 72.80753 mv Span = 75.00000 mv



ATTACHMENT 3

Typical Herbicides on DB5 Column
(except MCPP & MCPA)

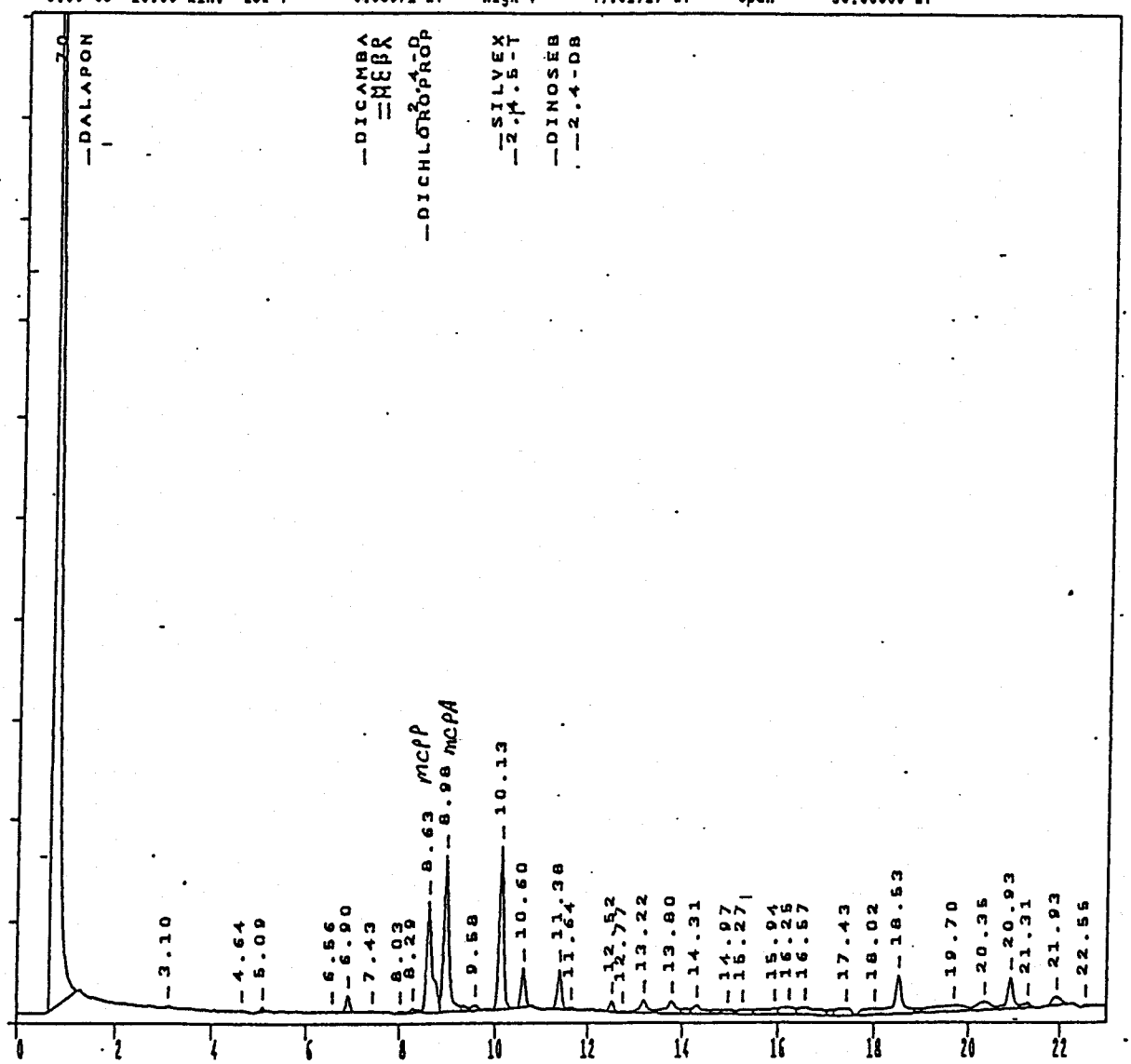
File=h:\cp2\hp1\HP109.30R Sample name=.10 PPM HERB Date printed= 12-30-1992 Time= 16:39:58
0.00 to 23.00 min. Low Y = -0.29839 mv High Y = 49.70161 mv Span = 50.00000 mv



