EMERGENCY RESPONSE BRANCH REGION VIII
QUALITY ASSURANCE PROJECT PLAN

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EMERGENCY RESPONSE BRANCH

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ENDORSEMENT AND APPROVAL
FOR IMPLEMENTATION

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INTRODUCTION

Environmental Protection Agency (EPA) policy requires that all organizational units performing environmentally-related measurements, including program offices, all EPA regional offices, and EPA laboratories, participate in a centrally managed quality assurance (QA) program. This requirement applies to all environmental monitoring and measurement efforts mandated or supported by EPA (Administrator's Memorandum, May 30, 1979). As stated in EPA Executive Order 5360.1, "Policy and Program Requirements to Implement the Mandatory Quality Assurance Program," the primary goal of the QA program is to ensure that all environmentally-related measurements performed or supported by EPA produce data of known quality. The quality is known when all components associated with its derivation are thoroughly documented, with such documentation being verifiable and defensible.

As part of their participation in the Agency-wide QA program, EPA program offices are required to establish their own "QA Program Plan." The plan is to be prepared and annually updated based on guidelines established by the Quality Assurance Management Staff (QAMS). The Office of Emergency and Remedial Response (OERR), within the Office of Solid Waste and Emergency Response (OSWER), is responsible for developing and managing the CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act) QA Program. The OERR has established four levels of QA documentation (OSWER Directive 9360.0-01, Figure 1):

Quality Assurance Program Plan
(Headquarter Level)
¦
¦
Regional QA Program Plan
(Regional Level)
¦
¦
Generic QA Project Plan
(Branch Level)
¦
¦
Sampling QA/QC Plan
(Site Specific)

Figure 1: EPA Quality Assurance Documentation

As per QAMS-004/80 guidance, OSWER Directive 9200.1-05 provides the structure, responsibilities, and authorities of the CERCLA QA Program Plan. It describes resources for performing quality assurance and specifies the QA activities involved in the development of environmental data that relate to the implementation of CERCLA, which includes the Removal program.

The EPA Region VIII Environmental Services Division (ESD) is responsible for developing and managing the Region VIII QA Program Plan (RQAPP, Document Control #R8-QAMS-89-1). The RQAPP is management's statement of and commitment to the total process that governs the quality assurance activities within the region.

To meet the requirements for a QA Project Plan, the Emergency Response Division (ERD) of OERR established a QA Workgroup to provide QA guidance for the Agency-wide Removal program. The Workgroup decided that the QA Project Plan would be divided into two functional documents: a generic "Branch QA Project Plan," and a site specific "Sampling QA/QC Plan." Combined, both documents should address the sixteen elements described in QAMS-005/80. As a result, OSWER Directive 9360.4-01 provides a detailed description of each section to be contained in a "Sampling QA/QC plan." The Environmental Response Team (ERT) computerized the "Sampling QA/QC plan" in Wordperfect 5.0 (called Quality Assurance Sampling Plan (QASP)).

The Region VIII Emergency Response Branch (ERB) develops this Branch QA Project Plan (QAPjP) for Removal program in Region VIII under the guidance of OSWER Directive 9200.1-05, OSWER Directive 9360.4-01, Region VIII QAPP (R#8-QAMS-89-1), and Guidelines and Specifications for Preparing Quality Assurance Project Plan (QAMS-005/80). The Branch QAPjP is to be reviewed and updated at any time if necessary to reflect operational changes in the Region VIII Removal program.

PURPOSE

This ERB QAPjP specifies the policies and all other essential elements of a QAPjP for Removal program within the Region. As stated in OSWER Directive 9360.4-01, this document is used as a generic ERB QAPjP for Removal projects. For each specific site, where sampling would be performed, a Sampling QA/QC Plan would be prepared. In the case of emergency response (classic emergency/opportunity sampling), this ERB QAPjP will be used as a generic QAPjP. However, all emergency responses require a QA Project Plan/site-specific Sampling QA/QC Plan to be in files no later than 30 days after the response date,

even though the requirement for the plan was initially waived (OSWER Directive 9200.1-05).

STANDARD OPERATING PROCEDURES

A large number of field and laboratory operations can be standardized and written as Standard Operating Procedures (SOPs). The EPA-ERB has developed the Region VIII ERB-QA Sampling Guidelines that cover all routine activities which could directly or indirectly influence data quality. The Region VIII ERB-QA Sampling Guidelines contents include:

- Health and Safety Procedures
- Instrumentation
- Sampling Procedures
- Field QA/QC Control
- Sample Handling, Custody, Packaging and Shipping
- Laboratories and Analytical References

A copy of the Region VIII ERB-QA Sampling Guidelines is incorporated into this ERB QAPjP as an Appendix (Appendix A). This includes references of all available EPA approved/adopted documents. If necessary, the ERB On-Scene Coordinator (OSC) has the option to adopt other SOPs utilized by the Environment Response Team (ERT) or the sampling contractor(s).

PLAN PREPARATION, REVIEW, AND APPROVAL

The OSC has the responsibility to ensure that the Sampling QA/QC Plan is developed, and that his/her objectives and all requirements specified in this ERB QAPjP are met. To develop the site-specific Sampling QA/QC Plan, the OSC may wish to use the instructions in the ERT computerized Sampling QA/QC Plan as amended (Appendix B). If a site specific QAPjP is needed or required by the OSC, the sixteen elements listed in QAMS 005/80 which are described in this QA Project Plan should be addressed.

The OSC will review and approve the site-specific Sampling QA/QC Plan and may obtain assistance from the Regional Quality Assurance Officer (QAO).

For the potentially responsible parties (PRPs) Removal project overseen by EPA-ERB, it is required that the PRP develops its own QAPjP which should be reviewed and approved by the OSC.

GENERIC QUALITY ASSURANCE PROJECT PLAN

(1.0 Title Page)

QUALITY ASSURANCE PROJECT PLAN

(THE SITE/PROJECT NAME)

Prepared For:

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
EMERGENCY RESPONSE BRANCH

Prepared By:

(NAME/CONTRACTOR NAME)
(ORGANIZATION)
(EPA Work Order/Contract Number)

Date: _____

APPROVALS

(CONTRACTOR)		EPA	
_____	_____	_____	_____
(Task Leader)	Date	(EPA-OSC)	Date
_____	_____	_____	_____
(Project Manager)	Date	(Name/Title)	Date

(2.0 Table of Contents)

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3.0 Project Description

3.1 Introduction

A brief description of the site including the name, location, and site specific features. A brief description of the events or occurrences that led to the initiation of the sampling activity.

3.2 Background

A brief description of the site's history (past/current operations). The history includes information of chemicals known to have been processed, dumped, or spilled on site which possibly contributed to the suspected contamination, and a summary of previous sampling efforts. This subsection also should include the area, size, and proximity to local residents, or any other information that may be useful in an assessment of the situation and determination of sampling/ analytical needs. Sources of such data may come from inventories, manifest, or other records; prior sampling data, such as that generated by a Remedial Investigation/ Feasibility Study (RI/FS) and geological/hydro-geological surveys; and incidents of exposures.

3.3 Project Objectives and Scope

Identify the specific objectives of the work assignment (i.e., to determine the presence or extent of contamination). Determine the intended data uses (site monitoring, site characterization, risk assessment, enforcement action, disposal, etc.)

Give an overview of the project's scope (sample locations, matrix, number of samples and parameters for analysis, etc.)

4.0 Project Organization and Responsibility

4.1 Project Management

The ERB-OSC has the ultimate responsibility for decisions concerning the project/site (See Appendix C for Organization and Delegation of QA Responsibilities for the ERB Analytical Data Collection Activities).

The Task Leader or Project Manager is the primary point of contact with the EPA-OSC. The Project Leader is responsible for the development and completion of the Sampling QA/QC Plan, project team organization, and supervision of all project tasks, including reports and

deliverables.

The site QC Coordinator is responsible for ensuring field adherence to the Sampling QA/QC Plan and recording any deviations. The Site QC Coordinator is also the primary project team contact with the lab. The following field sampling personnel will work on this project:

Personnel	Responsibility
i.e., ERB-OSC	Overall Project
Project Manager/Leader	Sampling Operations
	Site QC
	Site Health and Safety
	Sampl. Activities Report
Laboratory	Sample Analysis/QC
	Data Validation/Report
	Overall Q.A.
	Final Report, etc.

The QA Officer, Health and Safety Officer and Project Manager are responsible for auditing and guiding the project team, reviewing the final deliverables and proposing corrective action, if necessary, for nonconformity to the Sampling QA/QC Plan or Health and Safety Plan.

4.2 Project Schedule

Identify the project tasks and time lines associated with them in Table 1.

Table 1: Proposed Schedule of Work

Activity	(Time Period)			
1. Laboratory Procurement				
2. Sample Staging				
3. (Sampling - Soil)				
4. (Sampling - Groundwater)				
5. Laboratory Analysis				
6. Data Review				
7. Draft Report				
8. Final Report				

5.0 Quality Assurance Objectives

The QA objectives must correspond with the data use objectives. In order to provide defensible data, the OSC should establish Data Quality Objectives (DQOs) for each major sample collection effort. The data quality criteria should be addressed as part of the DQO development process, including:

Precision (the level of agreement among repeated measurements of the same characteristic);

Accuracy (the level of agreement between an estimate based on the data and a true value of the parameter being estimated);

Representativeness (the degree to which the collected data accurately reflect the medium being sampled);

Completeness (the comparison of the amount of data to be collected and the amount intended in the design);

Comparability (the similarity of data from different sources included in a single data set).

The QA objectives of this project apply to all the following parameters:

Parameters	Matrix	Intended Use of Data	QA Objective
(VOA)	_____	_____	_____
(BNA)	_____	_____	_____
(PESTICIDE)	_____	_____	_____
(PCB)	_____	_____	_____
(METALS)	_____	_____	_____
(CYANIDE)	_____	_____	_____
(OTHER)	_____	_____	_____

Note: There may be more than one Matrix or Intended Use of Data or QA Objective for each Parameter.

Three equally important QA objectives have been defined (OSWER Directive 9360.04-01) for assessing and substantiating the collection of data to support its intended use. The three QA objectives, hereafter referred to as QA1, QA2, and QA3, are described below.

QA1:

This objective for data quality is available for data collection activities that involve rapid, non-rigorous methods of analysis and quality assurance. The methods are used to make quick, preliminary assessments of type and levels of pollutants. The resultant data are non-definitive as to identification and quantitation. Methods will be applied as per standard operating procedures and equipment manufacturer's specifications.

The following requirements apply:

Sample documentation

Instrument calibration or a performance check of a test method (i.e. Draeger tubes, test strips, spot tests)

Determination of detection limit (unless inappropriate)

Note: QC procedures prescribed in SOPs and methods must be followed.

QA2:

This quality objective is intended to give the decision maker (OSC) a level of confidence for a select portion of preliminary data. This objective allows him/her to focus on specific pollutants and specific levels of concentration quickly, by using field screening methods and verifying 10% by more rigorous analytical methods and quality assurance.

The following requirements apply:

Sample documentation

Chain of custody (optional for field analysis)

Sample holding times

Method blanks, rinsate blanks, trip blanks (refer

to table 2, footnotes 3 and 4)

Definitive identifications: confirm the identification of analytes via a second GC column or mass spectra on 10% of the samples collected (for organics only); and provide gas chromatograms and/or mass spectra.

Definitive quantitation: verify preliminary quantitative results by reanalyzing 10% of the samples collected and make a determination of precision, accuracy, and confidence limits* by preparing and analyzing 10% or 2 pairs of matrix spike duplicates (whichever is greater) of the samples verified. (Note: If the preliminary method is a field screening procedure, an alternate, EPA-approved analytical method must be used to verify quantitative results.)

Initial and continuing calibration data

Performance Evaluation Sample (optional)

Determination of detection limit (unless inappropriate)

* See data validation procedures (OSWER Directive 9360.04-01) for determining precision, accuracy, and confidence limits.

QA3:

This quality objective is intended to give the decision maker (OSC) a level of confidence for a select group of "critical samples" so he/she can make a decision based on an action level with regard to: treatment; disposal; site remediation and/or removal of pollutant; health risk or environmental impact; responsible party identification; enforcement actions; and clean up verification.

The following requirements apply:

Sample documentation

Chain of custody

Sample holding times

Initial and continuing instrument calibration data

Definitive identification: confirm the identification of analytes via a second GC column or mass spectra on 100% of the samples collected (for organics only); and provide gas chromatograms and/or mass spectra.

Definitive quantitation: analyze 100% of the "critical" samples collected and make a determination of precision, accuracy, and confidence limits* by preparing and analyzing 20% or 4 pairs of matrix spike duplicates (whichever is greater) of the critical samples collected.

Method blanks, rinsate blanks, and trip blanks

Performance Evaluation Samples

Determination of detection limit (unless inappropriate)

* See data validation procedures (OSWER Directive 9360.04-01) for determining precision, accuracy, and confidence limits.

6.0 Sampling Procedures

6.1 Sample Media/Matrix and Design

Provide a sampling location map, a summary listing the matrices to be sampled, and a short rationale for the selection of sample locations. Details of sample numbers, locations, and rationale, etc., should be addressed in the sampling activities report.

6.2 Field Instruments, Equipment, and Decontamination Procedures

Provide a list of field instruments (if any) to be utilized at the site (See Region VIII ERB-QA Sampling Guidelines in Appendix A, Section 2.1).

The following equipment will be utilized to obtain samples from the respective media/matrix:

Matrix/Media	Sampling Equipment	Fabrication	Dedication

Indicate decontamination solution (if any) to be utilized for equipment decontamination procedures (See Region VIII ERB-QA Sampling Guidelines in Appendix A, Section 3.3).

6.3 Sampling Collection Techniques

(The following collection techniques could be obtained from Region VIII ERB-QA Guidelines. See Appendix A, Section 3.2):

Surface Soil Samples

Subsurface Soil Samples

Sludge and Sediment Samples

Surface Water samples

Ground Water samples

Air Samples

Petroleum Product Samples

Soil Gas Sampling Methods

Special Wastes

Field Screening

(Note: Other collection techniques, if not addressed explicitly in Appendix A, Section 3.2, could be obtained through its references, Section 3.4. The other alternative is addressed in Section "Standard Operating Procedures Guide", page 3 in this QAPjP.)

6.4 Personnel Safety

(See Region VIII ERB-QA Sampling Guidelines in Appendix A, Section 1.)

7.0 Internal Quality Control Checks

7.1 Sample Containers

Sample containers used in sampling efforts will generally be provided by a Superfund Sample Bottle Repository (SSBR) and will have passed the quality control criteria for that program. If non-SSBR containers are used, selection of a supplier with a quality control program similar to SSBR will have to be made. Container testing procedures and quality control data will be maintained by the container supplier. No additional testing of sample containers is required for specific sampling projects.

7.2 Quality Control Samples

Indicate (if any) following QA/QC samples are collected. A summary of results are listed in Tables 2 and 3 (See Section 8).

(Information regarding to following QA/QC samples could be obtained from Region VIII ERB-QA Sampling Guidelines. See Appendix A, Sections 4.1 and 4.2)

Trip/Field/Rinsate Blanks

Duplicate/Co-located Samples

Splits (Duplicates and Replicate/Triplicate)

Background Samples

Spike Samples

Performance Evaluation (PE) Samples

8.0 Field Sampling Summary

(See Tables 2 and 3)

Table 2: Field Sampling Summary

Analytical Parameter	Level of Sensitivity[1]	Matrix*	Container Type and Volume (# container rq'd)	Preservative	Holding Times	Subtotal Samples	QC Extras				Total Field Samples
							Rinsate Blanks[2]	Trip Blanks[3] (VOAs)	QC Positives[4]	Matrix Spikes[5]	
VOA		S	40ml vial (1)	4°C	7day						
VOA		W	40ml vial (3)	4°C**	7day						
BNA		S	8oz glass (1)	4°C	7/40d						
BNA		W	32oz amber glass (2)	4°C	7/40d						
PEST		S	8oz glass (1)	4°C	7/40d						
PCB		S	8oz glass (1)	4°C	7/40d						
PEST		W	32oz amber glass (2)	4°C**	7/40d						
PCB		W	32oz amber glass (2)	4°C**	7/40d						
P.P. METALS		S	8oz glass (1)	4°C	6mon						
P.P. METALS		W	1 liter glass or polyethylene (1)	NO_3 ph<2 4°C	6mon						

* Matrix: S-Soil, W-Water, O-Oil, DS-Drum Solid, DL-Drum Liquid, TS-Tank Solid, TL-Tank Liquid, X-Other, A-Air

** If residual chlorine is present, preserve with 0.008% $Na_2S_2O_2$.

1. The concentration level, specific or generic, that is needed in order to make an evaluation. This level will provide a basis for determining the analytical method to be used.
2. Only required if dedicated sampling tools are not used. One blank required per parameter per 20 samples.
3. One trip blank required per cooler used to ship VOA samples. Each trip blank consists of two 40ml vials filled with distilled/deionized water.
4. Performance check samples; optional for QA-2, mandatory for QA-3 Level. One per parameter.
5. For QA-2: One matrix spike duplicate per lot of 10 samples; therefore, collect two additional environmental sample volumes (water matrix) for every 10 environmental samples. For solid matrix, one additional volume per 10 environmental samples. For QA-3: Two matrix spike duplicates per lot of 10 environmental samples; therefore, collect four additional volumes of environmental samples for every 10 samples. Collect two additional volumes of environmental sample for solid matrix spikes.

Table 2: Field Sampling Summary (continued)

Analytical Parameter	Level of Sensitivity[1]	Matrix*	Container Type and Volume (# container rq'd)	Preservative	Holding Times	Subtotal Samples	QC Extras				Total Field Samples
							Rinsate Blanks[2]	Trip Blanks[3] (VOAs)	QC Positives[4]	Matrix Spikes[5]	
CYANIDE		S	8oz glass (1)	4°C	14day						
CYANIDE		W	1 liter polyethylene (1)	NaOH to pH > 12 4°C	14day						
PHENOLS		S	8oz glass (1)	4°C	28day						
PHENOLS		W	1 liter amber glass (1)	H_2SO_4 to pH < 2 4°C	28day						

* Matrix: S-Soil, W-Water, O-Oil, DS-Drum Solid, DL-Drum Liquid, TS-Tank Solid, TL-Tank Liquid, X-Other, A-Air

** If residual chlorine is present, preserve with 0.008% $Na_2S_2O_3$.

1. The concentration level, specific or generic, that is needed in order to make an evaluation. This level will provide a basis for determining the analytical method to be used.
2. Only required if dedicated sampling tools are not used. One blank required per parameter per 20 samples.
3. One trip blank required per cooler used to ship VOA samples. Each trip blank consists of two 40ml vials filled with distilled/deionized water.
4. Performance check samples; optional for QA-2, mandatory for QA-3 Level. One per parameter.
5. For QA-2: One matrix spike duplicate per lot of 10 samples; therefore, collect two additional environmental sample volumes (water matrix) for every 10 environmental samples. For solid matrix, one additional volume per 10 environmental samples. For QA-3: Two matrix spike duplicates per lot of 10 environmental samples; therefore, collect four additional volumes of environmental samples for every 10 samples. Collect two additional volumes of environmental sample for solid matrix spikes.

Table 3: QA/QC Analysis and Objectives Summary

Analytical Parameter	Matrix*	Analytical Method Ref.	Spikes		QA/QC	
			Matrix[1]	Surrogate[2]	Detection Limits[3]	QA Objective[4]
VOA	S	8240/SW-846				
VOA	W	624/CLP				
BNA	S	8250 or 8270/ SW-846				
BNA	W	625/CLP				
PEST	S	8080/SW-846				
PCB	S	8080/SW-846				
PEST	W	608				
PCB	W	608				
P.P. METALS	S	SW-846				
P.P. METALS	W	EPA-600/CFR 40				

* Matrix: S-Soil, W-Water, O-Oil, DS-Drum Solid, DL-Drum Liquid, TS-Tank Solid, TL- ank iquid, X-Ot er, A-Air

1 For QA2: One matrix spike duplicate analysis per lot of 10 samples. For QA3: Two matr x spike duplicate analyses per lot of 10 samples.

2 Surrogate spikes analysis to be run (enter yes) for each sample in QA-2 and QA-3.

3 To be determined by the person arranging the analysis.

4 Enter QA Objective desired: QA-1, QA-2, or QA-3.

Table 3: QA/QC Analysis and Objectives Summary (continued)

Analytical Parameter	Matrix*	Analytical Method Ref.	Spikes		QA/QC	
			Matrix[1]	Surrogate[2]	Detection Limits[3]	QA Objective
CYANIDE	S	SW-846				
CYANIDE	W	SW-846				
PHENOLS	S	8040/SW-846				
PHENOLS	W	604/CFR 40				

Matrix: S-Soil, W-Water, O-Oil, DS-Drum Solid, DL-Drum Liquid, TS-Tank Solid, TL-Tank Liquid, X-Other, A-Air

1 For QA2: One matrix spike duplicate analysis per lot of 10 samples. For QA3: Two matrix spike duplicate analyses per lot of 10 samples.

2 Surrogate spikes analysis to be run (enter yes) for each sample in QA-1 and QA-2.

3 To be determined by the person arranging the analysis.

4 Enter QA Objective desired: QA-1, QA-2, or QA-3.

9.0 Sample Documentation and Custody

(The following procedures are described in Region VIII ERB-QA Sampling Guidelines. See Appendix A, Sections 4.3, 5.4, 5.5, and 5.7)

Field Activity Logbook

Traffic Reports

EPA Sample Tags/Labels

Chain of Custody Record

Chain of Custody Seals

Sample Handling/Shipping

10.0 Analytical Procedures

10.1 Analytical Parameters

The type of analyses required for the satisfactory completion of this project have been determined by the EPA-OSC based on guidance in Section 6, Appendix A.

Analytical parameters are summarized along with the sample types and quantities in Tables 2 and 3. Analytical requirements, including any special data delivery time requirements, have been summarized on the laboratory specification form if the TAT has been tasked to arrange for analyses. If the OSC tasks another agency or party with any responsibility for sample analyses, the analytical requirements for those samples will be arranged by that agency or party. All sample analysis-related decisions need to be approved or agreed upon by the ERB-OSC.

10.2 Laboratories and Analysis Request Procedures

The following laboratories will be providing the following analyses:

Lab Name/Location	Lab Type	Parameters
_____	_____	_____
_____	_____	_____
_____	_____	_____

(Information regarding to laboratories, analysis request procedures and analytical references could be obtained from Region VIII ERB-QA Sampling Guidelines. See Appendix A, Section).

11.0 Calibration Procedures and Preventative Maintenance

The field instrumentation list, and its calibration procedures and maintenance are described in Region VIII ERB-QA Sampling Guidelines (See Appendix A, Section 2).

12.0 Data Reduction, Validation, and Reporting

Where the analytical data have been reduced, the method of reduction will be described in the report.

Validation of all analytical data will be performed by TAT, ERT, Environmental Services Division (ESD), or other EPA contractor(s). The criteria for validation are specified in "Removal Program Data Validation Procedures Interim Guidance" (OSWER Directive 9360.4-01). Upon completion of the review, the reviewer will be responsible for developing a QA report and submitting to the management (ERB-OSC). The format for reporting the results depend on the requirements for a given site.

13.0 Performance and System Audits

The National Enforcement Investigation Center (NEIC) is responsible for performance and system audits. In addition, un-announced performance and system audits are possible at the discretion of the QAMS/Regional QAO. Performance and system audits may also be conducted upon the ERB-OSC request.

A field performance audit may be conducted to evaluate the execution of sample identification, sample control, chain-of-custody procedures, field documentation, and sampling operations. This type of audit is generally based on the extent to which the QAPjP and applicable SOPs are followed.

A system audit consists of an evaluation of both field and laboratory quality control procedures to determine their proper selection and use. System audits will be conducted before or shortly after the system is operational and on a regularly scheduled basis during the lifetime of the program. After the program is operational and generating data, performance audits are conducted periodically to

determine the accuracy of the total sampling and laboratory program or its parts.

14.0 Specific Routine Procedures For Data Quality Assurance Review

The following QA/QC protocols will be addressed while following "Removal Program Data Validation Procedures Interim Guidance", OSWER Directive 9360.4-01:

- sample documentation
- chain of custody documentation (optional for field analysis)
- sample holding time documentation
- collection and evaluation of blanks and sample replicates (Refer to Tables 2 and 3)
- instrument calibration documentation
- PE samples, if appropriate
- detection limit, unless inappropriate
- definitive identification: Determined by QA level.
- definitive quantitation: Determined by QA level.

15.0 Corrective Action

The EPA-OSC is responsible for making decisions on all field activities which may affect the project; including the schedule, scope of field investigation, sample locations, sampling techniques, etc. All these changes should be clearly documented in the field log books, and this documentation will be available upon completion of the Sampling Activities Report.

Corrective action for both on-site and off-site labs are specified in the Test Methods for Evaluating Solid Waste (SW-846) adopted by the EPA Contract Laboratory Program (CLP). The SW-846 specifies quality control; selection of appropriate test methods; and analytical methods for metallic species, organic analytes and miscellaneous analytes and properties.

Corrective action can be initiated as a result of QA/QC audit activities, including:

- Performance audit

- System audit

- Laboratory comparison studies

- QA program audit conducted by QAMS

The audit shall be done routinely by the ESD or upon the ERB-OSC request. The ERB-OSC will receive the audit report and recommendations for correction. Corrective action will be taken at the discretion of the EPA-OSC, based on the audit recommendations or when data are found to be outside the predetermined limits of acceptability.

Documentation that supports major corrective actions must be maintained in the project files.

16.0 Quality Assurance Reports to Management

The Contractor/Project Leader will maintain contact with the EPA-OSC to keep him/her informed about the technical and financial progress of this project. This communication will commence with the issuance of the work assignment and project scoping meeting. Activities under this project will be reported in field sampling activities report and other deliverables.

The following deliverables will be provided under this project:

- Field Sampling Activities Report

The Sampling Activities Report will be prepared within two weeks of the last day of sampling mobilization. The Sampling Activities Report shall include a summary of sampling activities; including date(s) and personnel on-site (affiliations and phone numbers), a discussion of problems encountered, a documentation of EPA-OSC field decisions and any deviations from the QAPjP/sampling plan. The report also should include information of field equipment if any, a map detailing sample locations, a summary of sample descriptions (sample collection date and time, QC samples, sample numbers, sample locations and rationales), requested laboratories and analyses, and expected result date to be received from the labs. Additional information may include all photographs of sampling related activities, copies of Field Logbook notes, Chain of Custody documentation, packaging and shipping papers, etc.

- Analytical Report

An analytical report will be prepared for samples analyzed under this plan. Information regarding the analytical methods/procedures employed, sample results,

QA/QC results, chain-of-custody documentation, laboratory correspondence, and raw data, if requested, will be provided within this deliverable.

- Data Review/Validation and Draft Final Report

A review of the data generated under this plan will be undertaken. The assessment of data acceptability or useability will be provided separately or as part of the analytical report.

A draft final report will be prepared to correlate available background information with data generated under this sampling event and identify supportable conclusions and recommendations which satisfy the objectives of this QA project plan.

(SITE/PROJECT TITLE)
Figure 1-1 Site Location Map

APPENDIX A

Region VIII ERB-QA Sampling Guidelines

REGION VIII ERB-QA SAMPLING GUIDELINES

Prepared by
Ecology and Environment, Inc.
Under TDD #T08-8812-013

January 12, 1990

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SECTION 1 - HEALTH AND SAFETY PROCEDURES

1.1 HEALTH AND SAFETY REQUIREMENTS CHECKLIST

Compliance with health and safety regulations requires that workers be covered by a health and safety program encompassing the following major points:

- Medical surveillance program
- Emergency medical care and treatment
- Health and safety training
- Standard operating safety procedures
- Site Safety Plan

1.2 HEALTH AND SAFETY PROGRAM

The U.S. Occupational Safety and Health Administration (OSHA) regulations governing employee health and safety at hazardous waste operations and during emergency responses to hazardous substance releases contain general requirements for safety and health programs, site characterization and analysis, site control, training, medical surveillance, engineering controls, work practices, personal protective equipment, exposure monitoring, informational programs, material handling, decontamination, emergency procedures, illumination, sanitation, and site excavation.

Personnel responding to environmental incidents involving hazardous substances may encounter a wide range of physical and chemical hazards. To ensure the safety of response personnel, an effective, comprehensive health and safety program must be established and followed. The minimum components of the health and safety program include:

1.2.1 Medical Surveillance Program

- Pre-employment medical examinations to establish the individual's state of health, baseline physiological data, and ability to wear personnel protective equipment.

- Follow-up medical examinations performed annually or more often due to known or suspected exposures.

- Termination examinations conducted at the end of employment.

- Permanent maintenance of all personnel medical records.

1.2.2 Emergency Medical Care and Treatment

- Advanced first aid and emergency lifesaving (CPR) training for all personnel.

- Refresher training for First Aid and emergency lifesaving (CPR).

- Site-specific medical emergency procedures. Detailed

procedures are part of the Site Safety Plan.