ATTACHMENT 4

Typical Herbicides MCPP & MCPA on DB5 Column

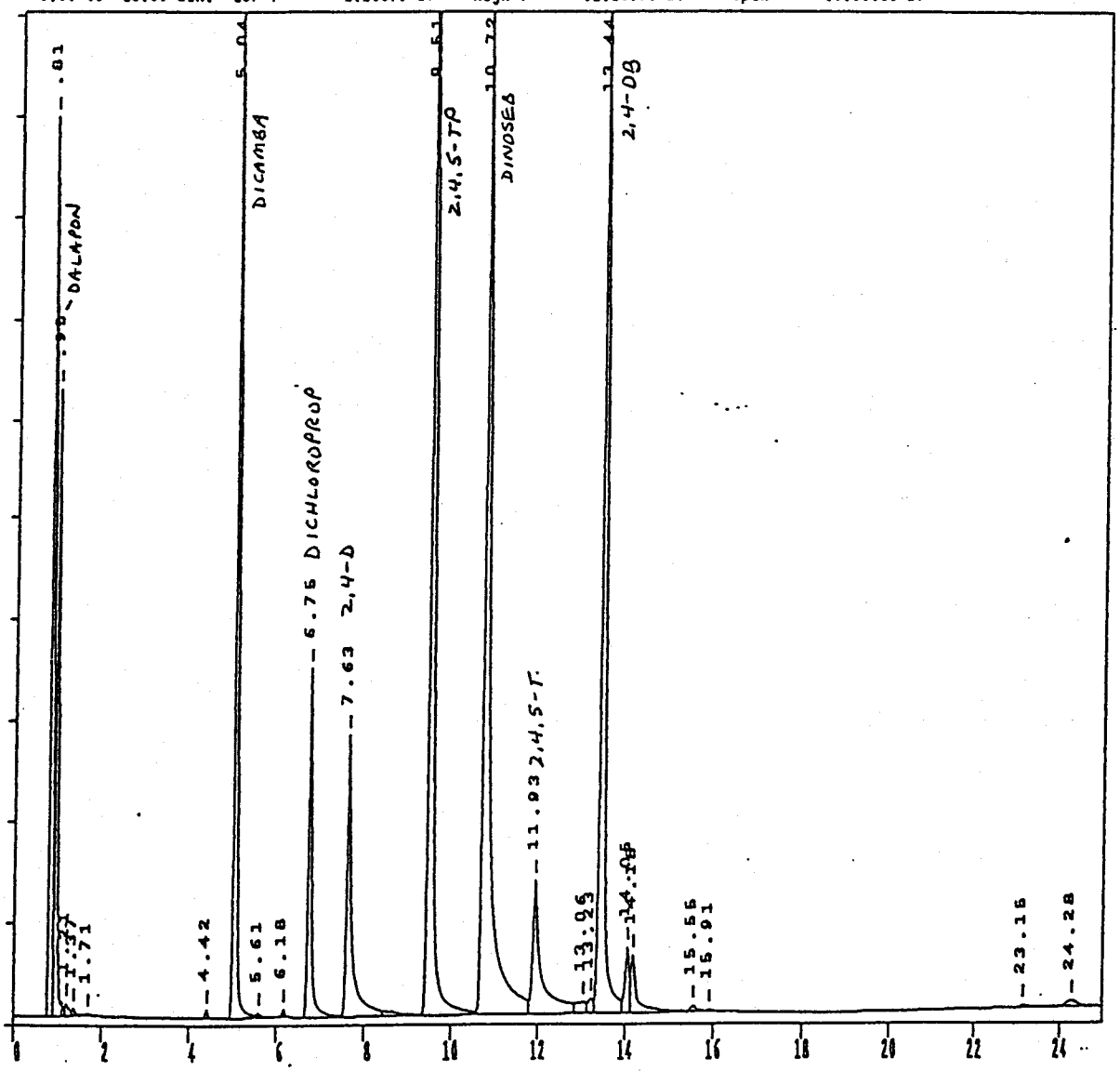
File=h:\cp2\hpl\HP109.33R Sample name=30 PPM MCPP & MCPA Date printed= 12-30-1992 Time= 17:54:33
0.00 to 23.00 min. Low Y = -0.38071 mv High Y = 49.61929 mv Span = 50.00000 mv



ATTACHMENT 5

Typical Herbicides on RTx 1701 Column
(except MCPP & MCPA)