1.2.3 Health and Safety Training

All personnel involved in responding to environmental incidents and who could be exposed to hazardous substances and other health hazards must receive a Basic 40-Hour Health and Safety Training Course including:

- Use of personal protective equipment.
- Safe work practices and standard operating procedures.
- Hazard recognition and evaluation.
- Medical surveillance requirements.
- Site safety plans and plan development.
- Site control and decontamination.
- Site entry and use of monitoring equipment.
- Training for Sampling of Hazardous Materials.

In addition, personnel must attend annual 8-hour refresher training courses in safety, first aid and CPR.

Anyone who directs activities on a hazardous waste site is considered a supervisor and is required to attend an additional 8 hour safety training course for supervisors.

1.2.4 Standard Operating Safety Procedures

Standard operating safety procedures should be developed and written by competent safety professionals and include safety precautions and operating practices that all responding personnel should follow. All personnel involved in site activities must have access to copies of the safety procedures and be briefed on their use.

Standard procedures include guidelines for personnel precautions, weather conditions, and site survey and reconnaissance.

State and local regulations and EPA's Standard Operating Safety Guides supplement the OSHA regulations and may also be considered when developing worker health and safety programs.

Prior to site entry, all suspected conditions that are immediately dangerous to life and health (IDLH) shall be identified, and the following information shall be gathered:

- Site location and size.
- Description of response activities or job function.
- Planned duration of employee activity.
- Site topography.
- Site accessibility by air and roads.
- Pathways for hazardous substance dispersion.
- Present status and capabilities of local emergency response teams for employee on-site emergencies.
- Hazardous substances involved or expected at the site and their chemical and physical properties.

Location and route to local hospital.

Prior to initiating any site activities, the Site Safety and Health Supervisor shall conduct a site inspection and hold pre-entry safety briefings.

OSHA personnel may conduct safety inspections at any time during site activities.

1.2.5 Site Safety Plan

A site safety plan must be developed and implemented for all phases of site operations in accordance with the appropriate OSHA regulations. The plan should be conspicuously posted or distributed to and discussed with all response personnel. All personnel must be familiar and act in compliance with the site safety plan, which must include:

- Name of key personnel and alternates.
- Name of health and safety personnel.
- Task/operation safety and health risk analysis.
- Employee training.
- Personal protective equipment to be used.
- Frequency and types of air monitoring, personnel monitoring, and sampling techniques.
- Site control measures.
- Decontamination procedures.
- Site standard operating procedures.
- Site contingency plan.
- Confined space entry procedures.
- Medical surveillance program.
- Location and route to local hospital.

The site safety plan used by Ecology & Environment is included in Appendix A as an example.

The various contractors working on a hazardous waste site will, in all likelihood, want to supply their own site safety plan. The OSC may elect to review all plans as submitted by the contractors and request modifications. This action is to ensure a thorough, detailed plan.

1.3 REFERENCES

1. U.S. Environmental Protection Agency. "Standard Operating Safety Guides." Memorandum from Henry L. Longest II. 5 July 1988.

2. U.S. Environmental Protection Agency. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. Developed by NIOSH/OSHA/USCG/EPA. October 1985.

3. Occupational Safety and Health Administration. "Interim Final Rule for Hazardous Operations and Emergency Response." 29 CFR 1910.120. 19 December 1986.

4. U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response. December 1987.

5. U.S. Environmental Protection Agency. Field Standard Operating Procedures (FSOP) #4, Site Entry. Office of Emergency and Remedial Response. January 1985.

6. U.S. Environmental Protection Agency. Field Standard Operating Procedures (FSOP) #6, Work Zones. Office of Emergency and Remedial Response. April 1985.

7. U.S. Environmental Protection Agency. Field Standard Operating Procedures (FSOP) #7, Decontamination of Response Personnel. Office of Emergency and Remedial Response. January 1985.

8. U.S. Environmental Protection Agency. Field Standard Operating Procedures (FSOP) #8, Air Surveillance. Office of Emergency and Remedial Response. January 1985.

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SECTION 2 - FIELD INSTRUMENTATION

2.1 FIELD INSTRUMENTATION LIST

1. HNu Photoionizer (Model PI-101)
2. Organic Vapor Analyzer (OVA-128)
3. Combustible Gas (Explosimeter)/Oxygen Alarm (MSA 261) and the Hydrogen Sulfide, Combustible Gas and Oxygen Alarm (MSA 361)
4. Vapor Detection Tubes (Draeger Gas Detector)
5. Radiation Monitor (Victoreen Thyac III Model 490)
6. Geiger Counter (Ludlum Model 5)
7. pH Meter (Corning pH Meter 3)
8. Conductivity/Salinity Meter (YSI Model 33)
9. Geophysical Equipment (Geonics EM 31 and EM 34)
10. Photovac (Model 10S70)
11. X-ray Fluorescence Analyzer (X-MET Model 840)

2.2 FIELD INSTRUMENTATION STANDARD OPERATION PROCEDURES

Field instruments are typically used for health and safety monitoring, estimating the extent of contamination at the site, and generating data used in refining sampling plans.

Sections 2.2.1 through 2.2.8 provide basic information on the operation of field instruments typically used in Region VIII and are not intended to be training manuals or technical references for these instruments. Refer to the listed references for further information.

Sections 2.2.9 through 2.2.11 contain introductory information on field instruments which should only be used by trained and experienced operators.

2.2.1 HNu Photoionizer (Model PI-101)

Capabilities:

The HNu photoionizer is used to determine the concentration of organic and inorganic vapors and gases with ionization potentials of less than the probe rating. The analyzer employs the principle of photoionization for detection and is non-specific depending on the chemical nature of the molecular species being measured. The useful range of the instrument is from a fraction of a ppm to about 2,000 ppm.

Restrictions:

The HNu photoionizer does not respond to methane or hydrogen cyanide and will not detect a compound if the probe used has a lower energy level than the compound's ionization potential. Sensitivities for various gases are not uniform. Response is not linear over a wide range of concentrations. The instrument's sensor cannot be immersed and the lamps are sensitive to acid vapors. The response is affected by high humidity, powerlines, and cold temperatures. It should be noted that certain compounds in

very high concentrations may affect readings.

Start Up and Calibration:

1. Connect the 10.2 ev. probe to readout assembly making sure that the function switch on the control panel is in the OFF position.
2. Turn the function switch to the BATT position and verify condition of the battery. If the needle on the meter is in the lower portion of the battery arc, the instrument should be recharged prior to making any measurements. If the red LED comes on, the battery should be recharged.
3. Turn the function switch to STANDBY and rotate the zero potentiometer until the meter reads zero.
4. Turn the function switch to STANDBY and let instrument warm up for about 5 minutes. Calibrate instrument using manufacturer's calibration gas. Adjust span setting to read ppm as specified on calibration gas bottle. Record span setting in field log.

Operation:

1. Select the appropriate range. For most survey operations, the setting used is 0 to 20 ppm.
2. Verify the instrument's operation by exposing an organic vapor source, such as a marker or butane lighter, to the probe. Check the end of the probe to see that the lamp is operating.
3. To shutdown, turn the function switch to OFF and disconnect the probe from the readout unit.

References:

1. U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response. December 1987. Section 15.2.
2. U.S. Environmental Protection Agency. "Standard Operating Safety Guides." Memorandum from Henry L. Longest II. 5 July 1988. Appendix I.
3. U.S. Environmental Protection Agency. Field Screening Methods Catalogue, User's Guide. Office of Emergency and Remedial Response. September 1988. Pages 16-17.
4. U.S. Environmental Protection Agency. Field Screening Methods Catalog, User's Guide. Office of Emergency and Remedial Response. September 1988. Page 15.
5. Manufacturer's literature.

2.2.2 Organic Vapor Analyzer (OVA-128)

Capabilities:

The OVA uses hydrogen flame ionization to detect and measure organic gases and vapors found in ambient air. Will detect methane. Detection limit of 1 ppm in air.

Restrictions:

The OVA will not detect inorganics. The OVA--which does not evaluate explosive potential--should be used in conjunction with an explosimeter for initial screenings. DOT shipping regulations are strict for the OVA which is fueled with pressurized hydrogen. A relative humidity greater than 95 percent will cause inaccurate and unstable responses and a temperature less than 40°F will cause slow and poor response. Specific contaminants and their quantities cannot easily be identified. In the absence of a specific analytical standard, the concentration of total hydrocarbons is expressed as ppm methane equivalent.

Start Up and Calibration:

1. Connect the probe/readout connectors to the side-pack assembly.
2. Check battery condition and hydrogen supply.
3. For measurements taken as methane equivalent, check that the GAS SELECT dial is set at 300.
4. Turn the electronics on by moving the INST switch to the ON position, and allow 5 minutes for warm-up.
5. Set CALIBRATE switch to X10; use CALIBRATE knob to set indicator to 0.
6. Open the hydrogen tank valve and supply valve all the way. Check that the hydrogen supply gauge reads between 8.0 and 12.0 psig.
7. Turn the PUMP switch ON, and check the flow system (see manufacturer's instructions).
8. Check that the BACKFLUSH and INJECT valves are in the UP position.
9. To light the flame, depress the igniter switch until a meter deflection is observed. The igniter switch may be depressed for up to 5 seconds. Do not depress for longer than 5 seconds, as it may burn out the igniter coil. If the instrument does not light, allow the instrument to run several minutes and repeat ignition attempt.

Operation:

1. Confirm operational state by exposing an organic vapor source, such as a marker or butane lighter, to the probe.
2. Establish a background level in a clean area or by using the charcoal scrubber attachment to the probe (depress the sample inject valve).
3. Set the alarm level, if desired.
4. For shutdown, close hydrogen supply and tank valves (do not overtighten), and turn INST switch to OFF. Wait until hydrogen supply gauge indicates system is purged then switch off pump (approximately 10 seconds).

Operation of the OVA in the Gas Chromatography Mode:

When operated in the gas chromatography (GC) mode, chemical standards of known constituents and concentration must be analyzed by the GC. These standards must be run at the same operating conditions used in the sampling procedure i.e., carrier gas flowrate, column type and temperature, and ambient conditions. The purpose of running standards is to determine retention times, concentrations (or instrument response), and optimal instrument operating conditions. It should be noted however that the operation of the instrument in the GC mode should be left to personnel that have been trained specifically for this purpose.

References:

1. U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response. December 1987. Section 15.3.
2. U.S. Environmental Protection Agency. "Standard Operating Safety Guides." Memorandum from Henry L. Longest II. 5 July 1988. Appendix I.
3. U.S. Environmental Protection Agency. Field Screening Methods Catalogue, User's Guide. Office of Emergency and Remedial Response. September 1988. Pages 15-16.
4. U.S. Environmental Protection Agency. Field Screening Methods Catalog, User's Guide. Office of Emergency and Remedial Response. September 1988. Page 13.
5. Manufacturer's literature.

2.2.3 Combustible Gas (Explosimeter)/Oxygen Alarm (MSA 261) and the Hydrogen Sulfide, Combustible Gas and Oxygen Alarm (MSA 361)

Capabilities:

These instruments test atmospheres for sufficient oxygen content, and for the presence of hydrogen sulfide (model 361), combustible gases or vapors which may pose a potential flammability hazard.

Restrictions:

Instrument response must be appraised by someone trained or experienced in properly interpreting the instrument readings.

Check Out and Calibration:

1. Open the instrument lid and turn the center ON-OFF control to the HORN OFF position. Meter pointers will move and one or more alarms may light.
2. The % LEL meter pointer should be set to zero by adjusting the ZERO LEL control. Adjustment should be made within 30 seconds after instrument is turned on; this is to prevent accidental

activation of the meter latch circuit.

3. Press the SELECT button firmly to obtain % OXY on the readout (Model 361 only). If the % oxygen meter stabilizes at a value other than 20.8%, set to 20.8% by using the CALIBRATE 02 control.
4. On Model 361, press the SELECT button firmly to obtain PPM TOX on the readout; then set the readout to zero (00) by adjusting the TOX ZERO control.
5. Press the ALARM RESET button; the Alarm(s) should reset and the green pilot light should flash.
6. Momentarily place a finger over the sample inlet fitting or the end of the sample line probe. Observe that the flow indicator float drops out of sight, indicating no flow. If the float does not drop, check the flow system for leaks.
7. On Model 261, press the CHECK button and observe the % LEL meter. The pointer must read 80% LEL or higher as marked by the BATTERY zone on the meter. On Model 361, a low battery condition is indicated by a BATT sign in the readout or by a steady horn.

Operation:

On the Model 261, turn the ON-OFF control to the ON position. The pilot lamp should light continuously.

On the Model 361, turn the FUNCTION control to MANUAL for continuous readout of any one gas or to SCAN for automatic scanning of the three gas readings. All alarm functions operate in either position.

References:

1. U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response. December 1987. Sections 15.4, 15.5 and 15.6.
2. Manufacturer's literature.

2.2.4 Vapor Detection Tubes (Draeger Gas Detector)

Capabilities:

The colorimetric tube and pump measures concentrations of inorganic and organic vapors and gases. The detector tubes are specific for individual compounds, or groups of compounds, and require specific sampling techniques.

Restrictions:

Cross sensitivity is typical and there is a large degree of error in the readings. Not useful where contaminant is unknown.

Start Up and Calibration:

No calibration required. However, pump must be checked for leakage. Check pump by placing an unbroken tube into the suction inlet of the pump and completely depressing the bellows. The bellows should not completely extend in fewer than 30 minutes. Check the expiration date of each detector tube.

Operation:

1. Break off both tips of the Draeger tube in the break-off eyelet located on the front pump plate.
2. Tightly insert the tube into the pump head with the arrow pointing toward the pump head. If multiple tubes are used, join the tubes with the rubber tube provided, then insert the tube into the pump head.
3. Fully compress the bellows and allow the bellows to re-extend until the chain is taut. Repeat as often as specified in the tube operating instructions.
4. Read concentration as specified in the instructions included with the tube.

References:

1. U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response. December 1987. Section 15.7.
2. Manufacturer's literature.

2.2.5 Radiation Monitor (Victoreen Thyac III Model 490)

Capabilities:

The Victoreen Model 490 Thyac III is a sensitive portable pulse count ratemeter designed to be used with a variety of detector probes. The pancake probe is sensitive to alpha (with cap removed), beta, and gamma ionizing radiation. This type of instrument is capable of detecting very small amounts of radiation, but is energy (type of radiation) dependent.

The ionization chamber has a high voltage applied to its electrodes. Any ionization within the chamber causes a brief electrical pulse to pass between the electrodes. The rate of these pulses can be related to the ionizing radiation intensity.

Limitations:

1. Should be used only by persons who can properly interpret its readings and are familiar with the appropriate safety procedures to be followed in the presence of radiation. Failure to follow instructions and warnings contained in the instruction manual or on the instrument may result in

inaccurate readings and/or user hazard.

2. Does not give a uniform response for different radiation energy levels and is accurate only for the type of radiation energy it is calibrated for.
3. Special consideration for respiratory protection should be used when alpha exposures may be present.

Start Up and Calibration:

1. This instrument is shipped with batteries removed. To install batteries:

   - Snap open the pull catch at each end of the case and separate the case top from the case bottom. This exposes the battery box and battery retainer clip.
   - Remove the clip by squeezing its end until it can be pulled out of the slots in the battery box.
   - Insert the two D-cell batteries in the battery box (the battery box is designed to be mechanically selective so that the batteries cannot be inserted with reversed polarity).
   - Replace the battery retainer clip.
   - Align the case top with the bottom and squeeze them together gently.
   - Snap the pull catches closed.

2. Primary factory calibration should be conducted annually by the manufacturer. The meter should bear a calibration sticker as a result of this work. This documentation should indicate the expected counts per minute (CPM) for the stated instrument and probe from the affixed operational check source. This check source should be found fastened to the side of the case. To test the calibration, the pancake probe should be placed directly over the 3/8-inch diameter circle on the operational check source. A reading approximately equal to that given on the primary calibration document should result. This check must be carried out in an area free from any source of radiation.

Operations:

1. Designed for up to two-hundred hours of continual use on two "D" cell batteries.
2. Temperature limits at -30 to +50 degrees centigrade.
3. Do not connect or disconnect any detector while the instrument is on. Wait two minutes after instrument has been turned off before making any such connections or disconnections.

References:

1. U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response. December 1987. Section 15.8.
2. Manufacturer's literature.

2.2.6 Geiger Counter (Ludlum Model 5)

Capabilities:

The Ludlum Model 5 is a 5-scale (0 to 2000 MR/Hr), self-contained Geiger Counter. This type of instrument can detect beta and gamma ionizing radiation. The unit is operated with two "D" size batteries (carbon zinc) for operation from 150° to approximately 32°F. For temperature operation to 0°F, either very fresh alkaline batteries or rechargeable NiCad batteries may be used. Note: Never store the instrument over 30 days without removing the batteries.

Limitations:

This instrument should only be used by trained and qualified operators who are thoroughly familiar with its use and operation and can interpret its results.

Start Up and Calibration:

1. Slide battery box button to rear, open lid and install two "D" size batteries. Match battery polarity to the marks on the inside of the lid. Do not twist lid button - it slides to the rear. Close battery box lid.
2. Turn instrument range switch to x1000. Depress BAT switch. Meter should deflect to the battery check position of the meter scale. If meter does not respond, recheck to be certain that batteries have proper polarity.
3. Expose detector to radiation check source. Speaker should click with audio switch in the ON position.
4. Move range to lower scales until meter reading is indicated. Toggle switch labeled F-S should have fast response in "F", slow response in "S".
5. Depress RES switch. Meter should zero.
6. Check calibration and proceed to use the instrument.

Operation:

An instrument operational check should be performed prior to each use by exposing detector to a known source and confirming proper reading on each scale.

References:

1. U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response. December 1987. Section 15.8.
2. Manufacturer's literature.

2.2.7 pH Meter (Corning pH Meter 3)

Capabilities:

Electrochemical pH determination utilizes the difference in potential occurring between two aqueous solutions of different pH separated by a special glass membrane. A complete pH measuring system consists of a glass pH electrode, a sample solution, reference electrode, and a pH meter. This instrument will measure pH through a range of 2-12 pH (0-14 extended) at an accuracy of 0.2 pH units.

Limitations:

For accurate work, fresh buffer solution should be used. Contamination of the buffer solution may occur after repeated insertion of the electrode into the bottle. To verify the quality of the buffer, check against the fresh replacement buffer solution. The electrode, buffers and samples should be maintained at the same constant temperature during measurements.

Calibration and Operation:

1. Turn the ON/OFF switch to the ON position.
2. Check the battery by turning CALIBRATE knob fully clockwise. The needle should swing into the green section on the scale.
3. Install the electrode by removing the fill hole plug and the wetting cap and inserting the electrode connector into the pH input on the right side of the meter.
4. Lower the electrode into the pH buffer and allow the meter needle to stabilize. If the pH of the material is known approximately then the instrument should be calibrated with the buffer closest to the pH of the material eg. 4.00, 7.00 or 10.00 and confirmed with another pH buffer.
5. Adjust the CALIBRATE knob so that the needle is on the proper pH.
6. Adjust the TEMPERATURE control knob to the temperature of the solution to be measured.
7. Remove the electrode from the buffer and rinse with the solution to be measured or distilled water.
8. Immerse the electrode into the unknown solution and read the pH value from the meter. If it is not within +/- 3 pH units of the buffer, remove the electrode, rinse with distilled water, and immerse it into a second buffer solution of known pH and temperature identical to that of the first buffer. Adjust the TEMPERATURE control knob until the meter reads the

pH value of the second buffer.

9. The pH range can be extended by calibrating the pH 7 buffer solution to read 5.0 or 9.0 on the meter and adding or subtracting 2 pH units respectively to the readings.

Maintenance:

1. Change battery as needed.
2. Replace electrode as needed.
3. If readings are noisy or drift.
   - Check electrolyte solution.
   - Check that reference electrode fill hole is open.
   - Try new electrode.
4. If poor buffer agreement.
   - Check buffers.
   - Check temperature setting.
5. If electrode response sluggish.
   - Check electrode.
   - Response is slow in unbuffered media.
   - Wait for stabilization.

References:

1. Manufacturer's literature.

2.2.8 Conductivity/Salinity Meter (YSI Model 33)

Capabilities:

The YSI Model 33 is designed to measure the salinity, conductivity, and temperature of fluids. It consists of a sampling probe and meter powered by two "D" cell alkaline batteries.

Specific conductance is measure in the range of 0 to 50,000 micromhos per centimeter (µmho/cm). Salinity is measured in the range of 0 to 40 parts per thousand (ppt). Temperature is measured from -2° to 50°C (28° to 122°F).

Operation:

1. With the unit in the OFF position, adjust the meter to 0 µmho and then plug the probe into the jack.

2. Turn the MODE switch to the RED LINE position. Then turn the RED LINE control to adjust the needle to the red line indicated on the meter.

3. To read temperature, set the switch to the TEMPERATURE position and read.

4. To read salinity, set °C control to the temperature determined above. Turn the MODE switch to the SALINITY position and read salinity as 0 to 40 ppt.

5. To read conductivity, set the MODE switch to the appropriate conductivity scale and multiply the meter reading by the factor indicated.

Maintenance:

1. Check the battery condition using the CELL TEST button and replace the batteries, if necessary. If the unit is not to be used for an extended period of time, remove the batteries.

2. Clean the probe in fresh water whenever it is exposed to salt water.

3. Replatinize the probe when the RED LINE adjustment cannot be made. This is done using YSI Kit No. 3139.

References:

1. Manufacturer's literature.

2.2.9 Geophysical Equipment (Geonics EM 31 and EM 34)

Capabilities:

The EM technique uses low-frequency electromagnetic impulses to measure terrain conductivity. Terrain conductivity is a variable of several factors, but is largely keyed to the concentration and abundance of electrolytic solutions and/or the presence of metallic materials in the subsurface. EM methods are useful for detecting lateral changes in conductivity, and to a lesser extent, vertical changes in conductivity. Specific capabilities include:

- Defining location of a contamination plume.
- Locating buried objects such as drums, tanks, pipelines cables, monitoring wells.
- Addressing presence and/or location of bedrock fault and fracture systems.
- Mapping boundaries of discontinuous clay-rich layers.
- Defining bedrock lithological boundaries (units).
- Mapping buried trenches.
- Defining lateral extent and relative depth of buried bedrock valleys.

Operation:

The conductivity value resulting from these instruments is a composite; it represents the combined effects of the thickness of soil or rock layers, their depths, and the specific conductivities of the materials. The instrument reading represents a combination of these effects, extending from the surface to the depth range of the instrument. The resulting values are influenced more strongly

by shallow materials than by deeper layers. Conductivity conditions from the surface to the instrument's nominal depth range contribute generally 75 percent of the instrument's response. However, contributions from highly conductive materials lying at greater depths may have a significant effect on the reading.

In areas surrounding hazardous waste sites, contaminants may escape into the soil and the groundwater system. In many cases, these fluids contribute large amounts of electrolytes and colloids to both the unsaturated and saturated zones. In either case, the ground conductivity may be greatly affected, sometimes increasing by one to three orders of magnitude above background values. However, if the natural variations in subsurface conductivity are very low, contaminant plumes of only 10 to 20 percent above background may be mapped.

In the case of spills involving heavy nonpolar, organic fluids such as diesel oil, the normal soil moisture may be displaced, or a sizable pool of oil may develop at the water table. In these cases, subsurface conductivities may decrease, causing a negative EM anomaly.

The following table summarizes operational data and exploration depths for the EM-31 and EM-34:

	EM-31	EM-34
Required personnel	1 to 2 persons	2 to 3 persons
Data recording	Continuous or station	Station
Intercoil spacing (meters)	3.7	10, 20, 40
Effective exploration depth (meters)	Up to 6	7.5, 15, 30, 60

Several factors are involved in the choice of EM instrumentation. The most obvious is exploration depth. Based on the geologic and hydrogeologic setting, types of wastes and containerization, and length of time since disposal, an estimate may be made of the lateral and vertical extent of contamination. If the site is large and there is little time to cover it, the EM-31 is much faster to use than the EM-34. In most cases, the EM-31 will be most appropriate for general reconnaissance due to its ease of use and ability to detect waste in the near-surface region, where most wastes are buried.

Design of the geophysical survey, operation of the instruments, and interpretation of the data should only be done by trained and experienced personnel.

Limitations:

In order for EM techniques to be useful, a detectable conductivity contrast must exist between the natural geologic setting and the contamination. Non-heterogeneity of subsurface materials may reduce the background-to-signal ratio and hamper data interpretation.

References:

1. U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response. December 1987. Section 8.
2. Manufacturer's literature.

2.2.10 Photovac (Model 10S70)

Capabilities:

The Photovac Model 10S70, an updated version of the Model 10A10, is a portable ultraviolet photoionization detector for monitoring many organic and some inorganic gases and vapors in air samples. Most halogenated and aromatic compounds typically found at hazardous waste sites can be detected by the PID.

Calibration:

Calibration of this instrument requires specific compounds with known concentrations. Due to the complexity of the procedure the manufacturer's instructions for the specific compound should be followed.

Operation:

This instrument should only be operated by personnel that have been trained in its use.

Limitations:

1. Effective use requires that the operator understand the operating principles and procedures, and be trained and experienced in calibrating, reading, and interpreting the instrument.
2. Does not detect methane, or compounds with ionization potentials greater than 11 electron volts.
3. Response may change when gases are mixed.
4. Specific calibration standards are required to perform the analysis. Calibration standards for a variety of compounds are available.
5. Readings can only be reported relative to the calibration standard used.
6. Sample analysis times are dependent upon compound sought and

any potential interferences, but can take up to 10 minutes.

Detectable compounds to 1 ppb or less include ethylene oxide, vinyl chloride and other chloro-ethylenes, benzene, toluene, xylene, ethane and higher alkanes to octane, isoprene, ethylene, methylene chloride and other chloro-methanes, light chloro-benzenes, hydrogen sulfide, light mercaptans, organic sulfides to DMDS, acetone and MEK, arsine and phosphine, acetaldehyde and subsequent aldehydes up to hexanal.

Detectable compounds to 50 ppb or less include glycol ethers, fluorochloromethanes (Freons), methylisocyanate, chloro-ethanes, cyclohexanone, ethyl acrylate, and light alcohols.

All detection limits are estimated. Practical quantitation limits vary with sample matrix but are usually higher.

References:

1. U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response. December 1987. Section 15.1. (Model 10A10 only).
2. Manufacturer's literature.

2.2.11 X-Ray Fluorescence Analyzer (X-MET Model 880)

Capabilities:

The X-MET 880 unit is a portable XRF analyzer capable of providing screening analytical data on most metals with the exception of mercury in soils and other solid matrices. Samples may be analyzed with no preparation, using a hand-held probe, or with minimal preparation. The detection limit varies with the element of interest, the matrix, and with the presence of interference. Estimated detection limits for arsenic, copper, lead, and zinc are approximately 100 ppm, however practical quantitation limits are usually higher.

The XRF analyzer irradiates metal complexes present in the soil, resulting in the emission of X-rays characteristic of the excited elements. The instrument examines the energies of the X-rays emitted by the irradiated sample and compares the intensities against reference standard emissions to quantitate the metals concentration. It is microprocessor controlled enabling ease of operation and is capable of the simultaneous assay of six elements per sample type.

Operation:

The analyzer needs approximately 60 minutes to stabilize. The actual analysis time varies (15 to 200 seconds).

Calibration programs are built-in and are interactive. To calibrate the X-MET 880 for a desired application, measurements are made on a series of samples with known concentrations. The measurements results, together with the concentration data, are then processed using a built-in multiple regression program. The acceptable calibration coefficients are then automatically transferred to the memory. Refer to the Instruction Manual for details.

Limitations:

Operation of this instrument and interpretation of the data should only be done by a trained and experienced operator.

References:

1. Manufacturer's literature.
2. U.S. Environmental Protection Agency. Field Screening Methods Catalog, User's Guide. Office of Emergency and Remedial Response. September 1988. Pages 3,5.

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SECTION 3 - SAMPLING PROCEDURES

The goal of hazardous waste site sampling activities is to generate verifiable and comparable data of sufficient quantity and quality to reduce risks surrounding necessary decisions at a site to an acceptable level. Toward that end, the application of consistent and documented field techniques is of primary importance in ensuring that sampling data is representative of the media being sampled and indicative of site conditions. The purpose of this manual is to outline a variety of standard sample collection methodologies for use in hazardous waste site investigative work. Routine application of these techniques will promote development of accurate, verifiable, and comparable data upon which site decisions can be based.

Due to the extreme variety of site conditions and investigative objectives that may be encountered, complete enumeration of all potentially applicable sampling techniques is not practical here. Rather, the goal is to present a summary description of those techniques most frequently or likely to be required. Modification of techniques to address site-specific considerations may often-times be necessary. Sample collection techniques must be clearly documented either in planning documents or in final reports.

Sampling programs are generally included to satisfy one or more of the following objectives:

- Presence of contamination;
- Magnitude of contamination;
- Impact of contamination;
- The effectiveness of new sampling methods;
- The effectiveness of new instrumentation;
- Waste characterization;
- Migration pathway characterization;
- Health affects assessment;
- Enforcement support;
- Emergency response; and
- Remedial investigation/feasibility study support.
- Extent of Contamination Survey

Satisfaction of any or all of these objectives in a particular sampling program depends, to a large extent, on the methods chosen to collect the samples. For example, data intended to support enforcement activities may require the use of more rigorous sampling techniques than data used in emergency response activities. Accordingly, specification of program objectives is a pre-requisite to selection of a sampling technique(s).

Similarly, operational concerns such as personnel health and safety, training requirements, resource availability and experience, and community relations may impact the choice of sampling techniques. Each of these, as well as a variety of related issues, must be considered when developing and/or implementing a sampling plan. Pre-sampling considerations that may impact sampling methodologies are listed below, but are not discussed in detail. Other technical or policy documents can be

accessed for further information. Pre-sampling considerations that impact sample collection activities include:

- Establishment of Data Quality Objectives (DQOs);
- Choice of relevant analytes;
- Site safety plan acceptance;
- Field team experience;
- Special equipment requirements;
- Budget and schedule constraints;
- Community and institutional issues.

Sample collection activities require attention to detail and a routine that insures quality and consistency while maintaining efficiency. Specific steps should be carried out during each sampling event, defined by a regular time period (e.g., day, shift) or sampled medium (e.g., tanks, ponds, ground water, etc.):

- Before collection of samples, thoroughly evaluate the site (observe the number and location of sample points, landmarks, references, and routes of access or escape);

- Record pertinent observations (include a sketch, where appropriate, identifying sample locations);

- Prepare all sampling equipment and sample containers prior to entering site (provide protective wrapping to minimize contamination);

- Place sample containers on flat, stable surfaces for receiving samples;

- Plan to collect samples first from those areas that are suspected of being the least contaminated so that areas of suspected contamination are collected last, thus minimizing the risk of cross contamination;

- Samples should be handled by as few people as possible;

- Collect samples and securely close containers as quickly as feasible;

- Document all steps in the sampling procedures (discussed in Section 3.2);

- Minimize investigation-derived waste.

All planning document requirements (Sample Plan, Site Safety Plan) should be adhered to or documented if changed.

3.1 Sample Types

There are two general sampling techniques recognized for defining contaminant distribution in the environment: grab and composite. A grab sample is defined as a discrete aliquot representative of a speci-

fic location at a given point in time. The sample is collected all at once and at one particular point in the sample medium. In general, as sources vary over time and distance, the representativeness of grab samples will decrease.

Composites are non-discrete samples composed of more than one aliquot collected at various sampling locations and/or different points in time. Analysis of this type of sample produces an average value and can in certain instances be used as an alternative to analyzing a number of individual grab samples and calculating an average value. It should be noted, however, that compositing can mask problems by diluting isolated concentrations of some hazardous compounds below detection limits.

For sampling situations involving medium and high hazard wastes, grab sampling techniques are generally preferred because grab sampling minimizes the amount of time sampling personnel must be in contact with the wastes, reduces risks associated with compositing unknowns, and eliminates chemical changes that might occur due to compositing. Compositing is often used for environmental samples and may be used for more hazardous samples under certain conditions. For example, compositing of hazardous samples is often performed (after compatibility tests have been completed) to determine an average value over a number of different locations (group of drums). This procedure provides data that can be useful by providing an average concentration within a number of units, can serve to keep analytical costs down, and can provide information useful to transporters and waste disposal operations.

The proper number of composited subsamples should reflect ultimate data use. Typically, by increasing the number of subsamples, the interpretive value of the data is reduced. By compositing samples of widely variable concentrations, those species appearing intermittently or in small quantities may be diluted out or masked by high detection limits imposed by species occurring in high concentrations. Data used to define the contents of drums for shipping to a TSD facility will be interpreted differently than data providing site characterization. These considerations should be evaluated at the time of sample plan conceptualization by calculating compositing outcomes with various possible data sets. As a rule, composite subsample numbers should not exceed five, for a reasonable expectation that data interpretation can be applied successfully under a wide range of conditions. This number may be increased if expected data variability is low or decreased if expected variability is high.

Biased sampling is the collection of samples from chosen locations, such as areas of spills, etc. Biased samples are often used for enforcement to prove that contamination exists at a given site. A biased sampling approach can be used for grab or composite sample collection.

Systematic sampling involves a statistically based method of choosing sampling points. A common method of systematic sampling is to grid-off a site and either equally space sample points or number the gridded units and use a random numbers chart to determine sample points. Systematic sampling can be used with both grab and composite sampling.

3.2 Sampling Techniques

3.2.1 Surface Soil Sample Collection Methods

Surface soil samples, whether composite or grab, should be collected using the following guidance:

- Avoid leaves, sticks, roots and rocks unless they are specifically needed. Screening may be necessary.
- Avoid mixing soil types unless specifically required.
- Samples should be collected to a uniform depth and from a uniform area.
- Anomalies such as animal burrows, root channels, desiccation cracks, sand lenses, and other aspects which may influence pollutant migration should be recorded. Consider taking the sample below the root or turf zone.
- To provide a more representative sample, three to six subsamples may be collected in a consistent pattern surrounding the designated sample locations and composited.
- Samples should be thoroughly homogenized either by tumbling/mixing or by multiple subdivision, unless analyses for volatile compounds are anticipated (the laboratory will use only a few grams of soil from a sample jar, so the sample should be well mixed from top to bottom).

An effective field compositing method requires use of large stainless steel mixing pans. These can be obtained from scientific, restaurant, or hotel supply houses. They can be decontaminated and are able to stand rough handling in the field. Sub-samples are placed in the pans, broken up, then mixed using a large stainless steel scoop. Careful observance of the soil will indicate the completeness of the mixing.

The soil is spread evenly in the bottom of the pan after mixing is complete. The soil is quartered and a small sample taken from each quarter and placed in the sample container. Excess soil is disposed of as waste. Case must be taken to avoid cross contamination when using a single mixing pan to composite several samples. To demonstrate the effectiveness of the pan decontamination process, rinsate blank samples may be required (see Section 4.2.1).

Surface soil sample collection methods of preference include scoop/trowel techniques, hand-held augers, soil punches, and ring samplers. Descriptions of each follow.

3.2.1.1 Scoop or Hand Trowel

Due primarily to its convenience, the scoop or trowel is generally the tool of choice for surface soil sampling. The scoop or trowel

should be made of stainless steel and, if possible, decontaminated under laboratory conditions prior to initiation of field work. It is transported to the field in a clean, sealed plastic bag or other appropriate sealed container to ensure cleanliness. If possible, sufficient scoops/trowels should be available to avoid collection of more than one sample with one trowel. When multiple sampling with a single unit is required, the tool must be decontaminated between samples. Decontamination, if necessary, may also require the preparation of one or more rinsate blanks.

To collect a surface soil sample with a scoop or trowel:

- Gently scrape away obvious leaves, rocks, etc. from the sample location, unless needed, with a clean spoon or knife;
- Collect soil from a predetermined area and to a predetermined depth, depending on the volume of soil required;
- Collect the VOA sample, if any, and place it into the appropriate sample container (if one homogenizes a VOA sample more than likely the contaminant of concern will volatize);
- Place the sample in a stainless steel bowl or mixing pan and record its appearance;
- Homogenize the sample, depending on the analyses required, by mixing with the scoop/trowel;
- Remove leaves, twigs, roots, bark, rocks, etc; and
- Transfer sample to an appropriate sample container, label it, and prepare it for storage/shipping.

Limitations

It is often difficult to collect identical sample volumes from different locations using the scoop or trowel. Consequently, this method should be avoided when volume, depth, and/or area are critical factors.

3.2.1.2 Hand-Held Augers

Commonly used hand-held augers include the Iwan, ship, closed-spiral, and open-spiral augers (Figure 3-1). Samples are generally collected using one of the following two techniques:

- Bore a hole to the desired sample depth, extract the auger, and remove the soil from the auger flights or bucket to a stainless steel mixing pan using a stainless steel spoon or knife (works with Iwan style or other similar augers); or
- Bore a hole to a point just above the desired sample depth, remove the auger and replace the auger tip with a tube corer, push the corer into the soil to the desired sample depth, and extract the corer with sample (several adjacent cores may be

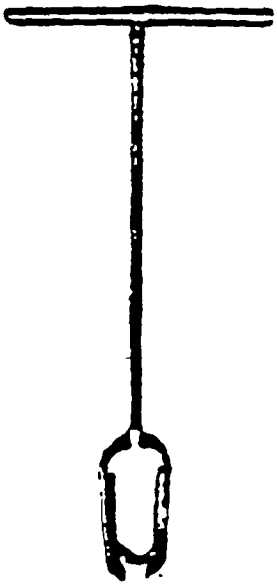
FIGURE 3-1

HAND AUGERS

Ship Auger

Closed-Spiral Auger

Open-Spiral Auger



Iwan Auger

necessary to collect the desired sample volume at a specific depth).

As with the scoop/trowel technique, care should be taken to avoid collection of grass, etc., unless specifically required. Also, sample appearance should be recorded as described previously, prior to homogenization and transfer to the sample container.

Limitations

The auger methods are not recommended in predominately sand (unless wet) or clay soils.

3.2.1.3 Soil Punch

The soil punch is a thin walled, 15 cm to 20 cm long steel tube that extracts short cores from the soil. The tube is driven into the soil by the sampler's foot or with a wooden mallet, extracted with the sample core, and the soil is then pushed out of the tube into a stainless steel mixing bowl. Frequently encountered soil punches include the short King-tube samplers or the tube type density samplers used by the Corps of Engineers. The latter is machined to a predetermined volume and is designed to be handled and shipped as a soil-tube unit. A number of similar devices are available for collecting short cores from surface soils.

The soil punch is fast and can be adapted to a number of analytical schemes provided precautions are taken to avoid contamination during shipping and in the laboratory. This method is potentially most useful in the collection of surface soil samples for volatile organic analysis. The tubes can be sealed with a Teflon plug and coated with a vapor sealant, such as paraffin or nonreactive sealant. These tubes can be decontaminated on the outside and shipped to the laboratory for analyses.

3.2.1.4 Ring Sampler

Ring samples consist of a seamless steel ring, approximately 15 to 30 cm in diameter, which is driven into the soil to a depth of 15 to 20 cm. The ring is extracted as a soilring unit and the soil removed for analysis. This device allows a constant surface area of soil to be sampled at each location and should be used when analytical results will be expressed on a per unit area basis.

Limitations

Removal of ring sampler cores is often difficult in very loose sandy soil and in very tight clayey soils. The loose soil will not stay in the ring. The clayey soil is often difficult to break loose from the underlying soil layers.

This device has not been used extensively for collecting samples for chemical analysis but the technique should offer a useful method for collecting samples either for area contamination measurements or for taking large volume samples.

3.2.2 Subsurface Soil Sample Collection Methods

Subsurface soil samples, whether composite or grab, should be collected using the following guidance:

- Avoid mixing soil types or geologic formations in a single sample;
- Drain excess water from samples prior to packaging;
- Sample appearance, including texture, wetness, grain size distribution, degree of roundness, color, etc., should be recorded per the United Soil Classification System;
- Anomalies such as root channels, fractures, sand lenses and other aspects which may influence pollutant migration should be recorded; and
- Samples should be thoroughly homogenized either by tumbling/mixing or by multiple subdivision, unless analyses for volatile compounds are anticipated.

Subsurface soil samples are collected using a variety of manual or mechanically assisted techniques. The choice of a particular method depends primarily on the soil type or geologic formation to be sampled and the sample depth. Descriptions of several of the most popular techniques follow.

3.2.2.1 Handheld Augers

A handheld auger (Figure 3-2) may be used to collect subsurface as well as surface soil samples. Sampling techniques are identical to those described in Section 3.2.1.2. Sample depth is generally limited to a maximum of ten feet and the method is most applicable to cohesive soils above the water table from which disturbed samples are acceptable. Collection of undisturbed samples is possible through the use of tubecoring tips. However, in such cases care must be taken to thoroughly clean out the bottom of the borehole and scrape off the top 1/4 inch of core so that sloughed soil from the borehole walls is not inadvertently sampled.

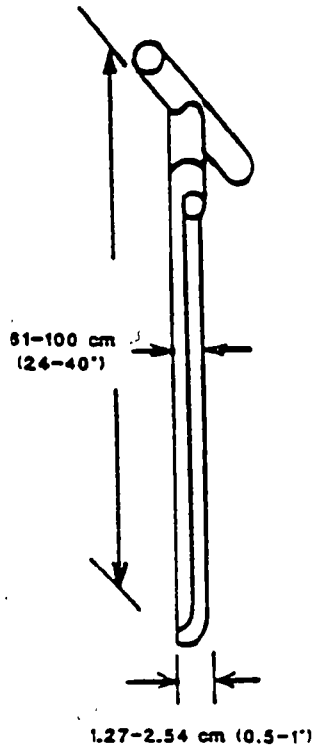
The choice of auger design is dependent on soil conditions. Ship augers are recommended for use in cohesive soils while open spiral augers are best suited for loosely consolidated deposits. Closed spiral augers work well in dry clay and gravelly soils, and the Iwan auger is useful in a variety of soils.

Limitations

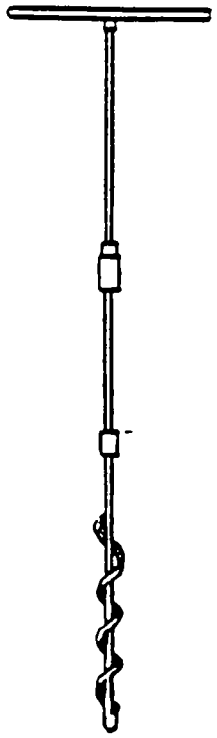
Hand augers generally result in collection of mixed samples and it is frequently difficult to define locations of changing strata. The method is not useful in hard or cemented soils, in noncohesive soils

FIGURE 3-2

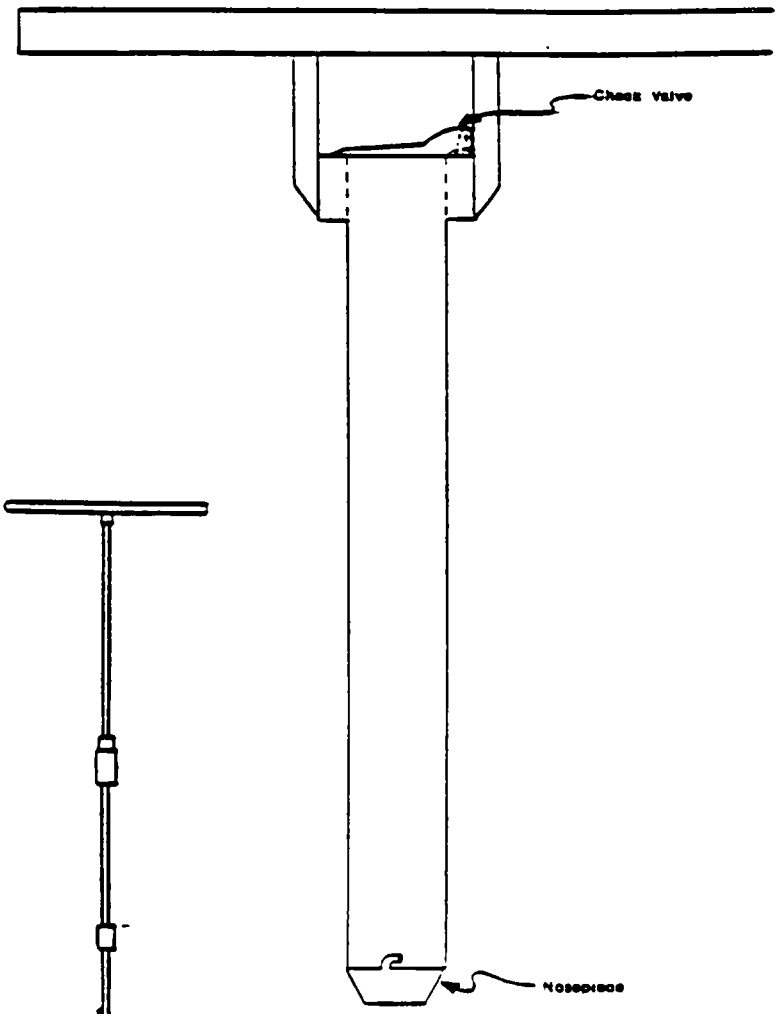
SAMPLING TRIER,
AUGER and HAND CORER



Sampling Trier



Auger



Hand Corer

where collapse or slough is likely, or cobbly soils. Depth of sampling is generally limited to ten feet.

3.2.2.2 Trier/Hand Corer

A slotted sampling trier (Figure 3-2) or hand corer (Figure 3-2) is useful for collection of shallow subsurface samples (maximum depth of approximately three feet). The trier or corer is simply pushed into the ground and the soil core extracted. Advantages of the method include its ability to collect undisturbed cores and, in the case of the trier, allow visual observation of the core prior to placement in a sample jar.

Limitations

The trier and corer are not recommended for use in rocky or compacted/cemented soils.

3.2.2.3 Powered Hand Augers

A variety of powered hand augers are available to increase depth and penetration capabilities of manual auger techniques (Figure 3-3). Sampling methods utilized with power augers are identical to those used with hand augers. Advantages of these units are their portability and their ability to penetrate soils that were not possible with a hand auger. Portable power augers are also relatively easy to use. Disadvantages of the drills are their difficulty in penetrating cobbly or rootbound soils. These augers become increasingly difficult to operate with depth, and are best suited for boreholes less than ten feet deep.

3.2.2.4 Backhoe/Trenching

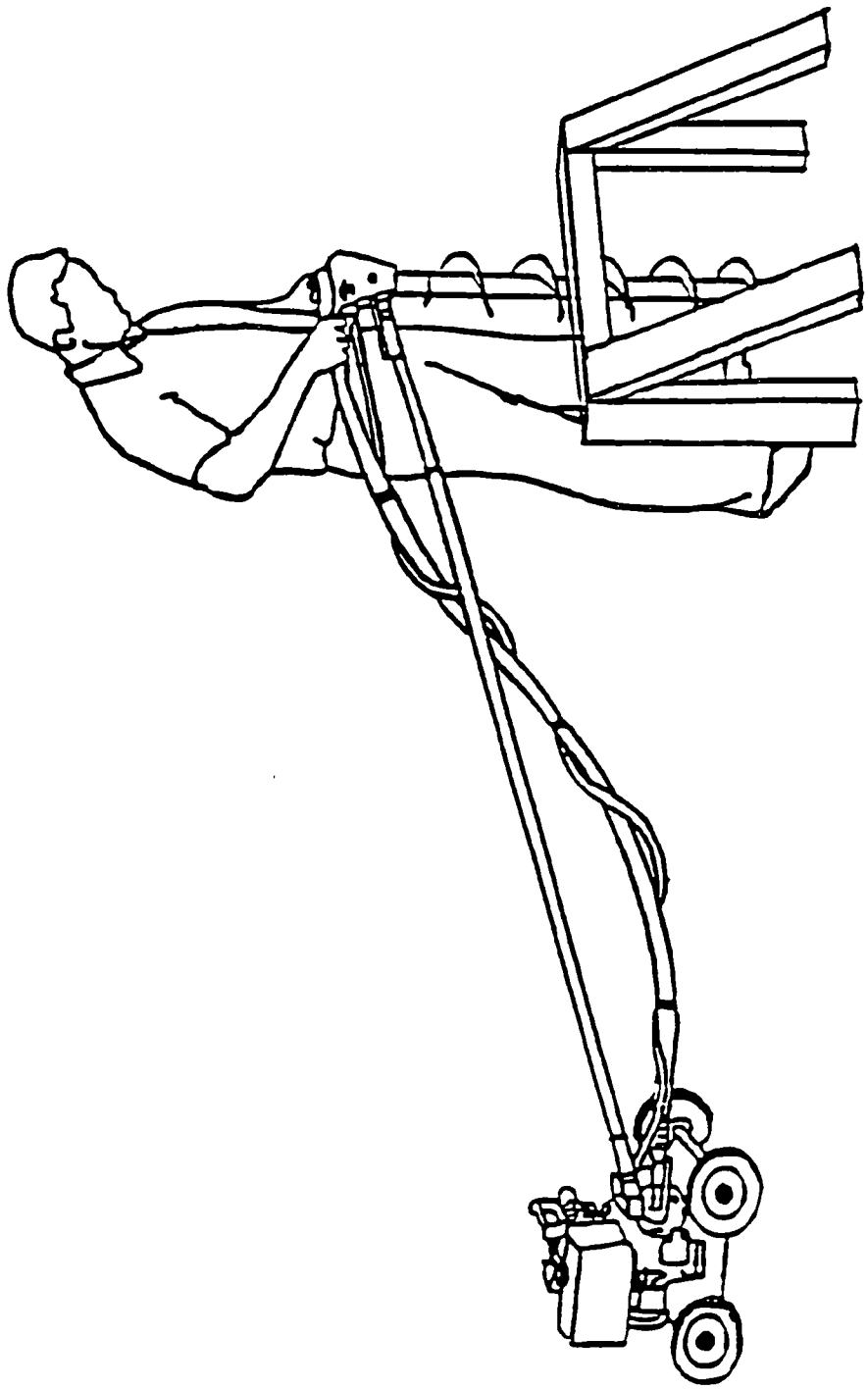
Trenching and test pitting are excellent methods of obtaining waste samples from dumps and landfills. While borings may be useful at greater depths, drilling through a landfill or dump creates unusual hazards (e.g., hitting pockets of explosive gases, rupturing buried containers, or potentially contaminating the transfer by penetrating confining layers beneath a landfill). Additionally, the samples gathered by drilling are not representative of the heterogeneous conditions found in a landfill. Trenching and test pitting allow a larger, more representative area to be observed, permit selection of specific samples from the pile of spoiled or stockpiled material (biased grab sampling), and, with reasonable precautions, allow the retrieval of intact, buried containers.

Backhoe and trenching methods involve the creation of shallow excavations for the purpose of obtaining detailed information about shallow subsurface conditions. It is a less cost effective sampling method than hand auguring, but far cheaper than hiring a drill rig.

Additionally, sampling from excavations at hazardous waste sites necessarily involves consideration of several health and safety issues, including the possibility of sidewall collapse and concentration of toxic or explosive gases within the excavation. Backfilling of the trench may require the segregation of hazardous materials to a collec-

FIGURE 3-3

POWERED HAND AUGER



Powered Hand Auger

tion area and addition of clean fill to make up the lost volume. The "hazardous material" may be defined by look (oily, colored) or by air monitoring.

The following guidelines for construction of test pits and trenches, and collection of samples are taken from EPA's A Compendium of Field Operations Methods: Volume 1.

Test pits and trenches may be excavated by hand or by power equipment to permit detailed explanation and clear understanding of the nature and contamination of the insitu materials. The size of the excavation will depend primarily on the following:

- The purpose and extent of the exploration;
- The space required for efficient excavation;
- The chemicals of concern;
- The economics and efficiency of available equipment.

Test pits normally have a cross section that is four to ten feet square; test trenches are usually three to six feet wide and may be extended for any length required to reveal conditions along a specific line. Fifteen feet is considered to be the economical vertical limit of excavation. However, larger and deeper excavations have been used when special problems justified the expense.

The construction of test pits and trenches should be planned and designed in advance as much as possible. However, field conditions may necessitate revisions to the initial plans. The field supervisor should determine the exact depth and construction. The test pits and trenches should be excavated in compliance with applicable safety regulations as specified by the health and safety officer.

If the depth exceeds four feet and people will be entering the pit or trench, Occupational Safety and Health Administration (OSHA) requirements must be met: walls must be braced with wooden or steel braces, ladders must be in the hole at all times, and a temporary guardrail must be placed along the surface of the hole before entry. It is advisable to stay out of test pits as much as possible. If possible, the required data or samples should be gathered without entering the pit. Samples of leachate, ground water, or sidewall soils can be collected with telescoping poles, etc.

Stabilization of the sides of test pits and trenches, when required, generally is achieved by sloping the walls at a sufficiently flat angle or by using sheeting. Benching or terracing can be used for deeper holes. Shallow excavations are generally stabilized by sheeting. Test pits excavated into fill are generally much more unstable than pits dug into natural inplace soil.

Sufficient space should be maintained between trenches or pits to place soil that will be stockpiled for cover, as well as to allow access and free movement by haul vehicles and operating equipment. Excavated soil should be stockpiled to one side, in one location, preferably downwind, away from the edge of the pit to reduce pressure on the pit walls.

Dewatering may be required to assure the stability of the side walls, to prevent the bottom of the pit from heaving, and to keep the excavation dry. This is an important consideration for excavations in cohesionless material below the ground water table. Liquids removed as a result of dewatering operations must be handled as potentially contaminated materials.

The overland flow of water from excavated saturated soils and the erosion or sedimentation of the stockpiled soil should be controlled. A temporary detention basin and a drainage system should be planned to prevent the contaminated wastes from spreading.

Sampling Guidelines

Sampling from test pits can be performed by "disturbed" and "undisturbed" methods. Sampling should begin from within the pit or trench only after proper safety precautions have been initiated.

Disturbed samples are those that have been collected in a manner in which the in situ physical structure and fabric of the soil have been disrupted. Disturbed sampling techniques typically include sampling from the walls or floors of the test pit by means of scraping or digging with a trowel, rockpick, or shovel. These samples should be collected after the face or floor of the pit is scraped clean. The sample is collected without sluff and at a specific measured depth. Large disturbed samples can be taken directly from the backhoe bucket during excavation; however, care must be taken to assure that the sample is actually from the unit desired and does not include slough or scraped material from the sides of the trench.

"Relatively undisturbed" samples can be obtained from test pits. Typically, an undisturbed sample is collected by isolating by hand a large cube of soil at the base or side of the test pit. This sample can be cut using knives, shovels, and the like. Care is taken to keep disturbances to a minimum. After the block of soil is removed, it is placed in an airtight, padded container for shipment to the lab. The overexcavated sample is "trimmed" at the laboratory to the size required for the designated test. In some instances (e.g., in soft cohesive soil), it may be possible to get an undisturbed sample by pushing a Shelby tube or other similar sampling device into an undisturbed portion of the test pit and by using a backhoe.

Backfilling Guidelines

Before backfilling, the on site crew should photograph all significant features exposed by the test pit and trench and should include in the photograph a scale to show dimensions. Photographs of test pits should be marked to include site number, test pit number, depth, description of feature, and date of photograph. In addition, a geologic description of each photograph should be entered in the logbook. All photographs should be indexed and maintained for future reference.

After inspection, backfill material should be returned to the pit

under the direction of the field supervisor.

If a low permeability layer is penetrated (resulting in ground water flow from an upper contaminated flow zone into a lower uncontaminated flow zone), backfill material must represent original conditions or be impermeable. Backfill could consist of a soil/bentonite mix prepared in a proportion specified by the field supervisor (representing a permeability equal to or less than original conditions). Backfill should be covered by "clean" soil and graded to the original land contour. Revegetation of the undisturbed area may also be required.

3.2.2.5 Hand-Driven Split-Spoon Samplers

A hand-driven split-spoon sampler provides a means to obtain relatively undisturbed core samples. The depth will again be limited by the soil type and also the number of sampling rod sections available for the split-spoon. When the split-spoon is opened, the core should be visually inspected for varying strata which are present. Samples should be obtained from each, using a stainless steel scoop.

3.2.2.6 Truck or Trailer Mounted Drilling Methods

Truck and/or trailer mounted drills represent extensions of the capabilities of powered hand augers. Drilling techniques such as solid or hollow-stem augers, cable tool and air-rotary can be used with several sampling devices, including split-spoons and Shelby tubes, to collect shallow and deep subsurface samples. The choice of a particular drilling and sampling method depends on the depth required, geologic formation, and program objectives. Descriptions of methods most frequently used are provided below.

Solid-Stem Continuous Flight Augers

Samples can be recovered by several methods when using solid stem continuous flight augers. Samples may be obtained from cuttings deposited at the top of the hole as the auger advances, by pulling the augers out of the hole at certain intervals and sampling the material adhering to the auger bit or cutter head, or by driving a split spoon sampler into undisturbed soil at the bottom of the boring. The first method is relatively quick and easy but it is often difficult to define the depth from which the sample was collected. The second provides better control over sample depth (although as depth increases some mixing of deep and shallow materials is inevitable while the augers are pulled), but is labor intensive. Neither technique allows for collection of undisturbed samples. Split spoon sampling is the preferred method for collecting relatively undisturbed samples representative of subsurface conditions.

Hollow-Stem Continuous Flight Augers

As with solid-stem augers, samples can be collected directly from the ground surface or flights of the hollow-stem auger. The hollow-stem method also allows for collection of relatively undisturbed samples,

through the use of split-spoon samplers (Figure 3-4), core barrel samplers, and other similar devices. To collect undisturbed samples through a hollow-stem auger the following general steps are employed:

- Drill to a point immediately above the desired sample depth;
- Remove the drill rods and center bit from the hole;
- Attach the sampling device to the drill rod and lower it down the hole;
- Drive the sampler beyond the lead auger to a predetermined distance;
- Record the number of blows required to drive the sampler in six inch increments;
- Retrieve the drill rod and sampler.

Once the sample is retrieved, the split-spoon sampler can be opened and the sample logged and removed. Most core barrels are constructed with an inner tube that contains the sample. The outer tube is first removed and the inner tube is split to expose the sample, similar to a split-spoon. Some inner tubes are made of transparent plastic so the sample can be inspected before the tube is cut open. Split-spoons can also be fitted with brass or stainless steel sleeves and catch baskets to assist in recovering a sufficient sample volume.