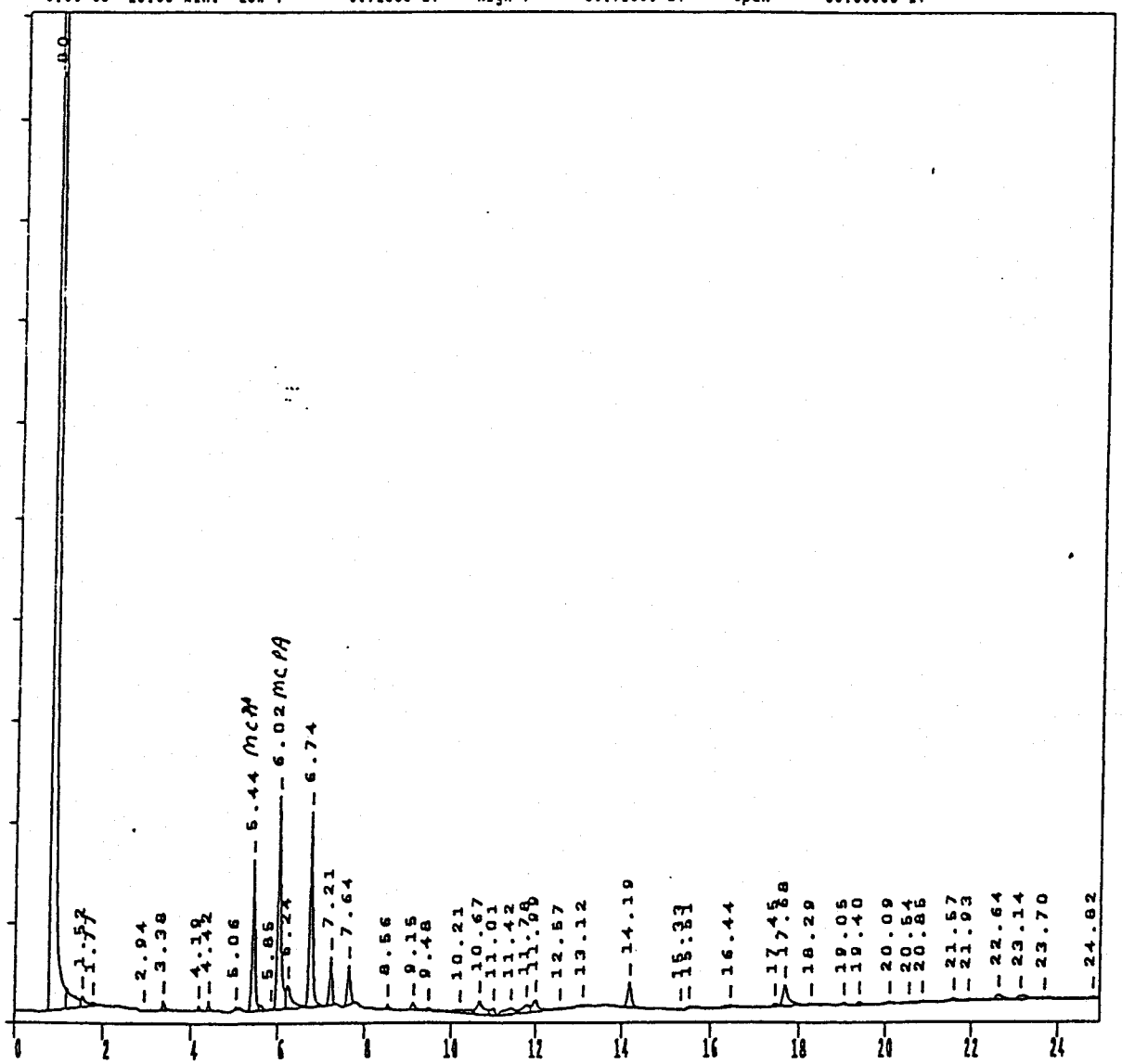
File=h:\cp2\hp7\HP708.71R Sample name=.20 PPM HERB Date printed= 12-14-1992 Time= 12:53:27
0.00 to 25.00 min. Low Y = 1.10575 mv High Y = 51.10575 mv Span = 50.00000 mv



ATTACHMENT 6

Typical Herbicides MCPP & MCPA on RTx 1701 Column

File=h:\cp2\hp7\HP708.75R Sample name=30 PPM MCPP & MCPA Date printed= 12-14-1992 Time= 14:42:23
0.00 to 25.00 min. Low Y = 0.92583 mv High Y = 50.92583 mv Span = 50.00000 mv



BELING CONSULTANTS

Beling Building, 1001 - 16th Street
Moline, Illinois 61265
(309) 757-9800
Fax: (309) 757-9812

Offices in Chicago, Joliet and Peoria, Illinois;
Davenport, Iowa; Beloit, Wisconsin; Hammond, Indiana; and Columbus, Ohio

PROVIDING PROFESSIONAL ENGINEERING AND ENVIRONMENTAL SERVICES FOR OVER 60 YEARS