In addition to split-spoons and core barrels, continuous cores can be collected as the augers are advanced using the wireline method. A thin-walled sample tube and special latching mechanism are placed within the deepest hollow-stem auger. The latching arrangement permits the tube to remain stationary while the auger rotates. When the sample tube is full, it is pulled to the surface by a wireline hoist and exchanged for an empty sampler. Drive samplers can also be driven out the bottom of the augers with the wireline method. When sampling below the water table in loose sand formations, the water level within the auger must be kept at or above the ground water level as the plug is pulled to prevent sand from rising up into the stem before the sampling tube is driven into the formation. Samples of the water added to the hole must be collected to ensure that contaminants are not introduced.

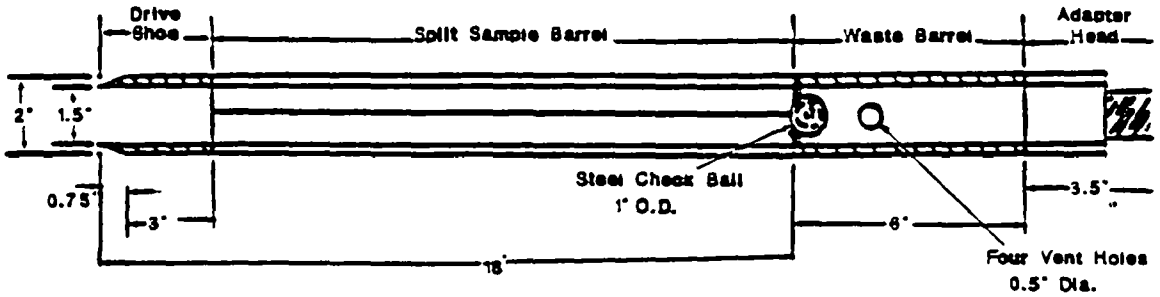
Specific descriptions of split-spoon and core barrel type sampling methods, as provided in EPA's Compendium of Superfund Field Operations Methods, are as follows.

Split-Spoon Samplers

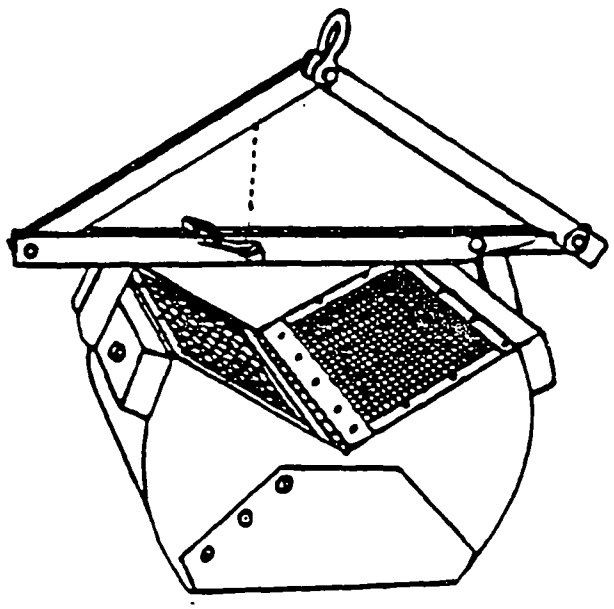
The split-spoon sampler is a thick-walled, steel tube that is split lengthwise. A cutting shoe is attached to the lower end; the upper end contains a check valve and is connected to the drill rods. When a boring is advanced to the point that a sample is to be taken, drill tools are removed and the sampler is lowered into the hole on the bottom of the drill rods.

FIGURE 3-4

SPLIT-SPOON
SAMPLER and PONAR GRAB



Split-Spoon Sampler



Ponar Grab

The sampler is typically driven 18 inches into the ground in accordance with a standard penetration test (ASTM D1586). The effort taken to drive the sampler the last 12 inches is recorded at six-inch intervals, and the sampler is removed from the boring. The density of the sampled material is obtained by counting the blows per foot as the split-spoon sampler is driven by a 140-pound hammer falling 30 inches. This field penetration test is valid from a lower limit of 5 to 10 blows per foot to an upper limit of 30 to 50 blows per foot. It is applicable to fairly clean, coarse-grained sands and gravels at a variety of water contents and saturated or nearly saturated fine-grained soils.

The standard-size split-spoon sampler has an inside diameter (ID) of 1.38 to 1.5 inches. When soil samples are taken for chemical analysis, it may be desirable to use a 2 or 2.5 ID sampler, which provides a larger volume of material but cannot be used to calculate aquifer properties by using the stated ASTM test method.

The split-spoon sampler is decontaminated between samples. In some instances, separate, previously decontaminated split-spoon samplers may be advisable for each sample taken to expedite the sampling process.

Aliquots are taken from the sampler at selected increments and are placed in jars or, where lenses or layers are evident, the material types should be separated into different jars.

Thin-Walled Tube Samplers

Thin-walled samplers, such as a Shelby tube, are used to take relatively undisturbed samples of soil from borings. The samplers are constructed of cold drawn steel tubing about 1 mm thick (for tubes two inches in diameter) or 3 mm thick (for tubes five inches in diameter). The lower end is bent to form a tapered cutting edge. The upper end is fastened to a check valve to help hold the sample in the tube when the tube is being withdrawn from the ground. Thin-walled tube samples are obtained by any one of several methods including pushed-tube, Pitcher sampler, Denison sampler, and piston sampler methods. Choosing the most appropriate method requires that field personnel use their own judgment. Since the purpose of thin-walled tube sampling is to obtain the highest quality undisturbed samples possible, special care should be taken in the sampling, handling, packaging, and shipping of these samples.

In obtaining pushed-tube samples, the tube is advanced by hydraulically pushing in one continuous movement with the drill rig. The maximum hydraulic pressure is recorded. At the end of the designated push interval and before lifting the sample, the tube is twisted to break the bottom of the sample.

Upon recovery of a thin-walled tube, the actual length of sample is measured and recorded (excluding slough or cuttings). At least 1/2 inch of soil is cleaned from each end of the tube, and the ends of the soil sample are squared off. Usually the top of the sample will contain cuttings or slough. These must be removed before sealing. The soil that

has been cleaned from the tube can be used for a visual classification of the sample. The resulting space at each end of the tube is filled with melted sealing material, such as approved wax, or with expandable packers. Previously decontaminated Teflon or stainless steel plugs are also used. After this initial sealing, a dry filler such as cuttings, sand, or paper can be placed in the remaining void areas, and sealing is again conducted. This filler prevents the sample from breaking the initial end seals during handling and shipment. The ends of the tube are then closed with tight-fitting metal or plastic caps, and the seam between the cap and tube is wrapped with tape. Finally, the ends are dipped in hot wax, completely covering the tape to ensure sealing.

Cable-Tool (Percussion) Drilling

The cable tool method is best suited for drilling relatively shallow holes in large, caving, gravelly formations with cobbles and boulders. It is also used effectively for detecting perched or narrow, confined water bearing zones. Sampling unconsolidated materials by the cable tool method present comparatively few difficulties. The depth from which the samples are obtained can be measured accurately.

Collecting samples by the cable tool method involves drilling and driving casing a short distance and then using a bailer to clean out the plug of material. Compact plugs may have to be loosened and mixed by the drill bit before the material can be picked up by the bailer. The casing may be driven about one foot (0.3 m) into interbedded sand and clay, or several feet in thick sand to isolate a sample.

Heaving sand conditions may interfere with sampling and logging when the cable tool method is used. There is no way to know what part of the sand formation is represented by the material inside the casing after the heave takes place. In addition, upward flow of the sand tends to separate fine fractions from coarse fractions. The usual practice is to discard materials that move up into the casing. Some drillers add water to the casing to control heaving. Be sure that the water added is from a controlled supply source and that samples of it are collected to check for contaminants.

More than one bailer load of material should be mixed together to provide a sample that is reasonably representative of the sampling interval. This is particularly important when sampling sand and gravel formations.

Several types of bailers can be used to remove the cuttings. A flat-valve bailer is worked down into a loose mass by a pumping action produced by lifting and dropping the bailer only a few inches. The driller often does this by pulling on the sand line. A sand pump with rod plunger is also useful for sampling work because the upward stroke of the plunger draws material up through the valve and into the bailer. The action produces some washing of the sample and this fact must be kept in mind. A dart-valve bailer is not as useful in sampling sand formations because it is effective only when enough clay is mixed with the sand to hold it in suspension in a mud slurry.

The method known as drive-core sampling provides the most accurate means of obtaining representative formation samples from unconsolidated strata. The method consists of driving a tube two to four feet (0.6 to 1.2 m) long into the material and then withdrawing it. To prevent loss of the core from the core barrel, the tube is overdriven - that is, it is driven a distance greater than its length in order to compact the material inside the tube. This practice permits recovery of the core in most cases, even when sampling clean sand or clean sand and gravel. The drive-core tube may be driven into a plug or material inside the casing after driving the casing a short distance, or it may be driven into the material below the bottom of the casing. The driller usually must determine the best procedure by trial in any given situation.

Air Rotary Drilling

Air rotary is an efficient method of drilling through both unconsolidated and consolidated deposits. It is of particular value in consolidated formations or formations that contain erratics or boulders that present serious problems for other drilling methods.

Some drawbacks to air rotary drilling are the fact that compressed air is used to force the cuttings to the surface. This air must be filtered to assure no trace contamination by oil carried in the compressed air. Several filters are available for this purpose, but are fairly costly. In addition, the agitation of both cuttings and ground water as they are brought to the surface will affect concentration of volatile compounds and affect the original soil structure for logging purposes. These factors should be considered and precautions taken if it appears that these conditions could jeopardize a drilling sampling program.

When collecting samples using the air rotary method of drilling, the cuttings are blown from a discharge point into a "cyclone" or other type of collection device. The exit velocities for these materials are fairly high so a sieve or strainer with a long handle is essential to catching the sample. Several scoops should be combined as a particular interval is penetrated to minimize the effects of sorting as the cuttings are brought to the surface.

3.2.2.7 Compositing Strategies

Methods for compositing subsurface soil samples are identical to those described for surface soils (Section 3.2.1). The subsurface composite sample can be obtained by mixing aliquots from the same soil type or formation from several holes as well as vertically from the same hole.

3.2.2.8 Summary

Regardless of the sampling method, each sample should be completely and accurately identified. Excess water should be drained from the samples before sending them to the laboratory. The depth from which the sample was collected, the thickness of material that it represents, and its sequence in the soil profile should be clearly documented.

It is important that all equipment coming in contact with the soil be decontaminated between sampling locations (see Section 3.3).

Many techniques exist for obtaining subsurface soil samples. It is important that the type of samples collected satisfy the purpose of the investigation. Discuss the type of samples needed with the project manager and driller to ensure the objectives of the sampling episode are met. Follow all health and safety guidelines when handling samples, because the sample often is the closest you will come into contact to hazardous materials. Dispose of any extra samples in an acceptable manner.

3.2.3 Sludge And Sediment Sample Collection Methods

Sludge and sediment samples, whether composite or grab, should be collected using the procedures outlined in Section 3.2.1 for surface soil. However, it must be noted that sludge may represent concentrated wastes (i.e., from bottom of sump or drum) and should therefore be handled with caution.

General items that should be considered when sampling sediments include the distance from the bank of a stream or pond one should be before sampling (i.e., bank versus bottom) and consideration of stream hydraulics in deposition of sediments (where are the erosion points versus main areas of sediment deposition).

Sludge and sediment sample collection methods of preference include hand/gravity corers, the ponar grab, the ekman grab, and scrape/scoop collection.

3.2.3.1 Hand Corer

This device is essentially the same type of thin-wall corer described for collecting soil samples (Figure 3-2). It is modified by the addition of a handle to facilitate driving the corer and a check valve on top to prevent washout during retrieval through an overlying water layer.

Hand corers are applicable to the same situations and materials as the scoop described in Section 3.2.1.1. It has the advantage of collecting an undisturbed sample that can profile any stratification in the sample as a result of changes in the deposition.

Some hand corers can be fitted with extension handles that will allow the collection of samples underlying a shallow layer of liquid. Most corers can also be adapted to hold liners generally available in brass or polycarbonate plastic. Care should be taken to choose a material that will not compromise the chemical integrity of the sample.

3.2.3.2 Gravity Corer

A gravity corer is a metal tube with a replaceable tapered nosepiece on the bottom and a ball or other type of check valve on the top. The check valve allows water to pass through the corer on descent but prevents washout during recovery. The tapered nosepiece facilitates cutting and reduces core disturbance during penetration. Most are constructed of brass or steel and many can accept plastic liners and additional weights (Figure 3-5).

Corers are capable of collecting samples of most sludges and sediments. They collect essentially undisturbed samples that represent the profile of strata that may develop in sediments and sludges during variations in the deposition process. Depending on the density of the substrata and the weight of the corer, penetration to depths of 30 inches can be attained. Care should be exercised when using gravity corers in vessels or lagoons that have liners, since penetration depths could exceed that of substrate and result in damage to the liner material.

There are many different types of corers that can be used for sludge or sediment sampling. Those most commonly used are presented in Table 3-1 with a discussion of disadvantages and advantages for each.

3.2.3.3 Ponar Grab

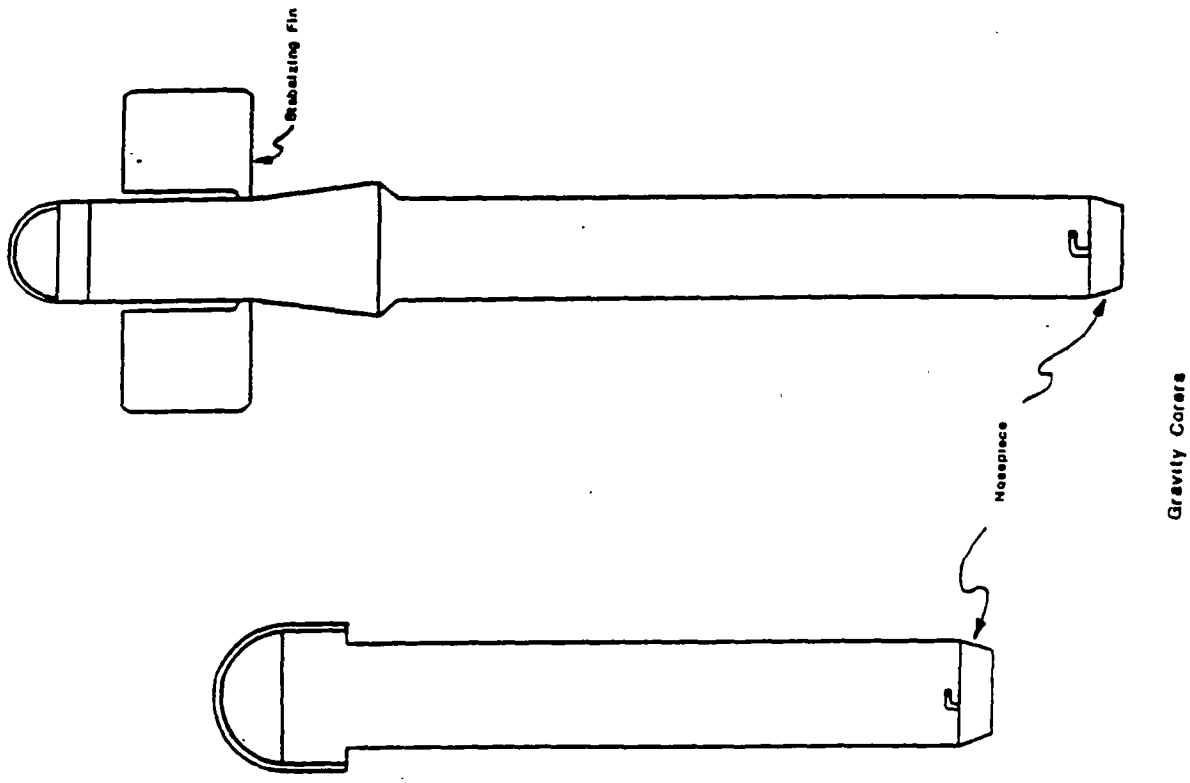
The Ponar grab (Figure 3-4) is a clamshell type scoop activated by a counter lever system. The shell is opened and latched in place and slowly lowered to the bottom. When tension is released on the lowering cable the latch releases and the lifting action of the cable on the lever system closes the clamshell.

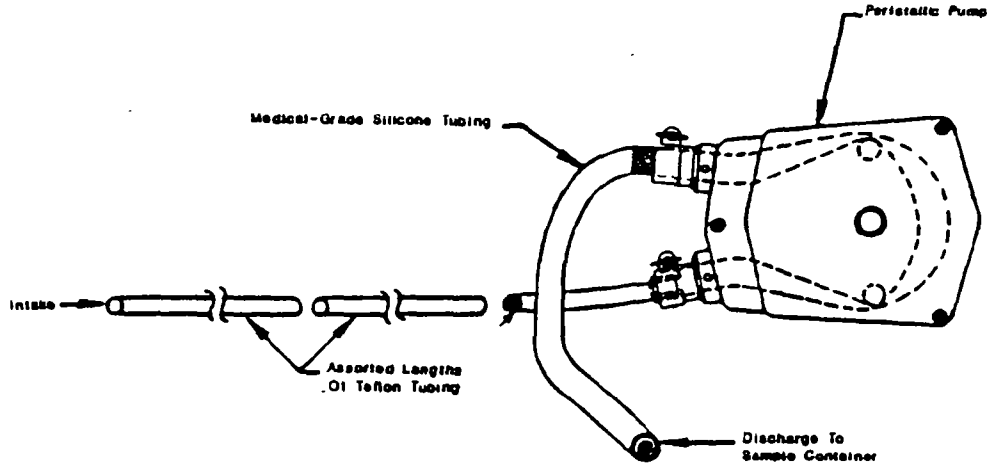
Ponars are capable of sampling most types of sludges and sediments from silts to granular materials. They are available in a "Petite" version with a 36 square inch sample area that is light enough to be operated without a winch or crane. Penetration depths will usually not exceed several centimeters. Grab samplers, unlike the corers described above, are not capable of collecting undisturbed samples. As a result, material in the first centimeter of sludge cannot be separated from that at lower depths. The mechanical action of these devices create turbulence that may temporarily resuspend some settled solids. This disturbance can be minimized by slowly lowering the sampler the last half meter and allowing a very slow contact with the bottom. It is advisable, however, to only collect sludge or sediment samples after all overlying water samples have been obtained.

Although the Ponar grab is one of the most popular sediment samplers available, it is only one of many different kinds of bottom grabs available for collecting samples of this type. Although it has its advantages, it can become buried in soft bottom sediment and become difficult to remove. Table 3-2 provides a list of the most commonly used bottom grabs and the advantages and disadvantages for each.

FIGURE 3-5

GRAVITY CORERS and
PERISTALTIC-PUMP SAMPLER





Peristaltic Pump Sampler

TABLE 3-1

COMPARISON OF CORING DEVICES

Device	Advantages	Disadvantages
Kajak or K.B. Corer	Does not impede free flow of water, no pressure wave, easily applied to large area.	
Moore (Pfleger)	Valve allows sample to be held.	Careful handling necessary to avoid sediment rejection, not appropriate in soft sediments.
O'Connor	Can sample water with hard bottoms.	Not apporpriate in deep water.
Elgmork's	Sample easily removed, good in soft muds, easy to collect, easy to remove sample.	Not appropriate in hard sediments.
Jenkins	Good in soft sediments and for collecting an undisturbed sediment-water interface sample. Visual examination of benthic algal growth and rough estimates of mixing near the interface after storms can be made.	Complicated.
Enequist	Good in soft/medium sediments, closing mechanism.	Does not peentrate hard bottom.
Kirpicenko	Soft and hard bottoms, various sizes, closes automatically.	Not appropriate for stony bottoms.

TABLE 3-2

COMPARISON OF BOTTOM GRABS

Device	Advantages	Disadvantages
Ponar	Safe, easy to use, prevents escape of material with end plates, reduces shock wave, combines advantages of others, preferred grab in most cases.	Can become buried in soft sediments.
Ekman	Use in soft sediments and calm waters, collects standard size sample (quantitative), reduces shock wave.	Not useful in rought water; not useful if vegetation on bottom.
Tall Ekman	Does not lose sediment over top; use in soft sediments and calm water, standard sample size, reduces shock wave.	Not useful in rough waters, other as for Ekman.
Peterson	Quantitative samples in the fine sediments, good for hard bottoms; sturdy and simple construction.	May lose sampled material, premature tripping, not easy to close; does not sample constant areas; limited sampling capacity.
Smith-McIntyre	Useful in bad weather, flange on jaws reduced material loss, screen reduces shock waves, good in all sediment types.	Large, complicated and heavy, hazardous, for samples to 7-cm depth only, shock weave created.
Hayward Orange Peel	Easy to operate, commercially available in various sizes, does not rust easily, does not require messenger, good bottom penetration, takes undisturbed sample of top sediment.	Difficult to determine sampling cover, two cables required, active washing during sampling, jaws do not close tightly, soft sediment fouls closing mechanism.
Diver	Can determine most representative sampling point and current velocity.	Requires costly equipment and special training.

3.2.3.4 Teflon Beaker

To obtain sediments from larger streams or farther from the shore of a pond or lake, a Teflon beaker attached to a telescoping aluminum pole by means of a clamp may be used to dredge sediments.

3.2.3.5 Scrape/Scoop Collection

A trowel, or scoop or the sample jar itself can be used when exposed material is being collected. Sludges from sewer lines, empty ponds, etc. are collected by scraping/scooping and are transferred to the sample jar. This method is not advised for sediments with a fairly high liquid content, as disruption will alter the environment and the liquid/solid ratio in samples.

3.2.3.6 Compositing Strategies

Aerial composites of sludge and sediment samples are generally derived using the mixing bowl technique as described in Section 3.2.1. As with the soil samples, care must be taken when compositing to regulate the volume and number of sub-samples used in the composite. Wet samples will tend to clump and not mix well, especially if subsamples contain different water contents.

3.2.3.7 Summary

In general, one should choose the type of sampler that meets the needs of the sampling program by considering the advantages and disadvantages of the sampler type. For the most part, equipment of simple construction is preferred due to ease of operation and maintenance plus lower expense.

3.2.4 Surface Water Sample Collection Methods

A number of issues should be addressed while developing a surface water sampling methodology. In particular, consideration should be given to the following:

- The solubility and density of the compound(s) of interest determines the appropriate sample collection depth;
- The degree of mixing between the source and sampling station;
- Factors such as safety and accessibility determine how far from the bank one samples;
- Water samples are to contain only liquids and suspended matter (no sludges, etc.);
- A background sample is needed from upstream of the source in question for all bodies of water (i.e., if a tributary adds to a source stream, both must have background;

- Samples to be analyzed for volatile organics should have no head space (or bubbles) in the sample jar, should be handled as little as possible, and should be collected above areas of turbulence (i.e., in streams);

- Cyclical effects should be considered, such as time of discharge from a facility, time of year and weather;

- Sampling should be performed moving from downstream to upstream locations.

- Note the discharge of the stream, if possible.

Coupling surface water sample locations with sediment sample locations is beneficial as the likelihood for contamination of one media by the other is high.

3.2.4.1 Sample Container

This is the easiest surface water sampling method, and is suitable for collecting samples from shallow depths.

- Sampler is positioned downstream of the sample location in order to prevent stirred sediment from contaminating the sample.

- The sample container is submerged with the mouth facing upstream (if flowing).

- Allow the bottle to fill completely, as evidenced by the cessation of air bubbles.

- Raise and cap the bottle.

- Wipe the bottle clean.

In surface water bodies with a shallow bottom, the sampler can dig a hole, wait for it to fill and clear, and then collect the water sample.

Advantages of this method are that it alleviates the need for transferring the sample, which could significantly alter it. This is especially important with samples collected for oil and grease analysis, since material may adhere to the transfer container, thus producing inaccurately low analytical results.

A disadvantage to this sampling method is that the outside of each sample container will require decontamination prior to packaging.

3.2.4.2 Bailer or Dipper

This method is similar to using the sample container, however, decontamination of the final sample jar may not be necessary. Specific sample depths cannot be guaranteed unless only the immediate surface is

sampled. The increased sample handling between the source and the final sample jar may increase the loss of volatile organics from the sample.

- Sampler is positioned downstream of the sample location in order to prevent stirred sediment from contaminating the sample.
- The sample container is submerged with the mouth facing upstream (if flowing).
- The dipper (Figure 3-6) or bailer is slowly submerged, allowed to fill, and slowly retrieved.
- The sample is then poured into the sample container by allowing the liquid to run down the inside of the jar.
- Cap the bottle and wipe the bottle clean if necessary.
- Decontaminate the bailer.

3.2.4.3 Weighted Bottle Sampler

The following guidelines for the use of a weighted-bottle sampler are taken from EPA's A Compendium of Superfund Field Operations Methods.

A weighted-bottle sampler is used to collect samples at any predetermined depth. The sampler consists of a glass bottle, a weighted sinker, a bottle stopper, and a line that is used to open the bottle and to lower and raise the sampler during sampling. This sampler can be either fabricated or purchased. The procedure for use is as follows:

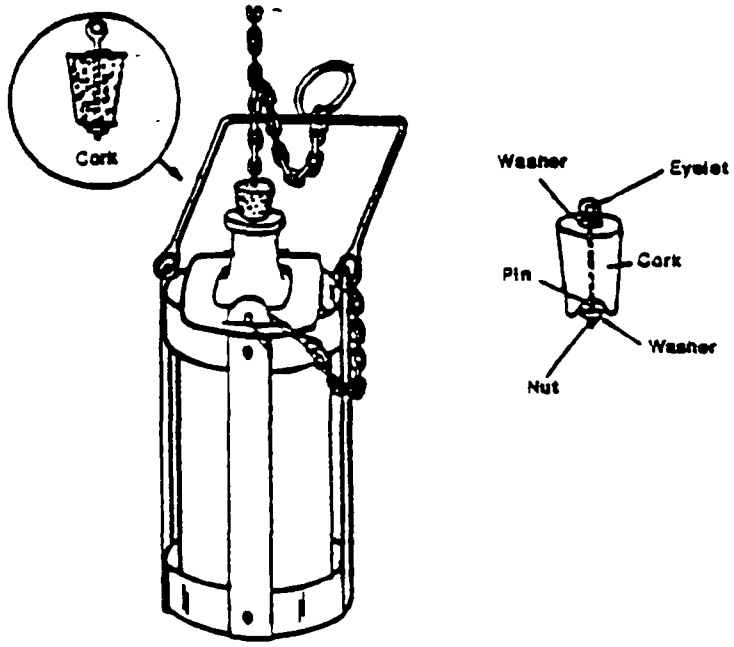
- Assemble the weighted bottle sampler as shown in Figure 3-6.
- Gently lower the sampler to the desired depth so as not to remove the stopper prematurely.
- Pull out the stopper with a sharp jerk of the sampler line.
- Allow the bottle to fill completely, as evidenced by the cessation of air bubbles.
- Raise the sampler and cap the bottle.
- Wipe the bottle clean. The bottle can also be used as the sample container.

3.2.4.4 Pump and Tubing

While the use of a pump requires a power source (batteries or generator), it also allows for remote sampling and sampling at a specific depth. The depth is limited by the type and power of the pump and by the hydraulic head.

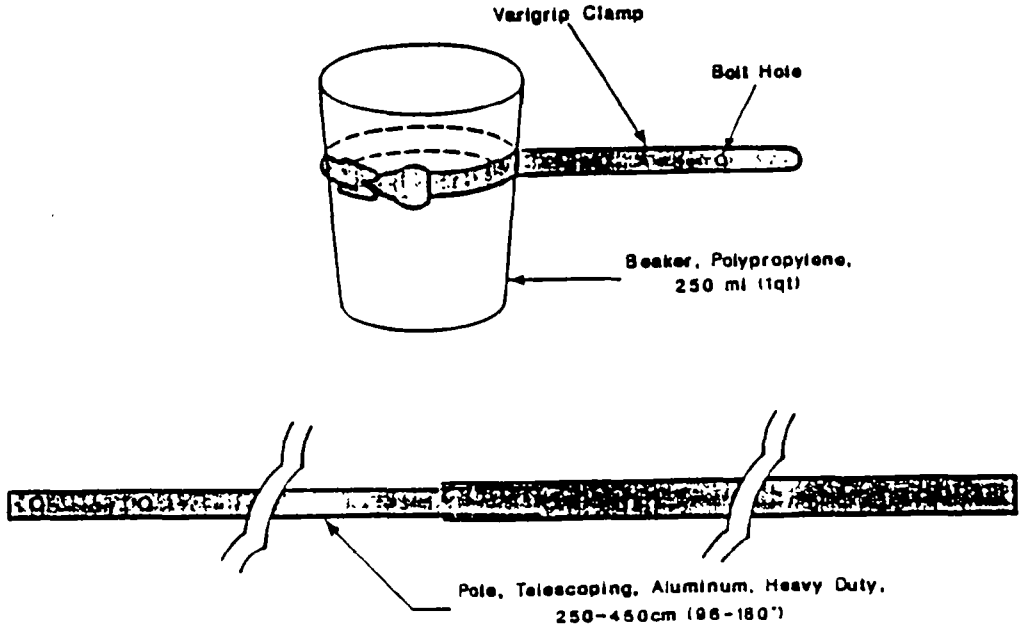
FIGURE 3-6

POND SAMPLER and
WEIGHTED-BOTTLE SAMPLER



Weighted-Bottle Catcher
1000ml (1qt)

Weighted-Bottle Sampler



Pond Sampler

Peristaltic Pumps

Peristaltic pumps can be used to collect surface water samples and transfer them directly to the sample container (Figure 3-5). Advantages of the pumps are that they are easy to use, and the discharge tubing can be easily changed between samples to prevent cross contamination. Disadvantages of the pumps are that they require a power source, and are not recommended for collection of samples for volatile organics analysis when the pump must be located higher than the water surface. Directions for using a peristaltic pump are as follows:

1. Install clean, medical-grade silicone tubing in the pump head, per the manufacturer's instructions. Allow sufficient tubing on the discharge side to facilitate convenient dispensation of liquid into sample bottles, but only enough on the suction end for attachment to the intake line. This practice will minimize sample contact with the silicone pump tubing. (Some types of thinner Teflon tubing may be used.)

2. Select the length of suction intake tubing necessary to reach the required sample depth and attach the tubing to intake side of pump tubing. Heavy-wall Teflon of a diameter equal to the required pump tubing will suit most applications. (A heavier wall will allow for a slightly greater lateral reach.)

3. If possible, allow several liters of sample to pass through the system before actual sample collection. Collect this purge volume, and then return it to source after the sample aliquot has been collected.

4. Fill necessary sample bottles by allowing pump discharge to flow gently down the inside wall of the sample container with minimal entry turbulence.

3.2.4.5 Kemmerer Sampler

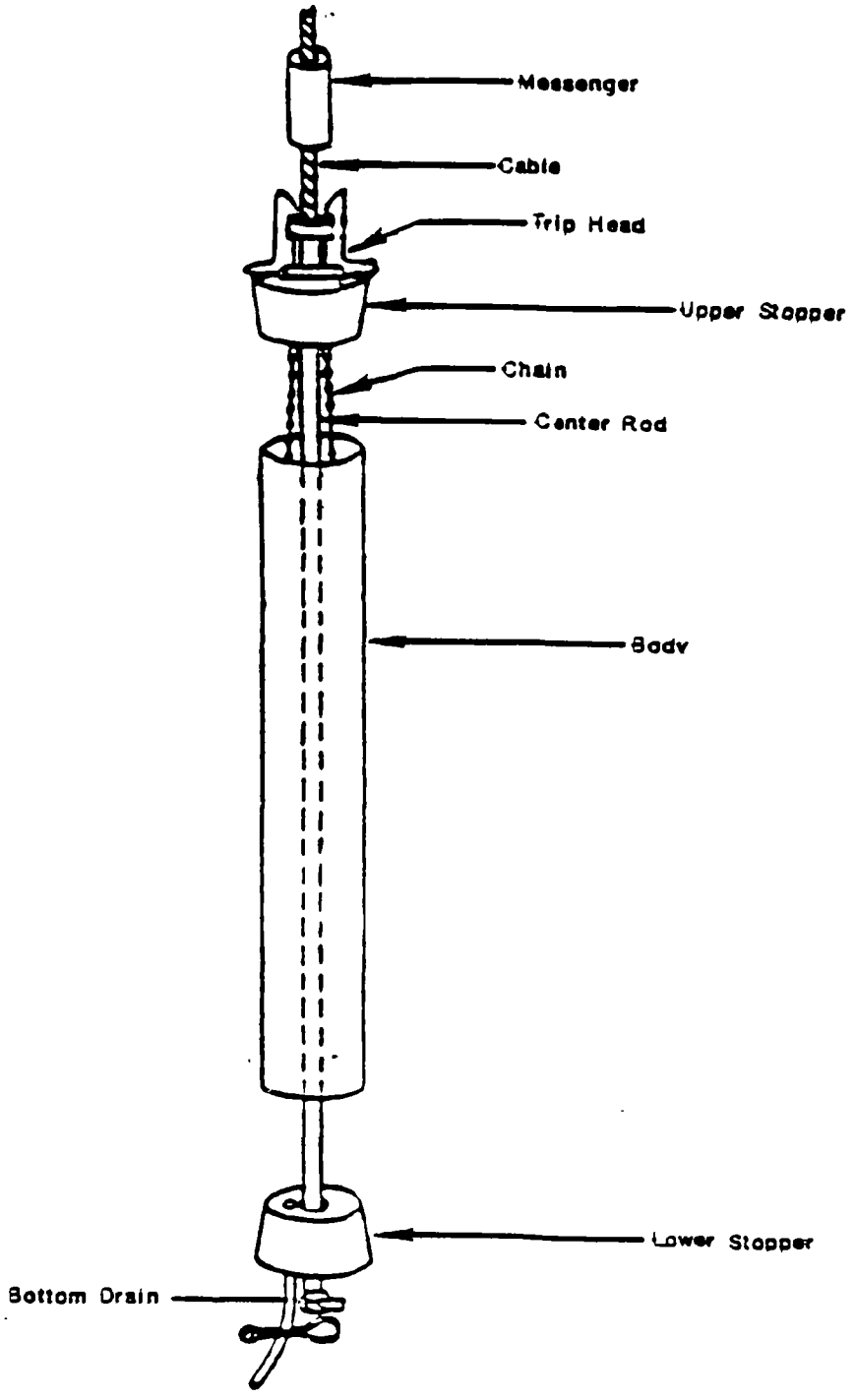
This apparatus allows the collection of surface waters at specified depths (Figure 3-7). The sampler is attached to a measured sampling line, and the messenger activated corking assembly is lifted open. The sampler is then lowered to the desired depth and the messenger is released, tripping the corking system. The sampler is retrieved and the contents transferred to the appropriate sample containers.

3.2.4.6 Glass Thieving Rod

Glass tubing can be used to collect surface water samples. Advantages of the method are the ability to sample stratified water bodies, such as a lagoon with a floating oil layer. Maximum sampling depths are limited to a few feet, and are dependent on the viscosity of the liquid being sampled. Disadvantages of the method are the relatively small volumes obtained by the tubes, difficulty in preventing drippage, and potential loss of oily sample fractions to the inside of the tube. To collect a sample, a glass tube generally of less than 20-mm is lowered

FIGURE 3-7

MODIFIED-KEMMERER SAMPLER



slowly into the source, so as to maintain the stratification of the source. The liquid on the inside and outside of the tube should be at the same height, indicating minimal disturbance while filling. Cap the top of the tube (usually with a thumb) to create a seal, and withdraw the tube from the source. Holding the end of the glass tube over the sample container, make a small break in the seal at the top to allow the sample to slowly drain into the sample container. This may need to be repeated several times to obtain sufficient sample volume.

3.2.4.7 Compositing Strategies

Composite surface water samples can be collected to represent an average discharge concentration over time, over a range of depths, or spatial locations. Time composites can also be used to sample seeps or other contaminant sources that have very low flow or discharge volumes. Automated systems can be programmed to collect sample aliquots at predetermined times.

3.2.5 Ground Water Sample Collection Methods

The following considerations should be addressed when preparing to collect ground water samples from wells:

- Background information should be recorded systematically using a method such as a "Ground Water Measurement Data Sheet" (Figure 3-8). Well information can be obtained from driller's logs, geotechnical reports, the facility owner, etc.

- The well owner should be notified of the proposed sampling and permission to access the well should be acquired. If the well is locked, arrangements should be made to obtain a key. Vehicle access to the well site should be determined, and if not possible, alternative arrangements to transport sampling equipment should be made.

- Preparation for fieldwork, which includes the selection of specific sampling equipment and collection techniques.

3.2.5.1 Monitoring Wells

This section outlines the steps necessary for obtaining ground water samples from a monitoring well. Construction methods may be found in EPA/600/2-851104 Section 2. An equipment checklist is provided in Table 3-3.

Removing Well Cap/Venting

As the well cap is removed, air monitoring of the breathing zone should be conducted using the appropriate instruments and health and safety procedures. Allowing the uncapped well to vent for several minutes prior to beginning sampling activities will enable gases that may have concentrated within the well to escape and dissipate.

FIGURE 3-8

GROUNDWATER MEASUREMENT DATA SHEET

SITE NAME: _____ WELL NO.: _____ DATE: _____

TYPE OF WELL: Monitoring _____ Domestic _____ Commercial/Industrial _____
Irrigation _____

ELEVATION: _____ MEASURING POINT AT: _____

CONSTRUCTED DEPTH: _____ DATUM: _____

1. FIELD OBSERVATIONS AND MEASUREMENTS

   a. FIELD PERSONNEL: _____

   b. WEATHER: _____

   c. CONDITION OF WELL: _____

   d. DEPTH TO STATIC WATER (from measuring point): _____

   e. MEASURED TOTAL DEPTH OF WELL: _____

   f. DIAMETER OF THE WELL: _____

   g. LENGTH OF WATER COLUMN (total depth - depth of wtr.): _____

   h. CALCULATED REQUIRED PURGE VOLUME: _____

   i. PURGING METHOD (type, model, composition, etc.):

      Hand Pump _____ Bailer _____

      Portable Unit _____ Dedicated Unit: _____

Date/ Time	Volume Purged	Temp	pH	Conduct. (umhos)	Turbidity	Other	Other

2. ADDITIONAL NOTES

_____

_____

_____

TABLE 3-3

MONITORING WELL SAMPLING EQUIPMENT CHECKLIST

Equipment	Use
Sample Containers	Appropriate to analyses desired
Sample Filtering	See Section 3.2.5.
Field Blanks	See Section 4.
Keys	For locked monitoring wells.
Pipe wrenches Propane torch Hammer and cold chisel	May be necessary to remove steel security caps on wells that have not been recently opened and sampled.
Electronic water level indicator/graduated depth sounder	Use to determine static water level and total depth of well.
Tape measure	Use to measure between increments on the water level indicator/depth sounder.
Pump	Use to purge or evacuate well prior to obtaining sample; it is not a recommended means to obtain a sample.
Generator	Power source for electric pumps.
Extension cord	For use with electric generators.
DOT approved storage drums	For storage of potentially contaminated purge water pending sample analysis.
Well bailer	Use to purge small amounts of standing water if pump is not used and to obtain ground water samples. Figure 3-9
Monofilament line/ Braided nylon cord	Use for lowering bailer into well; should be of sufficient strength to hold full bailer and overcome any resistance between well casing and bailer. Individual line/cord should be dedicated to each well.
Decontamination solutions/ water	Use for decontaminating bailer and water level indicator between wells.

TABLE 3-3 (Cont.)

MONITORING WELL SAMPLING EQUIPMENT CHECKLIST

Equipment	Use
Plastic pails, graduated	Use for measuring volume of water purged from well prior to sampling. Also used to contain potentially contaminated water until it can be disposed of properly.
Thermometer	Use to measure temperature of ground water.
Portable pH meter	Use to measure pH of ground water.
Portable specific conductivity meter	Use to measure specific conductivity of ground water.
Calibration solutions for conductivity and pH meters	Use to calibrate field instruments.
Field logbook	Used to record field observations.
Camera/film Sample tags Chain-of-custody records Receipt for sample forms Waterproof ink pen	Use to document sampling procedure.
Well sampling data sheets	Use to record well information and field measurements.
Disposable gloves	For personnel safety and to prevent cross contamination while handling equipment.
Field filtering unit (optional)	For filtration of samples.
Decontamination supplies: i.e., detergent, sponges, bottle brushes, Acetone or Methanol (reagent grade), paper towels	Use to clean sampling equipment between wells.
Water (organic-free or deionized)	Use for rinsing equipment between wells and for cleaning field instrument probes.

Water Level Measurements

The field measurements should include depth to standing water and total well depth. This information is required to calculate the volume of standing water in the well and provide a check on the integrity of the well (e.g., identify siltation problems). The measurements should be taken to the nearest 0.01 foot.

Electric Tape

a. The reference point (top of casing, top of security casing, pump base) should be constant through all measurements and should be recorded. The elevation of this reference point must be known and clearly marked at the well site;

b. A record of previous depth-to-water measurements of each well should be checked to see if the current measurement is reasonable. If not, then a second measurement should be made;

c. Always make the depth-to-water measurement immediately after opening the well. This measurement must occur before the well has been bailed or a sample taken;

d. Make sure the switch is in the "on" position;

e. Lower the probe into the well;

f. When the indicator light and/or buzzer goes on, slowly raise and lower the tape until the precise depth where the signal initiates is determined;

g. Mark the tape at the reference point, then measure the distance to the nearest measured increment on the tape. Add or subtract accordingly to obtain the depth to water;

h. To measure total well depth, lower the tape slowly into the well until a slight lessening of tension is observed. Raise and lower the tape, determining the precise point at which the tension eases, measure the depth as mentioned in step g. Special caution should be exercised to prevent snagging when measuring depths of wells with dedicated submersible pumps. Also, in deeper wells it may be necessary to add additional weight to the probe in order to make measurements possible.

i. The water level indicator should be at least wiped with a clean paper towel and rinsed/washed with distilled water, hexane and rinsed with distilled water after use. The time of the depth of water reading, point of reference, and depth to water level should be recorded in a water proof field notebook.

Steel Tape

a. This technique is identical to the electric tape method except that the bottom two feet of a weighted steel tape is chalked (powder) and lowered until contact with ground water. Approximate water depth should be known and the sound of an attached weight entering water must be noted. Chalk must not be contaminated.

b. Once water is contacted, lower the tape a few inches and mark tape at the reference point on the well head. Measure the distance from the top of the wetted chalk to the reference point.

Determining Water Volume to be Purged

The goal of well purging is to remove stagnant water in the well, and water in the disturbed formation/gravel pack surrounding the well screen prior to collecting a representative ground water sample. The EPA approved method, using a predetermined purge volume, is described below. In addition, alternatives for sampling slow recharge wells are provided.

Predetermined Purge Volume

A minimum of three casing volumes of standing water should be removed from the casing prior to sampling. The amount of water removed may be determined by collecting it in a graduated pail or drum, by the use of an in-line flow volume meter, or by previous knowledge of the pump capacity.

Using this method, the volume of standing water in the well must be calculated, and may be obtained using the following formula:

$$v = r^2 h \ (0.163)$$

where: v = static volume of water in well in gallons,
r = inside radius of well casing in inches,
h = length of water column in feet, and
0.163 = a constant conversion factor that compensates for the conversion of the casing radius from inches to feet, the conversion of cubic feet to gallons, and pi.

A water column volume table for various casing diameters is provided for fast calculations in Table 3-4.

It should be noted that to be truly assured that the well has been purged the stabilization of pH, conductivity and temperature will occur.

TABLE 3-4

Volume of Water in Casing or Hole

Diameter of Casing or Hole (In)	Gallons per foot of Depth	Cubic Feet per Foot of Depth	Liters per Meter of Depth	Cubic Meters per Meter of Depth
1	0.041	0.0055	0.509	0.509×10^{-3}
1½	0.092	0.0123	1.142	1.142×10^{-3}
2	0.163	0.0218	2.024	2.024×10^{-3}
2½	0.255	0.0341	3.167	3.167×10^{-3}
3	0.367	0.0491	4.558	4.558×10^{-3}
3½	0.500	0.0668	6.209	6.209×10^{-3}
4	0.653	0.0873	8.110	8.110×10^{-3}
4½	0.826	0.1104	10.26	10.26×10^{-3}
5	1.020	0.1364	12.67	12.67×10^{-3}
5½	1.234	0.1650	15.33	15.33×10^{-3}
6	1.469	0.1963	18.24	18.24×10^{-3}
7	2.000	0.2673	24.84	24.84×10^{-3}
8	2.611	0.3491	32.43	32.43×10^{-3}
9	3.305	0.4418	41.04	41.04×10^{-3}
10	4.080	0.5454	50.67	50.67×10^{-3}
11	4.937	0.6600	61.31	61.31×10^{-3}
12	5.875	0.7854	72.96	72.96×10^{-3}
14	8.000	1.069	99.35	99.35×10^{-3}
16	10.44	1.396	129.65	129.65×10^{-3}
18	13.22	1.767	164.18	164.18×10^{-3}
20	16.32	2.182	202.68	202.68×10^{-3}
22	19.75	2.640	245.28	245.28×10^{-3}
24	23.50	3.142	291.85	291.85×10^{-3}
26	27.58	3.687	342.52	342.52×10^{-3}
28	32.00	4.276	397.41	397.41×10^{-3}
30	36.72	4.909	456.02	456.02×10^{-3}
32	41.78	5.585	518.87	518.87×10^{-3}
34	47.16	6.305	585.68	585.68×10^{-3}
36	52.88	7.069	656.72	656.72×10^{-3}

1 Gallon = 3.785 Liters

1 Meter = 3.281 Feet

1 Gallon Water Weighs 8.33 lbs. = 3.785 Kilograms

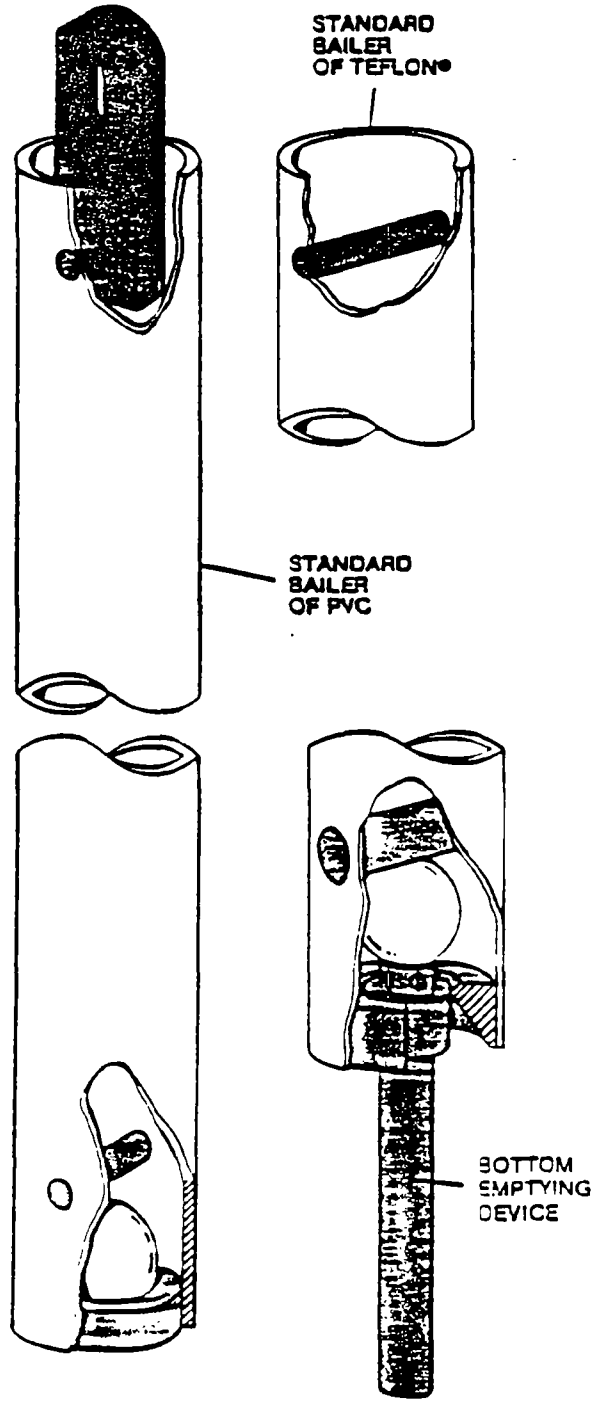
1 Liter Water Weighs 1 Kilogram = 2.205 lbs.

1 Gallon per foot of depth = 12.419 liters per foot of depth

1 Gallon per meter of depth = 12.419×10^{-3} cubic meters per meter of depth

FIGURE 3-9

STANDARD BAILER



Slow Recharge Wells

Where slow-recharging wells are encountered, the three casing volume minimum requirement may be waived. There are currently several different approaches to purging and sampling wells that recharge slowly, including:

- Evacuating the well to dryness and allowing it to recover enough such that a full sample volume can be withdrawn from the well.
- Allowing the well to recharge after complete evacuation while taking several small incremental samples during recharge.

Purging Methods

The method used to purge a well is dependent upon the size (inside diameter) of the well to be sampled, depth to water, volume of water in the well, and well accessibility. The types of equipment available for well evacuation include hand-operated or motor-driven suction pumps, peristaltic pumps, compressed gas (air lift) pumps, submersible pumps, and bailers made of various materials, such as stainless steel, Teflon, and PVC.

Some pumps cause volatilization and produce high pressure differentials, which result in variability in the analysis of pH, specific conductance, metals, and volatile organic compounds. They are, however, acceptable for purging wells if sufficient time is allowed to let the water stabilize prior to sampling.

When purging equipment must be reused, it should be decontaminated, following the same procedures required for the sampling equipment. Clean gloves must be worn by the sampling personnel. Measures should be taken to prevent surface soils from coming in contact with the purging equipment and lines, which could introduce contaminants to the well. Purged water should be collected and screened with photoionization or organic vapor analyzers, pH, temperature, and conductivity meters. If these parameters and facility background data suggest that the water is hazardous, it should be drummed and disposed of properly following analysis of the collected sample.

Table 3-5 lists some of the pros and cons of the various well evacuation methods widely available for use.

Purging Rates

The rate at which wells are purged of stagnant water should be kept to a minimum. Purging rates should be maintained below the rates at which well development was performed. High purging rates can also cause additional development to occur with resulting increased turbidity of water samples. Well hydraulic performance information is therefore helpful in determining optimum purging rates.

TABLE 3-5

EVALUATION OF WELL EVACUATION METHODS

Well Evacuation Method	Best Used When:
Peristaltic pump (Figure 3-5)	Water table is within suction lift. Used on wells that require less than approximately four gallons of water removal for adequate evacuation. Good for slow recovery wells. Should not be used for the collection of samples for volatile organic analysis.
Centrifugal pump	Water table is within suction lift. Used on wells that have moderate to high recovery rates. Cannot be used for sampling.
Bailer (Teflon or stainless steel)	Recovery is slow and on wells where access is difficult.
Electric submersible pump	Pump is permanently installed or in deep, large diameter wells where use of low yield pumps is not practical.
Bladder-type (e.g., Geotech, Well Wizard)	Water table is below suction lift. Used when water table recovery rates are moderate to high. Pump must be completely submerged.

If using an electric pump or other pump with a constant flow rate, the total purge time can be calculated using the following equation:

$$\text{Total Purge Time (min)} = \frac{[\text{Volume of Stagnant Water in Well Casing (gal)}] \times [\text{Desired Number of Volumes}]}{\text{Pumping Rate (gallons/minute)}}$$

Decontamination of Purging Equipment

Sampling personnel should assume that sampling equipment, either new or used, is contaminated and, therefore, should be decontaminated according to the procedures appropriate for its construction and intended use. The decontamination of equipment should be performed at the laboratory of the sampling team. Field decontamination of sampling equipment should be performed only under extenuating circumstances such as logistical considerations and shortage of dedicated sampling equipment. When field decontamination cannot be avoided, the following general rules should be adhered to:

1) No equipment should be decontaminated in the field more than once between laboratory decontamination.

2) Equipment used to collect hazardous waste samples must be decontaminated before it can be used to collect environmental samples. In general, any decontaminated equipment should only be used to collect samples of "lower quality" than the first sample collected.

3) All decontamination and subsequent use of decontaminated equipment should be documented in a field logbook.

4) Equipment should never be reused if visual signs, such as discoloration, indicate that decontamination was insufficient.

Refer to Section 3.3.2 Decontamination of Sampling Equipment, for specific decontamination procedures.

Collection/Disposal of Purged Water

Purged water may need to be containerized (drummed) and should not be discharged directly on the ground in the immediate well vicinity. However, based upon the site background review, the location of the well in relation to the site, and screening of the purged water with a HNu, OVA, or specific conductance meter, the water may not need special handling. The disposal of purged water will be developed as part of the site specific sampling plan.

Sample Collection

Ground water sample collection should take place immediately following well purging. At times, the same device can be used for sample

collection as was used for well purging. However, water samples should not be collected with the centrifugal pump because of unacceptable aeration. If a well was evacuated with a centrifugal pump, it can be sampled with a bailer or peristaltic pump. Wells evacuated with a peristaltic or bladder pump or with a bailer can and probably should be sampled using the same method (except for volatile organics) to save time and avoid the additional chance of possible contamination by introducing more equipment into the well. Limit the liquid flow rate when sampling for volatiles to less than 100 ml/min to reduce the chances of loosing product.

Sampling equipment should be constructed of material compatible with the well construction and analytical objectives. Equipment with neoprene fittings, PVC bailers, tygon tubing, silicon rubber bladders, neoprene impellers, polyethylene, and viton may not be acceptable. An inert cable-chain (e.g., fluorocarbon resin-coated wire, monofilament, single strand stainless steel wire) should be used to raise and lower the bailer. If nylon cord is used, it should be discarded between each well.

Most samples are obtained with a stainless steel or Teflon bailer. When one is ready to collect a ground water sample, a new cable should be securely attached to a cleaned bailer. The other end of the rope should be fastened to the well casing or protective pipe. The cable should be of more than sufficient length to allow for water level drawdown while sampling. To acclimate the bailer to the well water, the initial three (3) bails should be properly disposed of. When transferring the sample water from the bailer to the appropriate sample containers, care should be taken to avoid agitation which promotes the loss of volatile constituents by aeration of the sample and outgassing of volatile chemical constituents. Bottom-draw bailer designs with check valves and syringe samplers minimize these sources of bias.

The time of sample collection, as well as the field test results for temperature, pH, and conductivity should be recorded in the field log book or on the Well Sampling Data Sheet.

Sample fractions should be collected in the following order: 1) volatiles; 2) fractions that require field filtration; 3) large volume samples (e.g., extractable organics, total metals, or nutrient anions).

After the well has been sampled, the bailer should be cleaned by washing with water, rinsing with acetone and methanol, and rinsing with distilled water. The cable and plastic sheet should be properly discarded as provided in the site safety plan and new materials provided for the next well.

In summary, follow the below guidelines when sampling a well:

- Positive gas displacement bladder pumps should be operated in a continuous manner so that they do not produce pulsating samples that are aerated in the return tube or upon discharge.

- Check valves should be designed and inspected to assure that

fouling problems do not reduce delivery capabilities or result in aeration of the sample.

- Sampling equipment (e.g., especially bailers) should never be dropped into the well, because this will cause degassing of the water upon impact.

- The contents should be transferred to a sample container in a way that will minimize agitation and aeration.

- Clean sampling equipment should not be place directly on the ground or other contaminated surfaces prior to insertion into the well.

Collection of Light Immiscibles (Floaters)

The approach to collecting floaters is dependent on the depth to the surface of the floating layer and the thickness of that layer. The floater must be collected prior to any purging activities. If the thickness of the floater is 2 feet or greater, a bottom valve bailer is the equipment of choice. When the thickness of the floating layer is less than 2 feet, but the depth to the surface of the floating layer is less than 15 feet, a peristaltic pump can be used to "vacuum" a sample. When the thickness of the floating layer is less than 2 feet and the depth to the surface of the floating layer is beyond the effective "reach" of a pump (greater than 25 feet), a bailer must be modified to allow filling only from the top.

Collection of Heavy Immiscibles (Sinkers)

The best method for collecting sinkers is to use a double check valve bailer. The sinkers must be collected prior to any purging activities.

Filtration Methods

Sample fractions intended for dissolved metals analyses are typically filtered in the field using a 0.45-micron membrane filter.

In-line filtering at the well head is the most convenient method, but requires that the well be pumped and equipped with a sample collection spigot sized to fit tubing that will accommodate a filter. In this method, the sample passes from the well through a short length of tubing, preferably tygon, through the filter, and into the sample container.

A second method is to collect the sample into a container, then transfer it to a second container using a filter barrel or a peristaltic pump with the filter located between the first container and the pump.

3.2.5.2 Domestic Well Sample Collection Methods

There are two goals associated with sampling domestic wells: obtaining water that is representative of aquifer conditions and obtaining

water representative of drinking water. The construction of most domestic wells is significantly different from that of a typical monitoring well. As such, special considerations must be addressed when sampling domestic wells. Informational needs specific to domestic wells, and usually obtainable from the well owner, include the following:

- Location of well on property;
- Presence of water treatment system and/or pressure tank;
- Presence of a sampling port prior to treatment system or pressure tank; and
- Well construction information unavailable from well logs (well depth, diameter, screened zone, casing material, static water level, type of pump in well, pumping characteristics, etc).

Domestic wells normally include a sanitary seal to protect from the introduction of foreign materials down the casing. A metal plate covers the well with a port for water discharge and a port for venting. The vent port is usually between 1/2 to 3/4 inches in diameter and protected by a screw-on cap. Depending on the age and maintenance of the well head, this cap may be rusted in place. Other than lifting the sanitary seal (with attached piping), the vent port is normally the only access to ground water.

Calculation of Stagnant Water Volume

Because domestic wells are typically sealed, access for water level measurements may not be possible. A field decision must be made concerning the removal of the vent port cap, which may be rusted in place, or lifting the sanitary seal to insert the measuring tape. Destruction of private property should always be avoided. Although functional harm cannot be done by breaking the vent port cap, lifting of the seal with attached piping (and submersible pump if included) can cause great harm. If access to ground water is not possible, the stagnant water volume must be calculated using information from the driller's log. If well access is available, care must be taken not to get the water probe tangled in the piping and/or pump system. Measurements for static water level and total depth are collected in the same manner described for monitoring wells.

Well Purging

Domestic well piping systems normally exit the ground and enter a pressure tank (30 - 100 gallons) and an optional treatment system (for excess hardness, iron, etc.). Sampling ports (spigots) may be located at any point in the system. Well purging time will depend on whether the spigot is located before or after the pressure tank. If located at the well head, the recommended three (3) static volumes should be purged (with owner's consent) or until temperature, pH and conductivity have stabilized as recommended in Section 3.2.5.1. Traditionally, domestic wells have been sampled after running the tap for 15 to 20 minutes, regardless of stored volumes. If located after the holding tank, the tank

volume must be added to the static volume so that in-line water can be removed. Flow rates from domestic wells vary widely so purge times must be calculated at each location.

Care should be exercised not to stress well systems by purging large amounts of water. During home use, pump systems typically run for short periods of time (a few minutes) to maintain pressure in the holding tank. By forcing the pump to work longer periods, damage can be caused to older systems. Domestic wells are completed many times in shallow and relatively unproductive aquifers. Long pumping periods may result in excessive drawdown and the eventual sucking of air. Age of the pump should be ascertained prior to purging so that when combined with general water chemistry information, condition of the system can be assessed. Particularly harsh water chemistry may result in premature aging of the pump. Generally, pumps less than five (5) years old should be able to handle any purging scenario. Always consult the owner for permission to run the tap for extended periods of time.

If purging well water from a spigot located prior to the holding tank, water should first be run from a spigot further down the line to start the pump running. After the pump begins to run, open the wellhead spigot. Without maintaining pressure on the pump, a faulty foot valve may empty all water in the piping system to the bottom of the well, requiring the system to be re-primed.

If a ground water temperature has been established while sampling other wells in the area, an abnormally high or low temperature reading is an indication that the measured water may have been held in a pressure/storage tank, and is not fresh from the aquifer. If continued purging fails to show an adjustment in temperature to that similar of other nearby wells, make a note in your log book or at the bottom of the Ground Water Measurement Data Sheet (Figure 3-8).

Listening for when the pump turns on is additional confirmation that the well is indeed being purged and that you are not simply draining the pressure tank or storage tank. On some wells it may be possible to turn the pump on with a switch at the well head. However, this is not recommended because of possible well damage.

Sample Collection

Water samples collected from domestic wells should be obtained from outlets as close as possible to the pump. Samples should not be collected from leaky or faulty spigots or spigots that contain screens or aeration devices. In addition, all samples should be collected prior to any filter, water softening devices. If this is not possible, the presence of a treatment device should be noted in the logbook. A steady-flowing water stream at moderate pressure is desirable in order to prevent splashing and dislodging particles in the faucet or water line.

The samples should be collected directly into the appropriate sample containers, with minimum agitation and contact with air.

Filtration Methods

Typically, water from domestic wells is not filtered so that analysis reflects the quality of water consumed by the public. If filtering is deemed appropriate, see Section 3.2.5.1.

3.2.6 Air Sample Collection Methods

3.2.6.1 Continuous Monitoring

Continuous monitoring does not require the collection of a sample for laboratory analysis. An air monitoring instrument specific to the contaminant(s) being measured is carried on or set up near a site and an airstream is passed through the instrument, analyzed, and recorded instantaneously or on a continual basis. This method is usually limited to, but not restricted to, instruments with low accuracy (i.e., HNu, OVA), and is used primarily as a screening technique prior to a full-scale field investigation.

3.2.6.2 Grab Samples

Grab sampling involves the filling of syringes, Tedlar bags, or stainless steel canisters within a matter of seconds, then sending the sample off to be analyzed by the laboratory. This method characterizes specific concentrations at a particular time and space.

3.2.6.3 Integrated Samples

Integrated sampling is generally the most useful way of characterizing air contaminants at a site. Samples are collected over long periods of time (generally one to twelve hours) by trapping air in containers or passing air through filters or chemical adsorbants that trap contaminants. The canisters or filters are then sent to the lab for analysis.

3.2.6.4 Sampling Equipment

Meteorological Station

Before any gathering of samples can be performed, a meteorological station must be set up near the site to characterize the main meteorological parameters. The station should have the capabilities to measure wind speed and direction, temperature, barometric pressure, and humidity. It is also important that the station used is light and mobile enough to allow quick and easy set-up, yet sturdy enough to withstand the elements. Placement of the station depends on the topography of the surrounding area (including spacing and size of buildings, paved areas, etc.). Care should be used to set up the station in an area most representative of the site. Additionally, a three-meter tower should be used to avoid readings only representative of the immediate microclimate.

Meteorological data should be collected continuously throughout the sampling project. This information is extremely important since many

times background samples are determined by wind direction at the time of sample collection. Also, day-to-day changes in sample concentrations at the same site can usually be linked to corresponding changes in meteorological conditions.

Solid Adsorbent Collection

Solid adsorbents are a media commonly employed for sampling gas phase organics. The adsorbents include materials such as Tenax GC and XAD-2, with Tenax being the most commonly used. One advantage of the adsorbent collection technique is the absence of "active sites" that can lead to irreversible adsorption of certain polar compounds. A limiting factor with these materials is their inability to capture highly volatile materials (e.g., vinyl chloride) as well as many polar materials (e.g., methanol, acetone).

Figure 3-10 shows typical Tenax cartridges used in the field. Air is drawn through the cartridge for a specified length of time (usually about four hours) concentrating compounds on the Tenax material. If possible, a backup cartridge should be used. A schematic of the Tenax sampling train is shown in Figure 3-11. When the sampling time has ended, the ends of the cartridge are capped and the cartridge is packed and shipped to the laboratory for analysis via thermal desorption.

Solid adsorbents (silica gel and florisil) can also be used to trap inorganics in much the same manner. Activated Carbon or Molecular Sieves are also used on a limited basis.

Whole Air Collection

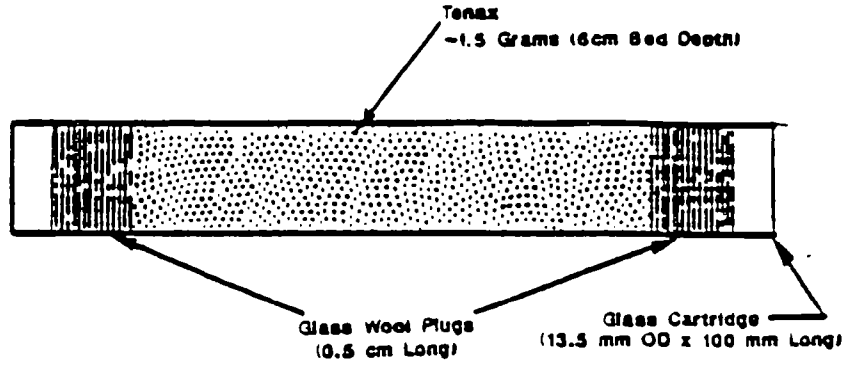
Sampling by whole air collection is simply the filling of evacuated glass bulbs, stainless steel canisters, or plastic bags over a desired length of time and analyzing the air directly by gas chromatography. This method is excellent for nearly all volatile organic compounds. Plastic containers made from materials such as Teflon or Tedlar are usually used when analysis will be carried out soon after sample acquisition, since the rate of leakage and/or permeation in and out of the bags is relatively high. Adsorption or decomposition of compounds through interaction with the container walls can also be a problem.

One of the best containers available for whole air sampling is the electropolished 6-liter stainless steel canister. Unlike the delicate non-rigid bags mentioned above, these rigid canisters are capable of being pressurized up to 20 or 30 psi, and can be stored for days or weeks at a time with limited or no effect on the compounds inside (5). These canisters provide the added bonus of allowing round-robin analyses of each sample because of the large volume of air captured.

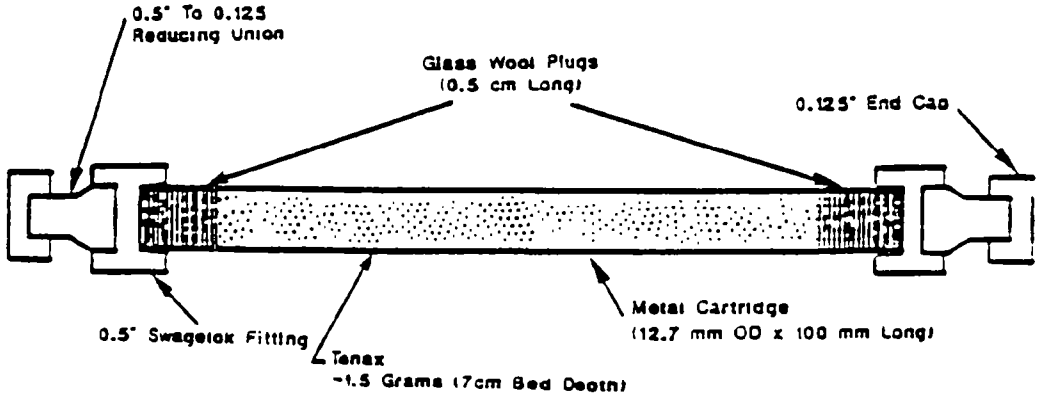
Containers used for whole air collection must be fully evacuated to 0.0 atmospheres after each sample is collected, and flushed with pure nitrogen if high concentrations of contaminants are found in the sample. As with other sampling methods, blanks should always be sent to the laboratory for analysis.

FIGURE 3-10

TENAX CARTRIDGE DESIGNS



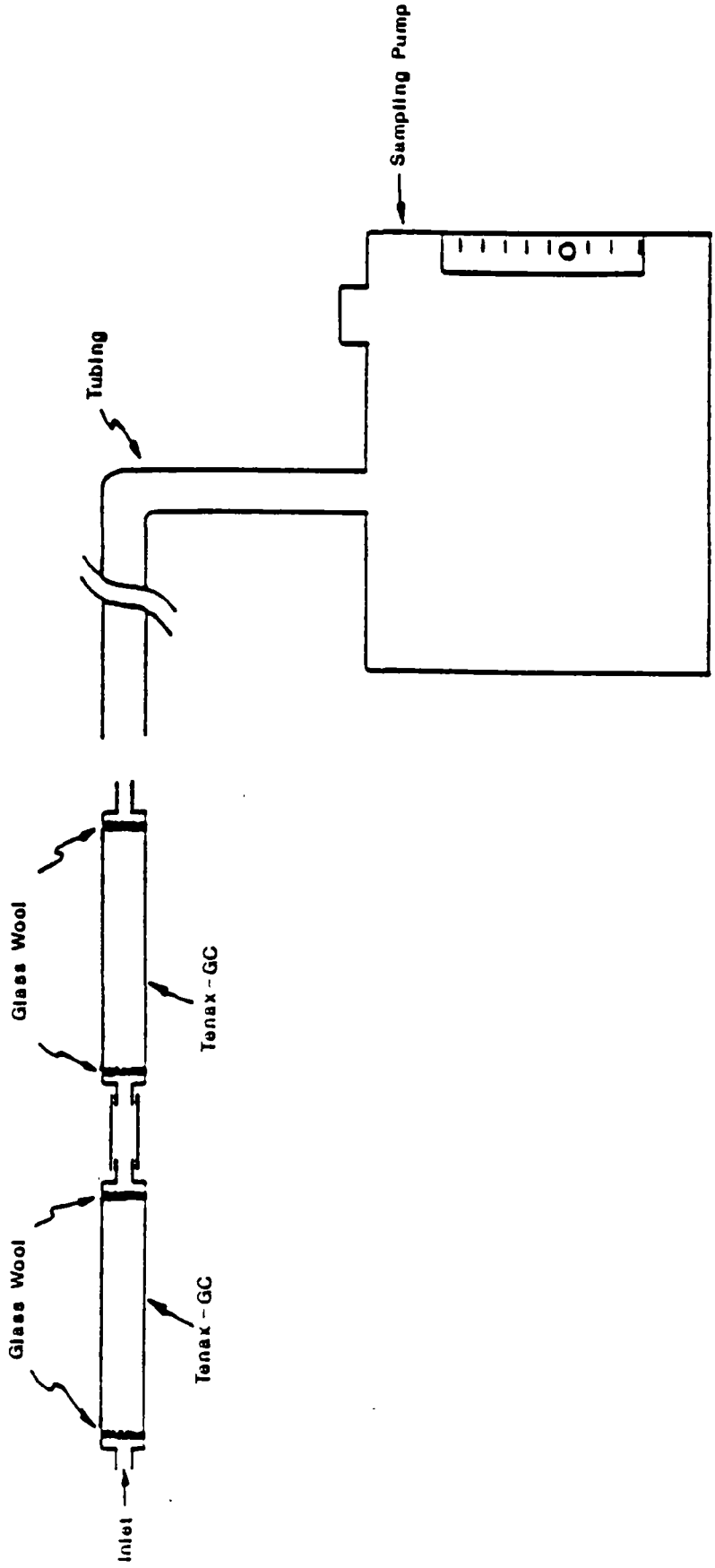
(a) Glass Cartridge



(b) Metal Cartridge

FIGURE 3-11

TENAX SAMPLING TRAIN



Polyurethane Foam (PUF)

Polyurethane foam (PUF) has been shown to be an excellent collection medium for trapping a variety of semi-volatile organic compounds. Foam plugs are cut from the type of PUF used for furniture upholstery, pillows, and mattresses, then treated with high grade hexane (pesticide quality or equivalent) prior to being fitted into specialized sampling cartridges (Figure 3-12). A known volume of air is drawn through the collection media to trap the airborne organics.

Cylindrical polyurethane foam plugs (polyether type, 0.021 gm/cm3) are cut from 3-inch stock using a 25-mm circular template. The soxhlet extracted plugs are then placed (under slight compression) in 22-mm (inside diameter) by 10-cm long hexane rinsed glass tubes. The glass tubes are constructed from 22-mm (inside diameter) stock that has been tapered at one end to facilitate attachment to the sampling pump. A Teflon reducing adapter can also be fabricated that permits attachment to the sampling pump with no modification to the glass tube.

Any high volume sampling pump capable of maintaining a constant flow rate of 3- to 4-liter/minute can be used. Samples are collected at this nominal flow rate for between eight to twelve hours, allowing a total sample volume of between one to four cubic meters (m^3).

Polyurethane foam has been shown to be excellent for trapping many semi-volatile compounds including polychlorinated biphenyls and naphthalenes, most pesticides, chlorinated benzenes, and polynuclear aromatic hydrocarbons. Table 3-6 lists most compounds the PUF procedure can be used for.

High Volume Sampling

In order to check for total suspended particulates (TSP) in the air, high volume sampling (HIVOL) is needed. Both total particulate loading and qualitative analysis of the particulates can be calculated using this technique.

Ambient air is drawn into a covered housing and through a filter by means of a high volume blower at flow rates between 1.13 to 1.70-m3/min (40 to 60 ft3/min) (Figure 3-12). Particles within the size range of 100 to 0.1-mm diameter are collected on the filter, although sampler flow rate and geometry tends to favor particles less than 60-mm aerodynamic diameter. The mass concentration of suspended particulate is computed by measuring the mass of collected particulates (gravimetric analysis) and the volume of air sampled.

After sample collection, pre-tared filters are analyzed gravimetrically to determine the total particulate loading. Trace metal analyses may be accomplished by extracting all or part of the filter and analyzing the extract accordingly (i.e., atomic absorption, ICP). It should be noted that when trace metal analysis is desired, it is extremely important to submit blank filters from each lot to the laboratory to determine back ground concentrations.

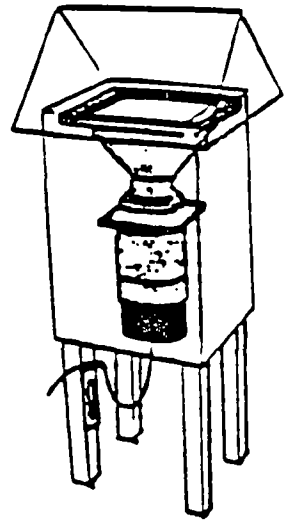
TABLE 3-6

ORGANICS COLLECTED IN AMBIENT AIR USING PUF PROCEDURES

Polychlorinated Biphenyls (PCBs)	Herbicides
Aroclor 1016	2,4-D esters
Aroclor 1221	Isopropyl
Aroclor 1232	Butyl
Aroclor 1242	Isobutyl
Aroclor 1248	Isooctyl
Aroclor 1254	2,4,5-T N-butyl ester
Aroclor 1260	Bromoxynil
Chlorinated Pesticides	Triallate
Chlordane (cis, trans)	Trifluralin
Heptachlor	Polynuclear Aromatic Hydrocarbons (PAHs)
DDE	Phenanthrene
Dieldrin	Anthracene
p,p'-DDE	Fluoranthene
p,p'-DDT	Pyrene
o,p'-DDT	Benz(e)acenaphthylene
α-BHD	Polychlorinated Naphthalenes
γ-BHC (Lindane)	Halowax 1001
Hexachlorobenzene	Halowax 1013
Toxaphene	Chlorinated Benzenes
Endrin	1,2,3-Trichlorobenzene
Endosulfan I	1,2,3,4-Tetrachlorobenzene
Aldrin	Pentachlorobenzene
Mirex	1,3,5-Trichlorobenzene
Organophosphorous Pesticides	Pentachloronitrobenzene
Diazinon	Chlorinated Phenols
Methyl Parathion	2,4-Dichlorophenol
Malathion	2,4,6-Trichlorophenol
Parathion	Pentachlorophenol
Ethyl Parathion	2,4,5-Trichlorophenol
Dichlorvos	
Ronnel	
Chlorpyrifos	

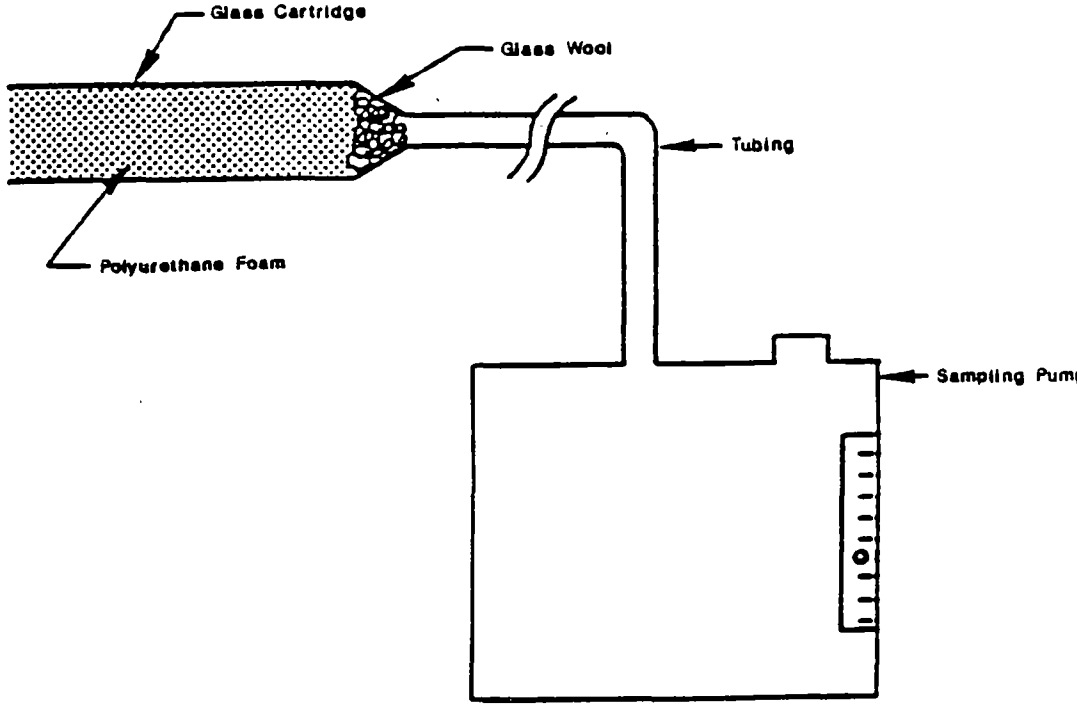
FIGURE 3-12

PUF SAMPLING TRAIN and
HIGH-VOLUME AIR SAMPLER



Assembled Sampler And Shelter

High-Volume Air Sampler



Polyurethane Foam (PUF) Sampling Train

3.2.7 Petroleum Product Sample Collection Methods

The collection of a petroleum/oil sample following a spill into surface waters is treated separately from the collection of other surface water samples due to the density and solubility characteristics of oil. However, many of the same considerations discussed under the section entitled "Surface Water Sample Collection Methods" are still applicable. These general considerations, presented in the referenced surface water section, are repeated here.

- The solubility and density of the compound(s) of interest determine the appropriate sample collection depth;
- Factors such as safety and accessibility determine how far from the bank one samples;
- Water samples are to contain only liquids (no sludges, etc.);
- A background sample is needed from upstream of the source in question for all bodies of water (i.e., if a tributary adds to a source stream both must have background);
- Samples to be analyzed for volatile organics should have no head space (or bubbles) in the sample jar, should be handled as little as possible, and should be collected above areas of turbulence (i.e., in streams);
- Cyclical effects should be considered, such as time of discharge from a facility, time of year and weather; and
- Sampling should be performed moving from downstream to upstream locations.

Coupling surface water sample locations with sediment sample locations is beneficial as the likelihood for contamination of one media by the other is high.

3.2.7.1 Oil Sampling Techniques

The thin layer of floating oil on water, frequently present only as a "sheen", presents difficulties in the collection of adequate sample volumes.

Manual Separation

Manual separation of the desired oil phase from the water phase is accomplished using repeated decantation steps. Several methods may be used in the decanting of the water phase.

- Collection of the oil/water sample in a sample jar followed by an inversion of the jar with a partially screwed on cap (allowing the water phase to trickle out).

- A separatory funnel.
- A pail fitted with a bottom tap.
- A syphon.

Adsorbent Materials

The use of commercially available sorbent pads with a high affinity for non-polar molecules (i.e., oil) can be used for the collection of an oil sample from surface water. The recovery of the oil from the sorbent material is accomplished using either mechanical or manual wringing/compression of the sorbent. Consultation with manufacturer will help determine which products/methods will work for a particular project.

3.2.7.2 Sampling Strategy

The choice of analyses to be performed on petroleum product samples is necessarily guided by the objectives of the sampler or project manager. Typically, the objective is to identify the probable source of the spill. To identify the source of an oil release it is necessary to obtain samples of the potential petroleum products at the point of release (i.e., above grade tanks, underground tanks, pipeline, tanker trucks, etc.) as well as samples of the spilled petroleum product in the surface water.

The analysis most typically employed to identify petroleum products in spill incidents, arson incidents, or oil reservoir ownership disputes is referred to as a GC fingerprint analysis. The results of these analyses have been proven accurate and are recognized as legally defensible data in court.

3.2.8 Soil Gas Sampling

Soil gas monitoring provides a quick means of waste site evaluation for volatile organic contamination.

3.2.8.1 Method Summary

A 3/8" diameter hole is driven into the ground to a depth of four to five feet using a commercially available "slam bar". Greater depths can be sampled by the use of a longer bar or bar attachments. A 1/4" O.D. stainless steel probe is inserted into the hole. The hole is then sealed at the top around the probe using modeling clay. The gas contained in the interstitial spaces of the soil is sampled by pulling the sample through the probe using an air sampling pump. The sample may be stored in Tedlar bags, drawn through sorbent cartridges, or analyzed directly using an HNu Model PI-101 Photoionizer. Other field air monitoring devices, such as the combustible gas indicator and the organic vapor analyzer can also be used dependent on specific site conditions. Measurement of soil temperature using a temperature probe may also be desirable. Bagged samples are usually analyzed in a field

laboratory using a portable Photovac GC.

3.2.8.2 Equipment/Apparatus

A. Slam bar (1 per sample team).
B. Soil gas probes, stainless steel tubing, 1/4" O.D., 5 ft length (3 per sample team).
C. Flexible wire or cable used for clearing the tubing during insertion into the well.
D. Connections, Teflon, to connect probe to HNu/sampler.
E. Modeling clay.
F. Plastic desiccator for drawing a vacuum around Tedlar bag for sample collection (1 per sample team).
G. Gilian pump Model HFS113A adjusted to approximately 3.0 L/min (1 to 2 per sample team).
H. 1/4" Teflon tubing, 2 to 3 ft lengths, for replacement of contaminated sample line.
I. Tedlar bags, 1.0 L, at least 1 bag per sample point.
J. Sample labels, data sheets, logbook, etc.
K. Field air monitoring devices.
L. Ice chests for equipment and protection of samples.
M. Metal detector or magnetometer for detecting underground utilities/pipes/drums.
N. Photovac GC for field-lab analysis of bagged samples.

3.2.8.3 Procedures

1. Well Installation

Initially a hole slightly deeper than the desired depth is made using a 5 ft single piston slam bar. For deeper depths, a piston slam bar with threaded 4 ft long sections can be used. Other techniques can be used as long as holes are of narrow diameter and no contamination is introduced.

After the hole is made, the slam bar is carefully withdrawn to prevent collapse of the walls of the hole. The soil gas probe is then inserted. It is necessary to prevent plugging of the probe, especially for deeper holes. A metal wire or cable, slightly longer than the probe, is placed in the probe prior to inserting into the hole. The probe is inserted to full depth, then pulled up three to six inches, then cleared by moving the cable up and down. The cable is removed before sampling.

The top of the sample hole is sealed at the surface against ambient air infiltration by using modeling clay and native soil molded around the probe at the surface of the hole.

2. HNu Analysis

The well volume must be evacuated prior to sampling. Connect the Gilian pump, adjusted to 3.0 L/min, to the sample probe using a section of Teflon tubing as a connector. The pump is turned on, and a vacuum is pulled through the probe for

approximately 15 seconds (longer for sample wells of greater depths).

After evacuation, the HNu is connected to the probe using a Teflon connector. When the HNu reading is stable, or peaks, the reading is recorded and the HNu is disconnected.

3. Tedlar Bag Sampling

Evacuate the well volume using the procedure explained above. If HNu analysis was performed prior to taking a sample, evacuation is not necessary.

Use desiccator and sampling train to take the sample. The sampling train is designed to minimize the introduction of contaminants and losses due to adsorption. All wetted parts are either Teflon or stainless steel. The vacuum is drawn indirectly to avoid contamination from sample pumps.

The Tedlar bag is placed inside the desiccator. The opened valve is connected to the 1/4" Teflon tubing. The other end of the Teflon tubing is connected, via sampling train, to the soil gas probe using a Teflon connector. A vacuum is drawn around the outside of the bag, using a Gilian pump connected to the sampling train via Tygon tubing and a "T" connector, causing the bag to inflate.

Break vacuum by removing the Tygon line from the pump. Remove bagged sample from desiccator and close valve. Label bag and record sample information.

CAUTION: Labels should not be pasted directly onto the bags, nor should bags be labeled directly using a marker or pen. Inks and adhesive may diffuse through the bag material contaminating the sample. Place labels on the edge of the bags, or tie the labels to the metal eyelets provided on the bags. Do not use markers with inks containing volatile organics.

4. Tenax Tube Sampling

Additional apparatus: a) Syringe with a luer-lock tip capable of drawing a soil gas or air sample from a Tedlar bag onto a Tenax/CMS sorbent tube. Capacity is dependent upon the volume of sample to be drawn onto the sorbent tube. b) Adapters for fitting the sorbent tube between the Tedlar bag and the sampling syringe. c) Two-stage glass sampling cartridge contained in a flame-sealed tube (Refer to "Standard Operating Procedure for Tenax/CMS Sorbent Tube Preparation" for preparation and storage procedures). d) Nylon glove or lint-free cloth.

Handle sorbent tubes with care, using nylon gloves to avoid contamination. Immediately before sampling, break one end of the sealed tube and remove the Tenax cartridge. Connect the valve on the Tedlar bag to the sorbent tube adapter. Connect

the sorbent tube to the sorbent tube adapter with the Tenax (white granular) side of the tube facing the Tedlar bag. Connect the sampling syringe assembly to the CMS (black) side of the sorbent tube. Fittings on the adapters should be finger tight. Open the valve on the Tedlar bag. Open the on/off valve of the sampling syringe. Draw a predetermined volume of sample onto the sorbent tube.

After sampling, remove the tube from the sampling train with gloves or a clean cloth. DO NOT LABEL OR WRITE ON THE TENAX/CMS TUBE. Place the sorbent tube in a conditioned stainless steel tube holder or culture tube. Culture tube caps should be sealed with Teflon tape.

3.2.8.4 Interferences and Potential Problems

Concentrations in soil gas are affected by dissolution, adsorption, and partitioning. Partitioning refers to the ratio of component found in a saturated vapor above an aqueous solution to the amount in the solution. Contaminants can also be adsorbed onto inorganic soil components or "dissolved" in organic components.

Soil "tightness" or amount of void space in the soil matrix will affect the rate of recharging of gas into the soil gas well. Existence of high, or perched, water table or of an impermeable underlying layer (such as a clay lens or layer of buried slag) may interfere with sampling of the soil gas.

A common problem with this method is soil probe clogging. A clogged probe can be identified by the sound of the pump laboring, or by using an in-line vacuum gauge. This problem can usually be eliminated by using a wire cable to clear probe.

Prior to selecting sample locations, conduct an underground utility search by contacting local utility companies. Each sample location should also be screened with a metal detector or magnetometer to verify that no underground pipes or drums exist.

3.2.8.5 Quality Assurance

Quality assurance should follow along the same lines as other types of samples; ie blanks, both trip and decon, using ultra pure air, and duplicates.

Holding times for Tedlar bags varies, depending on the sample type. However, usually the holding time is 24 hours or less. The lab should be consulted on this subject prior to sampling. All samples should be preserved on ice.

3.2.9 Sample Collection Methods For Special Waste Types

3.2.9.1 Leachate

At many hazardous waste sites the principle pathway of off-site movement of hazardous material(s) is via leachate migration. Because the leachate stream usually originates directly from buried wastes, it is usually considered to be of high concentration, and therefore must be handled appropriately. The following steps outline the procedure for sampling leachates:

1. The ideal situation is to sample leachate streams under both low and high flow conditions for an adequate data base.

2. The sample container is used as the sample obtaining device, as leachate stream samples will be grab samples. Unless prior arrangements have been made with the analytical laboratory, the container of choice will be an 8-ounce wide-mouth glass jar, with a 10% ullage (headspace) left.

3. If the leachate stream flow is low, a shovel may be used to dig a small hole at the sampling point. The hole is allowed to fill with leachate, and sufficient sample volume is then obtained. The shovel should be decontaminated after use.

3.2.9.2 Drums/Closed Containers

Perhaps the most hazardous type of sampling procedure involves the opening of containers to sample the contents. There are many different types of containers containing literally thousands of possible hazardous substances that may be found during a field sampling project. It is important that as much information as possible be gathered before the actual opening of any containers takes place.

Initial Hazard Assessment

Once the decision to open containers has been made, the team must first evaluate the site to obtain at least the following information:

1. Number, type and condition of containers. Included is information on bulging, exploded, burned, dented, rusted or otherwise deteriorated containers; special containers such as laboratory reagent bottles, compressed gas cylinders, tank cars, vaults, or drums of exotic construction or material; ponds, lagoons, sludge pits, or other open containers; and evidence of buried containers.

2. Site conditions adverse to safe and efficient container opening operations. Included are areas of the site that cannot support the weight of heavy machinery; the proximity of the surrounding populace; the proximity of the site to highways, railroads, air fields or other transportation routes that may have to be closed; the proximity of other facilities that could be in-

volved in, cause, or propagate a fire, explosion or toxic release on site; arrangement of containers (stacked, jumbled, piled) that might interfere with operations; and location and availability of areas off site that can be used for staging, opening and storage of any containers that have to be moved.

3. Hazards associated with the site. A thorough attempt must be made to discover, by any means short of opening the containers, exactly what they contain. Prior sampling data, air monitoring data, manifests, drum labels (these cannot be completely trusted), regulatory agency records, bills of lading, manufacturing records and the recollection of persons familiar with site history should all be used. Of particular interest are indications of the presence of substances that are radioactive, explosive, classed as Poison A, violently reactive with air or water, shock sensitive, highly flammable, percutaneous, or highly toxic. These substances all require specialized techniques and equipment.

Container Opening Devices

Several techniques can be used to open a closed container. Such devices as a hammer and chisel, picks, axes, or firearms have been used in the past; however, these devices are extremely dangerous. A remotely controlled opening device is far more desirable even though it tends to increase the team work load and the amount of equipment needed. Also, it cannot be used on all containers or in all situations. Larger containers (tankers, tank cars, storage tanks) can usually be opened only by hand.

Remotely Controlled Devices

EPA's National Enforcement Investigations Center (NEIC) has developed two remotely controlled drum opening devices shown in Figure 3-13. The NEIC "penetrating sample device" uses a hydraulic system to force a penetrator into the side of a drum. The penetrator also serves to seal the resulting hole; a sample is withdrawn through the hollow stem of the penetrator. The NEIC "bung remover" uses a compressed air tank, mounting bracket, air impact wrench and non-sparking bung socket to spin the bung from the top or side of a drum.

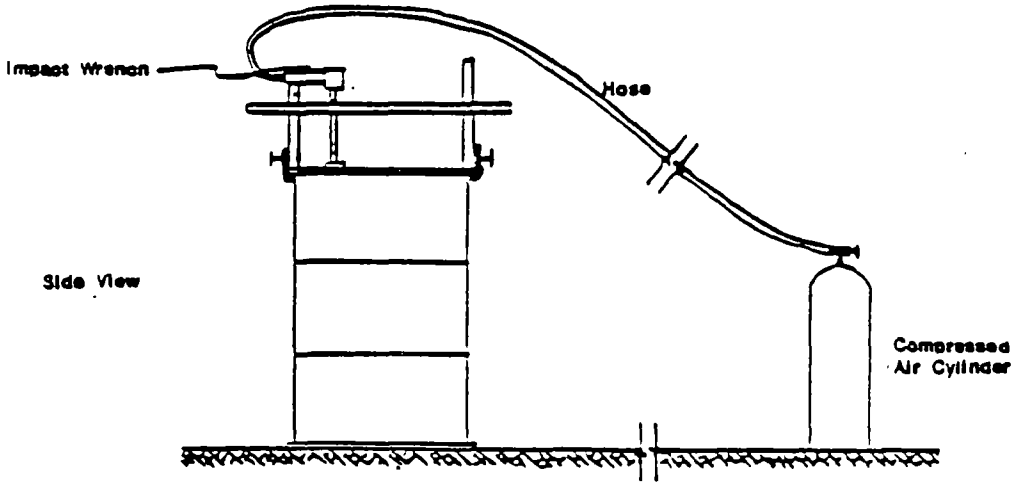
Ecology and Environment, Inc. has devised two modifications of the NEIC equipment. The E&E piercer hydraulically pierces drums from a top-mounted position. The piercer is automatically withdrawn, and the resulting hole is sealed after sampling. The E&E air drill uses a self-feeding, automatically retracting, air-powered drill to cut through the bung or top of a drum. The resulting hole is sealed after sampling.

Manual Method

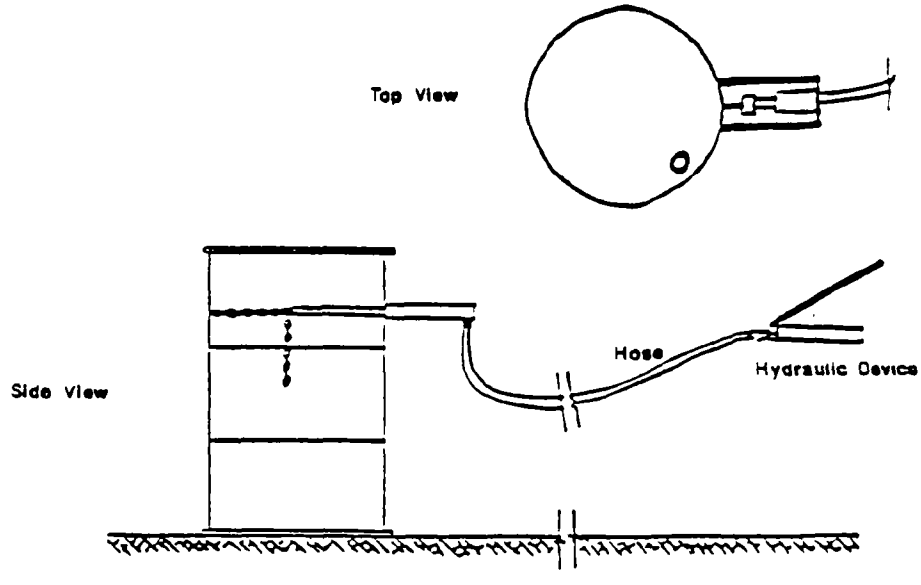
The manual method involves use of a non-sparking brass bung opening wrench to loosen the large or small bung plug on a drum. Drum bungs come in various shapes and sizes so an assortment of openers must be available to fit the bung. These sockets must be non-sparking as well.

FIGURE 3-13

NEIC BUNG REMOVER and
PENETRATING SAMPLER DEVICE



Bung Remover



Penetrating Sampling Device

This method of opening drums can only be used if the drum is in good condition. Any bulging or concave drums can not be opened using this method. If the bung is rusted shut or corroded, this method can not be used.

A second criteria for opening drums manually is that they be labeled properly or that there is a reasonably good idea of drum contents. Any material contained in a drum that has a low flash point, high vapor pressure, highly reactive properties, high toxic rating, or is explosive can not be opened using the manual method.

This method can not be used in confined spaces or in a tight area where emergency escape would be difficult. If at all possible, the drums should be opened early in the morning when the ambient air temperature is low and solar radiation is not intense.

1. The smaller bung should be opened, if possible, in order to reduce the amount of spray released if liquid in the drum sprays due to high vapor pressures. The smaller hole is also easier to seal if the bung plug cannot be reinstalled.

2. A small disposable splash tarp should be placed over the drum while the bung plug is being unscrewed. The tarp should be heavy enough to knock down any spray and have a small hole in the middle for the bung wrench arm to fit through. The tarp should be at least 6 x 6 feet in order to cover the top of the drum. This type of tarp can be reused or disposed of if it becomes contaminated.

3. If possible, an extension should be used on the wrench arm in order to keep the person removing the bung plug away from the drum as it is being opened. Any sound of vapor escaping from the bung opening should be considered a warning and the person opening the drum should move away from the drum quickly. After the pressure is released, then the team member can continue opening the drum.

The manual method should only be used for small quantities of drums to be sampled. If a remote opening device is available, then the manual opening method should not be used.

Backhoe Piercing Method

The backhoe piercing method involves the use of a contracted backhoe (extend-a-hoe) and operator to pierce the top of the drum using a point attached to the bucket. The extend-a-hoe should be able to extend at least 20 feet away from the operator.

Most equipment rental companies will weld a 6 to 8 inch brass point on the bottom of the bucket for no charge. This spear can then be pushed or pressed down into the top of the drum creating a hole that can be sampled using glass rods (thieves). The hole can then be repaired

using plugs or molly bolts that are available commercially for this purpose.

The backhoe must be equipped with a bulletproof type glass cab that totally encloses the operator in case of an explosion or spray. The backhoe operator must wear an air line respirator with a full-face piece while he is punching the drums and be dressed in Level C protective clothing as a minimum.

A combustible gas indicator with an alarm-type device must be set up near the backhoe so that operator can shut the unit down if concentrations exceeding 25% of the lower explosive limit are detected in the immediate area.

Sampling Techniques for Steel Drums

The sampling method is determined by the type of container, access to (opening of) the container, and the physical state of the material in the container (solid, liquid, sludge). Access to the contents of the drum will be provided by the remote opening method chosen, preferably through the top of the drum.

Liquid Waste

One member of the sampling team carefully inserts a four foot length of glass tubing (drum thief or rod) through the drum opening. If possible, the tubing should be inserted at an angle to help obtain a representative sample. For most liquids a piece of tubing with an inside diameter of 6 to 8 mm is adequate, but a larger bore may be required for more viscous materials. The top end of the tubing is then blocked with a thumb or rubber stopper, and the tubing is raised from the drum to transfer the contents to the sample container, which is held in a convenient place by the second sampling party member. Releasing the thumb or cork allows the contents to empty into the container. The operation is repeated until adequate volume is obtained.

Both members of the sampling party must try to avoid contact with the material on the outside of the tubing. Disposable wooden "toaster tongs" can be used to guide the contaminated part of the tubing to the container. When sufficient volume is obtained, the tubing is broken and discarded inside the drum.

Following are several important notes on sampling liquid wastes from containers:

- A 10% ullage (headspace) for expansion should be left in any container used.

- Sampling personnel must avoid allowing the material spilled on gloves during the sampling process to come in contact with the material from a subsequent drum. Potentially dangerous synergistic reactions may occur, resulting in failure of the protective clothing. Where the presence of incompatible materials is suspected, the sampler may put several disposable gloves over

the hand (outside of the butyl rubber suit for Level A) which comes in contact with the material. The outer glove can be disposed of after each sampling operation.

- A rubber pipet bulb may be used on the sampling tube. Care must be taken to prevent the material from contacting the bulb.

- If the sampling party sees any evidence of a reaction (light, smoke, etc.), they will immediately abandon all equipment and evacuate the site.

- If the glass tubing becomes clouded or smokey when it is inserted in the drum, it should be withdrawn and discarded since this indicates the presence of caustics or hydrofluoric acid. A length of rigid plastic tubing and a plastic sample container should be substituted.

Sludge Waste

For sludges, a larger-bore glass tubing or a 40 ml VOA (volatile organics analysis) vial fastened to a length of wooden dowel may be used. The sampling apparatus may be discarded with other waste accumulated during the sampling operation.

Solid Waste

Occasionally, a drum containing solid or granular waste may be encountered. This type of material is often contained in fiber-board drums. A disposable scoop may be used for an open-top drum, while a small ladle attached to a length of wooden dowel may be used to obtain material through a bung hole.

Following are notes on sampling sludges and solids from containers:

- It is possible that when a glass tube is inserted through a hole in a drum a solid layer may be encountered below the liquid layer. If the solid is hard, it could be a hardened sludge, or it may be as exotic as an active metal, such as sodium. It would be advisable to consider de-heading a drum of this type so that a visual examination could be made. A suggested sampling method would be to carefully put pressure on a length of glass tubing to obtain a small core for analysis. A stainless steel micro spatula could be used to remove the material from the end of the tubing. Care should be taken to keep the material from contacting water. It should also be noted whether the material discolors upon contact with air.

- The use of a sampling trier or slotted sampler is not recommended for obtaining a granular solid sample, as the friction and/or percussion associated with that action could cause an explosion.

- In the event that the use of glass tubing is not acceptable for removing a liquid or semi-liquid from a drum, an alternative is

the hand vacuum pump (Figure 3-14).

3.2.9.3 TCDD - Dioxin

TCDD is usually sampled as a contaminant in soil or sediment. Because TCDD binds tightly to the soil, it is most often found in near-surface soils, unless the contaminated material was used as fill or consists of transported sediments. Sampling for TCDD in soils is similar to other types of soil sampling with the exception that a thorough blending of the sample is of greater importance and that the sampling equipment must be rigorously cleaned. Because the "action levels" associated with TCDD contamination are very low, consider using sampling equipment (stainless steel spoons, etc.) that has been cleaned in a laboratory using CLP procedures and disposing of the equipment after only one sample is taken. This greatly decreases the possibility of cross contamination.

The quality control requirements listed below for dioxin sampling may be used:

- Do not composite field samples.
- Homogenize solid samples in the field using a mechanical blender or send an undisturbed sample to the laboratory for homogenization.
- Keep samples away from light.

3.2.9.4 Volatile Organics in Soil

If a soil sample is to be analyzed for volatile organics, do not composite field samples.

3.2.9.5 Wipe Sampling

Wipe sampling can be an integral part of the overall sampling program. Wipe sampling can help to provide a picture of contaminants that exist on the surface of drums, tanks, equipment, or buildings on a hazardous waste site or that exist in the homes of a populace at risk.

Wipe sampling consists of rubbing a moistened filter paper over a measured area of 100 cm^2 to 1 m^2. The paper is then sent to the laboratory for analysis. The results are related back to the known area of the sample. A proper sampling procedure is essential to ensure a representative, uncontaminated sample.

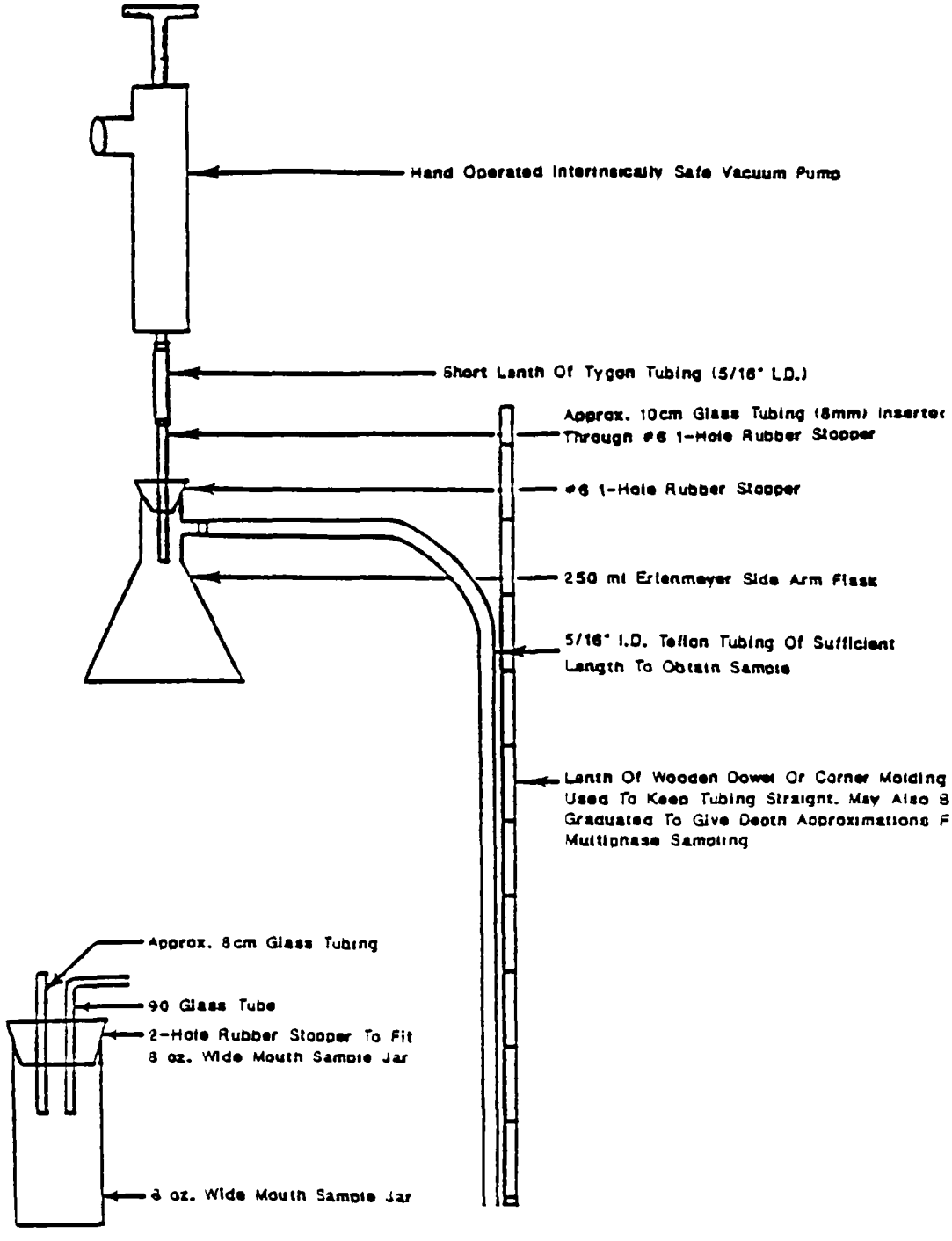
Equipment Required

The following equipment is needed for wipe sampling:

- Whatman 541 filter paper or equilivalent, 15 cm;
- Disposable, chemical-protective gloves;

FIGURE 3-14

HAND VACUUM PUMP



Solvent to wet filter paper.

Wipe Sampling Steps

The steps involved in obtaining a wipe sample are listed below:

- Using a clean, impervious disposable glove, such as a surgeon's glove, remove a filter paper from the box. Note that although it is necessary to change the glove if it touches the surface being wiped, a new glove should be used for each sample to avoid cross contamination of samples. A new glove should always be used when collecting a new sample.

- Moisten the filter with a collection medium selected to dissolve the contaminants of concern as specified in the sampling plan. Typically, organics-free water of the solvent used in the analysis is used. The filter should be wet but not dripping.

- Thoroughly wipe approximately 1 m^2 of the area with the moistened filter. Using a 1 m^2 stencil will help in judging the size of the wipe area. If a different size area is wiped, record the change in the field logbook. If the surface is not flat, be sure to wipe any crevices or depressions.

- Without allowing the filter to contact any other surface, fold it with the exposed side in, and then fold it over to form a 90-degree angle in the center of the filter.

- Place the filter (angle first) into a clean glass jar, replace the top, seal the jar according to quality and submit it with the other samples.

- Prepare a blank by moistening a filter with the collection medium. Place the blank in a separate jar, and submit it with the other samples.

- Document the sample collection in the field logbook and on appropriate forms, and ship the samples.

3.2.9.6 Waste Pile Sampling

Waste piles can range from small heaps to a large aggregates of wastes. The wastes are predominantly solid and can be a mixture of powders, granules, and chunks as large as or greater than 2.54 cm (1 in.) average diameter. A number of core samples have to be taken at different angles and composited to obtain a sample that, on analysis, will give average values for the hazardous components in the waste pile.

3.2.9.6.1 Sampling Methods

Waste piles are sampled in a similar manner as subsurface samples are collected, utilizing the same type of sampling equipment.

3.2.9.7 Above Ground Storage Tanks

Sampling a storage tank requires a great deal of manual dexterity. Usually it requires climbing to the top of the tank through a narrow vertical or spiral stairway while wearing protective sampling equipment and carrying sampling paraphernalia. At least two persons must always perform the sampling: One should collect the actual samples and the other should stand back, usually at the head of the stairway, and observe, ready to assist or call for help. The sample collectors must be accompanied by a representative of the company, who must open the sampling hole, usually on the tank roof.

3.2.9.7.1 Sample Collection Methods

In order to adequately sample a tank one must be sure to get a representative sample. This is accomplished by obtaining an aliquot from different elevations to ensure capturing some material from the different phases, if any.

Coliwasa

This device is similar to the Kemmerer Sampler, utilized in the collection of surface water, except the coliwasa extends the entire depth of the tank.

Bacon Bomb

The Bacon Bomb is a device that is similar to a weighted jar that is lowered into the tank to the desired level and opened. There are usually two lines attached to the apparatus, one to lower and raise it, and the other to open and close it.

Existing Valves

One must exercise caution when utilizing existing valves to sample through simply because they can get stuck open and cause a release. To sample using a valve one simply opens the valve a crack and collects the sample in the sample container. However, if there are more than one phase in the tank it probably won't be collected.

3.2.9.8 Underground Storage Tanks

Sampling underground storage tanks can be very easy or risky depending on the situation. A thorough record search should be done to determine what materials have been stored within the tank and its exact location. To determine the location, there are many geophysical methods that are available: ground penetrating radar, metal dectectors, and electro magnetic detectors, magnetometers to name a few each of these devices should be used by an experienced operator.

Once the location of the tank has been determined the sampling may be accomplished simply opening one of the ports on the tank, if they can be located. If the access ports cannot be found then the tank must be uncovered and an opening created. Extreme caution should be exercised

when approaching an uncovered tank because of hazards associated with them:

- An exposed tank can heat up from sunlight, the pressure inside increase and the tank explode due to the gas mixture.
- The tank may be corroded to the point where a person standing on it may fall through.
- Contaminants that have leaked out of the tank may have saturated the ground and the removal of an impervious cover, eg. concrete or asphalt, may liberate volatile material.

When the tank has been exposed and opening may have to be cut through the surface to gain access to the material inside. Only safe approved methods for cutting into the tank should be employed, such as a nonsparking drill or saw depending on the material. **DO NOT USE A TORCH!**

The material within the tank can be collected employing the same devices used when sampling an above ground tank.

3.2.10 HAZCLS Screening

The following procedures are used by TAT to provide a field screening capability that will allow a qualitative determination of chemical characteristics for virtually unknown wastes. Test results can be used to help segregate wastes into Hazard Classification (HAZCLS). Some of the tests will satisfy RCRA hazardous waste characteristic definitions and some will help define DOT hazard classes for placarding. These tests should not be viewed as an alternative to complete hazardous waste characterization required by these two bodies of regulation. HAZCLSing allows for a rapid assessment of materials at a site and the evaluation of their potential hazards to the populace and environment. Immediate mitigative measures, such as segregation or neutralization, can also be selected. HAZCLS results allow for bench-scale compatibility tests for eventual waste consolidation.

These tests should be performed in the numerical sequence as presented, unless otherwise specified in the HAZCLS procedure. The tests should also be conducted in Level C personal protective gear including a backmount canister respirator. The test bench should be established in a covered, but well ventilated area. If uncovered, the work area should be shaded.

A minimum of two field personnel are required to perform the 11 tests. Typically, the tests are split into two groups so that both workers can screen samples at the same time. Test stations may be established to facilitate efficient use of time when many samples must be run. Table 3-7 lists required HAZCLS supplies and equipment. Table 3-8 combines tests that can be performed at segregated stations. Typically, tests are performed in series at a single table. Workers may sit at chairs at the table. The table should be covered with plastic for later disposal.

TABLE 3-7

HAZCLS SUPPLIES AND EQUIPMENT

A. Equipment

1. Copper wire
2. Propane/butane torch and matches
3. Metal spoons
4. Small plastic bottles
5. Garbage bags
6. Test tubes and rack
7. 50 ml plastic graduated cylinder
8. Disposable pipettes
9. Plastic wash bottle
10. Thermometer
11. Felt tip pens
12. Absorbent material
13. Paper towels
14. HAZCLS Data Sheets
15. HAZCLS Procedure Sheet

B. Paper Test Strips

1. Potassium iodide
2. Lead acetate
3. pH
4. WATESMO

C. Reagents

1. Sodium Hydroxide (5%)
2. Acetone (reagent grade)
3. Hexane (reagent grade)
4. Hydrochloric acid (3N)
5. Deionized Water

D. Instruments

1. Radiation meter
2. Organic Vapor Analyzer
3. SETA flash point tester
4. PCB test kit
5. Cyanide test kit
6. Dexsil (PCB): 50 ppm and 500 ppm

TABLE 3-8

HAZARD CLASSIFICATION BENCH TEST FLOW CHART

Test	Action Level	Suspect Parameter	Hazard Class
Station 1:			
Visual Description			
- phases			
- color			
- viscosity			
Radiation	>Background (0.02 mRem/hr)		Radioactive
Organic Vapor	>100 ppm	Halogens	
	>200 ppm		Flammable
Acidity	pH≥7	Cyanide/	
	pH<7	Sulfide	
	pH<4		Strong Acid
	pH>10		Strong Base
Station 2:			
Water Solubility	Float	Flammability	
	Sink	Halogens, PCB, Flammability	
	Mix	Oxidizer	
Water Reactivity	≥5°F Temp Change		Water Reactive
Oxidizer (all water soluble materials)	(+) Potassium Iodide Test Strip		Oxidizer
Sulfide (pH≥7)	(+) Lead Acetate Test Strip		Toxic (Sulfide)
Station 3:			
Cyanide (pH≥7)	(-) Color Change Rhodanine Solution		Toxic (Cyanide)
Station 4:			
SETA Flash	<140°F	Halogens	Flammable
	<100°F		Flammable (DOT)
Station 5:			
Flame Test	(+) Green Flame	Halogens	Toxic (Halogen)
Station 6:			
PCB Test	0-50 ppm Oil	On-Site Storage	
	50-500 ppm Oil	Off-Site Disposal	Toxic (PCB)
	>500 ppm Oil	Incineration	Toxic (PCB)

Small glass test tubes (10 ml) are used to hold sample aliquots in a rack on the table. Five samples are carried through the test procedure at any one time. Unused test tubes are stored in a bag on the table and are continuously fed into the rack as they are used up. Used test tubes are thrown into a trash bag that lines a garbage can or is taped to the back side of the work table.

The OVA or HNu is set up at one end of the table and is used to measure vapors as sample jars are opened, prior to removal of small sample portions for testing. Samples are transferred to test tubes using disposable pipettes (eye droppers) or spatulas. Portions of all phases apparent in the sample jar must be transferred to individual test tubes (each phase of each sample must be tested separately). Approximately 5 ml of liquid or 3 g of solid is required for testing.

A HAZCLS identification form is provided as Figure 3-15 and can be filled out according to the procedures outlined below. Entries consist of + and - for positive and negative results or designators listed at the bottom of the form.

3.2.10.1 HAZCLS Procedures

1. SAMPLE DESCRIPTION - While still in the sample jar, describe the physical nature of the sample. Include color, viscosity (water as reference material), opacity or transparency, homogeneity, turbidity, phases, etc.

2. ORGANIC VAPORS - Using an HNu or OVA, crack the lid to the sample jar open and measure the concentration of organic vapors (ppm) in the headspace of the sample jar or container. Transfer sample aliquot(s) to test tubes. Separate phases into different tubes.

3. WATER DETECTION - Lay out the required number of WATESMO test papers on the table and place a small portion of each sample phase on a separate strip, using a spatula or eye dropper (if windy, dip paper). Color change to dark blue indicates presence of water (methanol and some other water soluble solvents may give false positive results).

4. CORROSIVITY - Lay out the required number of pH test papers on the table and place a small portion of each sample phase on a separate strip, using a spatula or eye dropper (if windy, dip paper). For solids wet the paper with a few drops of water and apply the moistened paper to the solid. Read the pH indicated on the paper using the scale on the pH paper container for reference.

   If pH is greater than or equal to 7, check for cyanides and sulfides (see steps 5 and 6).

   If pH is less than 7 or if water soluble, check for the presence of oxidizers (see step 4). (NOTE: some exceptions include sodium hypochlorite and halogens.)

SITE ID: _____
TDD: _____
PAN: _____

HAZARD CHARACTERIZATION DATA SHEET

DATE: _____ PROJECT: _____ LOCATION: _____ ANALYSTS: _____

Sample Container Number	Number of Phases	Color	Clarity	Visc	WATESMO +/-	Rad +/-	OVA ppm	pH	Water Solub N/P/S	Water Rct ΔF°	Oxid +/-	S +/-	CN +/-	BIC +/-	Cl +/-	PCB +/-	HAZARD CLASS

COLUMN ABBREVIATIONS

Colors
- RD red
- OR orange
- YL yellow
- GN green
- BU blue
- PR purple
- TN tan
- BR brown
- BK black
- GY gray
- WT white
- CL clear

Clarity
- CL clear
- OP opaque
- CD cloudy

Viscosity
- NV nonviscous (water)
- SV semiviscous
- VS viscous (motor oil)
- VV very viscous

Phases
- LQ liquid
- EM emulsion
- SD sediment
- SO solid
- PT particulate
- SL sludge

Notes

_____
_____
_____
_____

FIGURE 3-15
HAZARD CLASSIFICATION DATA SHEET

5. WATER SOLUBILITY AND REACTIVITY - Add 3 mls of room temperature water to test tube, insert thermometer and note temperature, then add 1 ml of sample. Note the generation of heat in degrees F, bubbles, and/or vapors, indicating that the sample is water reactive.

   If 1 ml (1 g of solid) sample completely mixes with 3 ml water and forms no precipitation or cloudy solution, the sample is soluble and test result is listed as "**MIX**".

   1. No density gradients indicate that the sample is possibly water.

   2. If density gradients are present, check flash point (see step 9).

   If original quantity of material does not go into solution, or becomes soluble only when the volume of water is doubled, the sample is considered insoluble and listed as either "**FLOAT**" or "**SINK**", depending on observed characteristics in water.

   1. If the sample floats, test for an organic base and/or organic acid, using same amounts of sample and water as described above for water procedure.

      Organic Base - react sample with three drops 3N HCl. Solubility indicates organic base (indicated as **FLOAT-BASE** in Water Solubility column).

      Organic Acid - react sample with three drops 5% NaOH. Solubility indicates organic acid (indicated as **FLOAT-ACID** in Water Solubility column).

   2. If sample sinks, test for halogenated hydrocarbons and PCBs (see steps 10 and 11).

6. OXIDIZER - The presence of oxidizing material contained in the sample is performed when sample water soluble.

   1. Lay out the required number of KI-starch papers and acidify with one to two drops of 3N HCl.

   2. Apply a drop of liquid sample (or aqueous solid sample) to paper.

   3. If paper turns blue or black after one to two minutes, sample is an oxidizer.

7. SULFIDE - The sulfide content of a sample is generally performed only on samples with pH ≥ 7. The detection limit is 0.6 ppm of the sulfide ion.

   1. Lay out the required number of lead acetate test

papers and acidify with one to two drops of 3N HCl.

2. Apply a drop of liquid sample or touch to solid sample.

3. If paper darkens after one to two minutes, sample contains sulfides.

8. CYANIDES - the presence of cyanides in a sample is generally performed only on samples with pH ≥ 7. Test kits are used that test for the presence of cyanide at 0-30 ppm levels. Instructions are provided in individual kits.

9. FLAMMABILITY - Three measurement methods are used to determine the flammability of the sample. These are:

   - HNu-photoionizer or Foxboro OVA measurements
   - BIC qualitative test
   - SETA Flash closed-cup measurements

   The sample is considered to be flammable, according to both RCRA and DOT regulations, if:

   1. The SETA flash point is less than 100°F; or

   2. The HNu reading (10.2 probe, 9.8 span) is greater than 200 ppm and the BIC test (see below) is positive, (+).

   The sample is considered to be combustible, according to DOT but flammable according to RCRA, if:

   1. If SETA flash point is less than 140°F, but greater than 100°F; or

   2. The HNu reading is less than 200 ppm and the BIC test is positive, (+).

   The sample is nonflammable/noncombustable if it does not ignite or burn after sustained exposure to the flame source.

   The SETA flash point procedure is outlined in the kit.

   For the BIC test procedure, use a butane or propane torch to heat the end of a copper wire until glowing (fold wire end so that extra sample can be supported). If sample ignites readily and vigorously upon exposure to a flame source, the estimated flash point is less than 100°F and a (+) is entered into the appropriate box. If the sample does not ignite and sustain flame, the estimated flash point is greater than 200°F and a (-) is entered into the appropriate box.

10. CHLORINATED HYDROCARBONS - The detection limit for this test is approximately 0.5% chlorine concentration as perchlorethylene. This test is performed on all samples that:

    1. Are insoluble and have specific gravity greater than 1; or

    2. Are slightly soluble and have HNu reading greater than 200 ppm; or

    3. Give any positive reading on a combustible gas indicator.

    NOTE: use gloves to avoid depositing chlorides from skin on the copper wire that is used for this test. Some amines also show positive interferences.

    1. Heat copper wire in flame until flame is yellow, with no trace of green.

    2. Cool wire by waving in ambient air for 10-15 seconds.

    3. Insert cool wire in sample.

    4. Insert sample-coated wire into flame.

    5. A green flame indicates that chlorinated hydrocarbons are present.

11. PCBs - Field testing for PCBs is performed using either the CLOR-N-OIL PCB Screening Kit, or the McGraw-Edison PCB test kit. Very clean transformer oil is required so that false positives are not encountered (tests indicate the presence of chlorine that may be due to salt water or other natural phenomenon). Instructions for use are found in each kit.

3.2.10.2 HAZCLS Procedure Limitations

The HAZCLS procedure is used as a screening mechanism for segregating and combining unknown wastes. Although the outlined steps have proven successful at a number of sites, many of the procedures have associated technical limitations that you should be aware of. The following are listed according to appropriate test step:

2. ORGANIC VAPORS

    - HNu and OVA response factors vary widely depending upon the compound. Readings can differ from true concentrations by as much as a factor of ≈ 50-100 times.

    - Both the HNu and OVA are affected by water vapor and will give false readings if excessive (>80-85% relative humidity) amounts are present.

- An OVA or HNu cannot be used to measure accurate concentrations of sample jars and small containers. The OVA has a 3 second response time (90%) and requires 33 ml/sec (total volume - 100 ml). The HNu has a 10 second response time (90%) and requires 3 ml/sec (total volume - 30 ml). For small containers serious dilution of sample occurs.

4. CORROSIVITY

- pH paper (and pH meter) results are valid only for water solutions. Results are meaningless for organic liquids.

5. WATER-SOLUBILITY AND REACTIVITY

- A temperature change is often due to heat of solution and does not necessarily indicate a chemical reaction.

- Most organic compounds do not exhibit complete solubility. One ml of organic compound dissolving in 6 ml of water is an extremely soluble organic.

- Solubility with HCl or NaOH is a test only for low molecular weight organic compounds that are strong acids or bases.

6. OXIDIZERS

- KI-starch paper works only for relatively strong oxidizing agents in water. Results are invalid for organic liquids.

7. SULFIDES

- Lead acetate paper works only for water solutions.

9. FLAMMABILITY

- Volatility does not necessarily correspond to flammability (e.g., carbon tetrachloride, methylene chloride).

10. CHLORINATED HYDROCARBONS

- The HNu has very low sensitivity to most chlorinated compounds.

- Many chlorinated compounds are not combustible.

- The copper flame test also gives a green flame with acidic compounds.

11. PCBs

- The test kits work only for low viscosity, light colored oils (transformer oil, clean kerosene or diesel). They do not work with heavy or dirty fuel oils. Test kits have a very high rate of both false positives and false negatives. Almost any chlorine or bromine containing compound will give a false positive.

3.3 Equipment Decontamination

General personnel safety and decontamination procedures are addressed in site-specific Site Safety Plans (depends on level of protection).

3.3.1 Decontamination of Heavy Equipment

Prior to mobilization on site (i.e., drill rig, backhoe, support vehicles), heavy equipment must be cleaned thoroughly to remove all oil, grease, mud, tar, oil-based preservatives, etc. The cleaning process will consist of high-pressure/detergent/hot water (steam cleaner) washing of the drilling equipment and a high pressure/hot water final rinse. Special attention will be given to areas, such as the thread sections of auger flights, drill rods, hoe buckets, and all down-hole tools.

All drilling and associated equipment will be thoroughly decontaminated at the close of the project, prior to departure from the site, to ensure that no contamination is transported from the site.

Petroleum-based lubricants, which are normally used to prevent binding, should not be allowed during field activities.

Vehicles should be washed (if possible) at the conclusion of each field trip. This routine maintenance should minimize any chance of further contamination of equipment or samples. A thorough interior and exterior cleaning is mandatory at the conclusion of investigations resulting in known or suspected vehicle contamination.

3.3.2 Decontamination of Sampling Equipment

Where practical, disposable sampling equipment will be used. When decontamination is required, equipment will be decontaminated prior to and following its use in the contaminated area. The decontamination procedure will include in sequence each of the following steps:

- Initially rinse item with tap water (from orchard sprayer or squirt-bottle) to remove gross contamination.

- Clean item by washing with Alconox detergent and tap water. A brush may be used to dislodge sediments. Personnel should be aware of the materials they are handling and use special decon

solutions for cleaning when warranted (see Table 3-9). No solvents are to be used on equipment that is constructed of butyl rubber and/or Neoprene components.

- Rinse with tap water (using brush if necessary), and shake off excess water.

- Triple rinse with an organic solvent. After final organic solvent rinse, allow all solvent to evaporate completely before continuing. Use hexane when the contaminant is dioxin; use pesticide-grade acetone or ACS-grade methanol to remove organics (see Table 3-10).

- Rinse thoroughly with distilled water and then carbon-free water. Shake off excess water.

- Wrap the sampling equipment with aluminum foil or in clean plastic bags once decontamination is completed to prevent accidental contamination of the sampling equipment.

The organic solvent rinse can be omitted for equipment that does not come into direct contact with sampled material or if there is no possibility of on-site organic contamination. Generally, plastic (Lucite R) filtering apparatus is not rinsed with acetone, unless it is severely contaminated by oils or organic film. Acetone may degrade the plastic.

All non-disposable equipment should be cleaned in the field before being returned to the warehouse for storage. During severe winter conditions, it may be necessary to repeat the final rinse step in warmer warehouse conditions. The following procedures are used to clean equipment prior to storage:

- After using equipment, rinse with water in the field, and wipe with paper towel;

- Wash thoroughly with warm water and phosphate-free laboratory detergent, using a bottle brush to remove particulate matter and surface film;

- Rinse thoroughly with warm tap water;

- Rinse thoroughly with distilled water (at least 3 times);

- Rinse thoroughly with acetone (pesticide-grade) or methanol, allow to air dry. Rinse with distilled water at least 3 times; and

- Wrap with aluminum foil or in plastic bags.

All ice chest and reusable shipping containers are washed with a mild detergent (interior and exterior) and rinsed with tap water and air-dried before storage.

TABLE 3-9
GENERAL PURPOSE DECONTAMINATION SOLUTIONS

Decontamination solutions should be designed to react with and neutralize specific contaminants found at a hazardous waste site. However, since the contaminants on a particular site will be unknown in the majority of cases, it is necessary to use a decontamination solution that is effective for a variety of contaminants. Several of these general purpose decontamination solutions (some ingredients are available at hardware or swimming pool supply stores) are listed below:

Decon Solution A - A solution containing 5% sodium carbonate (Na_2CO_3) and 5% trisodium phosphate (Na_3PO_4).

Decon Solution B - A solution containing 10% calcium hypochlorite ($CaCl_2O_2$).

Decon Solution C - A solution containing 5% trisodium phosphate (Na_3PO_4). This solution can also be used as a general purpose rinse.

Decon Solution D - A dilute solution of hydrochloric acid (HCl).

Type of Hazard	Sol.	Directions for Preparation
1. Inorganic acids, metal processing wastes	A	To 10 gallons of water, add 4 pounds of sodium carbonate (soda lime) and 4 pounds of trisodium phosphate. Stir until evenly mixed.
2. Heavy metals - mercury, lead, cadmium, etc.	A	Same as #1 above.
3. Pesticides, fungicides, chlorinated phenols, PCP's	B	To 10 gallons of water, add 8 pounds of calcium dioxins, hypochlorite. Stir with wooden or plastic stirrer until evenly mixed.
4. Cyanides, ammonia and other non-acidic inorganic wastes	B	Same as #3 above.
5. Solvents and organic compounds such as trichloroethylene, chloroform and toluene	C(or A)	To 10 gallons of water add 4 pounds of trisodium phosphate. Stir until evenly mixed.
6. PBB's and PCB's	C(or A)	Same as #5 above.

TABLE 3-9 (Cont.)
GENERAL PURPOSE DECONTAMINATION SOLUTIONS

Type of Hazard	Sol.	Directions for Preparation
7. Oily, greasy unspecified wastes.	C	Same as #5 above.
8. Inorganic bases, alkali and caustic waste	D	To 10 gallons of water, add 1/2 pint of concentrated hydrochloric acid. Stir with a wooden or plastic stirrer.

TABLE 3-10
RECOMMENDED SOLVENT SELECTION

Type of Hazard	Solvent
1. PCB's, PCP, pesticides, phenols	Methanol
2. oils, base neutrals, pesticides	Methylene chloride
3. xylenes, PCB's, chlorinateds	Hexane
4. phenols, PCB's	Acetone
5. oils, fatty materials	Carbon tetrachloride
6. metals	Nitric acid

3.3.3 Decontamination of Protective Clothing

Where possible, disposable personal protective equipment will be used. When decontamination is required, the following procedure should be used:

- Initially rinse item with tap water (from orchard sprayer or squirt-bottle) to remove gross contamination.
- Clean item by washing with Alconox detergent and tap water. A brush may be used to dislodge sediments. Personnel should be aware of the materials they are handling and use special decon solutions for cleaning when warranted (see Table 3-9). No solvents are to be used on equipment that is constructed of butyl rubber and/or Neoprene components.
- Rinse with tap water (using brush if necessary), and shake off excess water.
- Wash and rinse a second time if necessary.

Decontamination Problems And Solutions

Problem: Difficulty in cleaning equipment contaminated with heavy oily or wax-like material.

Solution: If standard decontaminants fail to properly clean equipment, try organic solvents such as acetone, benzene, hexane, trichloroethene or kerosene. To make certain that all of the solvent has been removed from the equipment after decontamination is complete, monitor with OVA or HNu.

Problem: PDS becomes inadvertently contaminated during decontamination operations.

Solution: Relocate PDS further upwind if possible; otherwise PDS operators must remain masked.

Problem: Instruments (e.g. OVA, HNu, explosimeter, etc...) taken into the waste site are getting contaminated.

Solution: Encapsulate instruments in plastic bags prior to entering the HWS. If instrument must be grounded while downrange, place on plastic drop.

Problem: Work party member dressed in Level B shows severe signs of heat stress and is experiencing difficulty in breathing while undergoing decontamination.

Solution: If you are faced with a potential life threatening situation, immediately take whatever action is necessary to alleviate the problem, i.e. in this case, remove respirator and treat for heat stress even though decontamination may be incomplete.

3.4 References

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rev. 1/11/90

SECTION 4 - FIELD QUALITY ASSURANCE/QUALITY CONTROL

4.1 QA/QC Sample Checklist

QA/QC Sample Type	Minimum Frequency
Transport/Trip Blank	1 per shipping container (volatiles only)
Transfer/Rinsate Blank	1 per 20 samples
Duplicates/Replicates Collocated	5% of submitted samples (QA/QC purpose)
Field Spiked Samples	Rare
Background Samples	2 per site (recommended)
Split Samples	Site specific
Lab Spiked Samples	Check with lab coordinator
Performance Evaluation Samples	1 per 20 samples (if available)

4.2 QA/QC Samples

There are a variety of sample types that are used to assess potential errors introduced during sample collection, storage, and analysis. Typical quality assurance/quality control samples are discussed in the following subsections.

4.2.1 Sample Blanks

Sample blanks are samples of deionized/distilled water or other solvents (e.g., hexane for dioxin), rinsed collection devices or containers, sampling media (e.g., sorbent), etc. that are handled in the same manner as the sample and subsequently analyzed to identify possible sources of contamination during collection, preservation, handling, or transport. The two primary types of sample blanks are explained below.

Transport/Trip Blanks

Transport, or trip, blanks must be included in each sampling project to ensure quality assurance and quality control. One volatile blank must be included with every VOA sample shipment. Contamination due to handling, preservation, or laboratory procedures can be found, and in many instances, quantitative corrections can be calculated. One sample blank should be prepared for every different bottle type that is filled. A transport blank is prepared by simply pouring carbon-free or deionized water directly into the sample container prior to the trip taking place. The container is then sealed and prepared for shipping.

Transfer/Rinsate Blanks

A transfer, or rinsate, blank determines whether sampling devices are contaminated. One rinsate blank should be collected for each type of sample device used. To collect a transfer blank, follow normal decontamination procedures, then pour organics-free, metals-free water, or the desired rinsate blank solvent over the sampling device and collect the runoff water in the sample container. The sample is then sent to the laboratory to be analyzed with the other samples. For instance, if a bailer is used, fill with organics-free or metals-free water and let it stand for approximately the same length of time a normal sample would be kept in the bailer. Transfer the water to a sample container and prepare it for shipment.

4.2.2 Duplicates/Replicates

Duplicates are sequentially, collocated samples collected obtained at the same time, in the same way, and contained, preserved, and transported in the same manner. These samples are often used to assess field/sampling variability. This variability tends to be relatively high in soils and low in waters.

Replicates are samples that have been mixed (homogenized) as if compositing and then separated into multiple sample containers for analysis. These samples are then contained, preserved, and transported in the same manner. Replicates are used to verify the analytical reproducibility of data (in addition to spiked samples). Field replicates provide a "blind duplicate" for the laboratory when sample labeling does not relate one replicate to the other. Laboratories perform their own replicate analysis by subsampling a single container and refer to this analysis as a "lab dup".

Duplicate/replicate sampling are not universally applicable to all media or analytes of concern. Generally, water samples will not exhibit variable chemical characteristics over the short time period required to fill three (3) volumes required for replicate analysis. Replicate samples for water do not require mixing prior to filling of containers, unless variability is expected to exist. Soils may exhibit wide variability and a distinction between duplicates and replicates is important. Due to the potential for loss of volatile contaminants during homogenization for replicate samples, VOA soil replicates must be collected as duplicates. It is important to note that replicate analysis results depend on the complete mixing of sample in the field. The more variable the distribution of contaminant, the more important a thorough mixing job is required.

At least five (5) percent of submitted samples for each media are required for replicate analysis in the Contract Laboratory Program (CLP). Water samples require triple (3) volume (all with the same sample I.D. number). Soil samples do not require any extra volume. Duplicate analysis is not necessary unless a measure of field variability is important to site characterization on a local scale (if samples are collected across entire contaminated areas, field variability is defined by comparison of all samples). "Blind duplicates" are prepared

by homogenizing samples in the field and submitting under different sample I.D. numbers, so that the laboratory cannot connect their common origin. This quality assurance measure is of dubious value since data variability may be attributed to either the laboratory or inadequate homogenization by the sampler. The best check on lab accountability is through the matrix spike and matrix spike duplicate analysis performed on designated samples (triple-volume waters and requested soils).

4.2.3 Spiked Samples

Spiked samples have a known amount of a substance of interest added to them prior to analysis. This may occur during field activities (rare) or in the lab (required). These samples are used to validate the accuracy of the analytical technique. Field spikes may indicate sample quality change during shipment to the laboratory.

The laboratory is required to perform analyses on a "matrix spike" and "matrix spike duplciate". Specific samples may be designated by the sampler for these analyses by filling out the "Chain-of-Custody" form appropriately. Water samples require double the normal volume, soil samples may require additional volume also (check with the designated laboratory coordinator). If not designated by the sampler, the soil analyses will be performed on samples chosen by the laboratory.

4.2.4 Background Samples

With any sampling program, sampling points beyond the limits of site contamination (e.g., upwind ambient air samples or upstream surface water samples) should be identified. Background sample data are useful in determining whether or not a release of a hazardous substance has occurred at a site. Background samples are collected to document ambient concentration levels, which can then be compared to levels found on site. This provides a means of assessing the true on-site concentration values. It is encouraged that two (2) background samples be obtained to indicate field/sampling variability.

4.2.5 Split Samples

Split samples are replicate (soil)/duplicate (water) samples given to the owner, operator, site representative or independent lab. If the split (replicate/duplicate) sample is being taken for the operator, the site representative must be contacted prior to sampling in order to arrange for them being present at the time of sampling. Split sample information is recorded in the space provided on the Chain-of-Custody form.

4.2.6 Performance Evaluation Samples

Performance evaluation samples are data validation samples used to measure the analytical capability of the laboratory performing the analyses. Performance evaluation samples are prepared and certified by the EPA Environmental Monitoring and Support Laboratory (EMSL/Las Vegas).

Currently, the following PE samples are available from EPA labs in liquids, sludges, oils and fish: VOA's, BNA's, Metals, and PCB/Pesticides. PE samples at varying concentrations can be obtained from the Cincinnati Lab. 2,3,7,8- TCDD/Dioxin and some specific BNA's in a soil matrix from the EMSL/LV. VOA's in air are available from the Research Triangle Park lab.

4.3 Field Activity Logbooks

This section establishes the minimum content requirements of logbook entries for all field activities conducted by EPA. This guidance is provided to ensure that the documentation for any EPA data collection field activity is correct, complete, and adequate for use in any potential legal proceeding. It is important to remember that field activity documentation can become evidence in civil and criminal law enforcement proceedings, as well as in administrative hearings. Accordingly, such documentation is subject to judicial or administrative review; even more importantly, it is subject to the review of an opposing counsel attempting to discredit its evidentiary value.

The National Enforcement Investigation Center (NEIC) and the United States Environmental Protection Agency have both prepared documents outlining their needs for legal proceedings. These various guidelines indicate the importance of all information obtained during the inspections, investigations, and evaluations of uncontrolled hazardous waste sites. Consequently, attention to detail must be applied by EPA and Contractor personnel to all field documentation efforts for all of EPA's projects. Project personnel must document where, when, how, and from whom any vital project information was obtained. These types of information are key to establishing a proper foundation for admissible evidence.

Logbooks can serve as links in the evidentiary process, and must be complete and accurate enough to permit the reconstruction of activities that took place during field assignments. Logbooks are also used for identifying, locating, labeling, and tracking samples and their final disposition. Documentation of any photographs taken during the course of the project must be provided in the logbook, along with a detailed description of what is shown in the pictures. In addition, data recorded in the logbook will assist in the interpretation of the analytical results. For example, if there was heavy rain prior to sample collection, or if the field team had trouble calibrating the pH meter, this information would later be necessary in order to correctly interpret the data.

In addition to every pertinent detail concerning the various field activities for a specific project, the logbook should contain a summary of any meeting and discussion both with the client and with any Federal, State, or other regulatory agency that was on site during the field activities. The logbook should also describe any other personnel that appear on site, such as representatives of a potential responsible party (PRP). The logbook can also be used for cost recovery purposes, which means that data concerning site conditions must be recorded before the response activity or the passage of time eliminates or alters those

conditions. The accuracy, detail, completeness, and quality of the logbook is subject to scrutiny by the client, the PRP, any opposing counsel, and the courts. Consequently, the individual making entries into the logbook must take time to ensure the information reflects the importance of the events.

4.3.1 General Guidelines

Following are general guidelines for preparing logbooks:

- A separate field activity logbook must be maintained for each project.
- All logbooks must be bound and contain consecutively numbered pages.
- No pages can be removed for any reason, even if they are partially mutilated or illegible.
- All field activities (meetings, sampling, surveys, etc.) must be recorded in the site logbook.
- All information is to be printed legibly into the logbook in waterproof ink, preferably black. If weather conditions do not permit this (i.e., if it is too cold or too wet to write with ink), another medium, such as pencil, may be used, but it should be specifically noted in the logbook why waterproof ink was not used.
- The language used in the logbook should be objective, factual, and free of personal feelings or terminology that might prove inappropriate.
- Contemporaneous entries are always preferred, since recollections fade or change over time. If you are unable to record your observations at the time, record them as soon after as possible. The time that the notation is made should be noted, as well as the time of the observation itself.
- Each successive day's first entry is made on a new, previously blank page.
- Each page should be dated and all entries should have a time notation based on the 24-hour clock (e.g., 0900 for 9 a.m., 2100 for 9 p.m.).
- At the completion of the field activity the logbook must be returned to the permanent project file.

4.3.2 Logbook Format

The information requirements of each field activity logbook will vary depending on the nature and scope of the project.

Title Page

Site Name
Location
Case No.
SSID No.

Successive Pages

Date
Time of site arrival/entry
Weather
Proposed Work Summary
Team Members and Duties
Time of site departure (24-hour clock)
Other personnel on site
(e.g., visitors, other agency representatives, property owners, etc.)
Persons contacted and discussions
(e.g., site owners, neighboring property owners)
Signature (bottom of page)
Levels of protection
(levels originally used, changes, reasons for changes, times of changes)
Specific activities undertaken
(e.g., site inspection, air monitoring, drum inventory, soil sampling, etc.)
Note changes in instruction or activities that occur on site
Note any changes in weather conditions
Equipment calibration and equipment model and serial number

Sample Documentation

Sample location description/ site sketch
Station numbers
Sampler's name
Sample collection time
Designation of sample as grab or composite
Type of sample
(e.g., ground water, soil boring, surficial soil, etc.)
On-site measurement data
(e.g., pH, temp., DO, etc.)
Field observations and details important to analysis or integrity of samples (e.g., heavy rain, odors, colors, etc.)
Preliminary sample descriptions
(e.g., clay loam soil, very wet)
Type of preservative used

Instrument readings
(e.g., OVA, HNu, etc.)
Lot number of sample containers, jar tag number
Shipping arrangements
(Federal Express air bill number)
Recipient laboratories

Photographs

The following information should be included for photographs:

1. Time, date, location, direction, and, if appropriate, weather conditions.

2. Complete description or identification of the subject in the photograph and reason for taking the picture.

3. Sequential number of photograph and film roll number.

4. Camera type and serial number (e.g., Olympus 35-mm, #1164916). Lens size and serial number, if appropriate.

5. Name of photographer.

Signatures

Each page of site logbook entries for a particular field activity must be initialed by the person recording the information. When two individuals make entries on the same page, they must initial their own entries. The individual making the last entry on the page must sign the bottom of the page. After reviewing the entries, the field team leader must sign the last page of each daily entry in the site logbook.

Data Collection Forms

If data collection forms are used to record specific information obtained during field activities, then the logbook must provide a record of what forms were used, an inventory of the forms that includes applicable station locations, and the name of the record taker.

Multiple Field Activities

In the event there are several field activities occurring simultaneously, there may be a need to use separate logbooks for each activity. Under these circumstances, a site summary logbook should be used in addition to each task or activity logbook. The summary logbook should describe the ongoing operations and the general field activities (including personnel on site), and should provide an inventory of the activity logbooks as well as of the field activity leaders.

Corrections

If corrections are necessary, they must be made by drawing a single line through the original entry (in such a manner that the original entry can still be read) and writing the corrected entry alongside it. The correction must be initialed and dated. Most corrected errors will require a footnote explaining the correction. Do not erase or render the incorrect notation illegible.

4.4 References

1. U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response. EPA/540/P-87/001. December 1987.

2. U.S. Environmental Protection Agency. Preparation of Soil Sampling Protocol: Techniques and Strategies. Environmental Monitoring Systems Laboratory. EPA-600/4-83-020. August 1983.

3. U.S. Environmental Protection Agency. Samplers and Sampling Procedures for Hazardous Waste Streams. Municipal Environmental Research Laboratory. EPA-600/2-80-018. January 1980.

4. U.S. Environmental Protection Agency. Soil Sampling Quality Assurance User's Guide. Environmental Monitoring Systems Laboratory. EPA-600/4-84-043. May 1984.

5. U.S. Environmental Protection Agency. Data Quality Objectives for the RI/FS Process. Office of Emergency and Remedial Response. Document No. 9355.0-7A. June 6, 1986.

6. U.S. Environmental Protection Agency. Test Methods for Evaluating Solid Wastes (SW 846). Volume II. September 1986.

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SECTION 5 - SAMPLE HANDLING, CUSTODY, PACKAGING AND SHIPPING

5.1 Concentration/Hazard Level Criteria

Specific procedures for sample handling, packaging, and shipping are determined by the anticipated sample concentration. Samples may be classified as either low, medium, or high level depending on the anticipated concentration.

5.1.1 Low Level Samples

Samples are classified as low level if they consist of:

- Low-hazard material, containing no more than 20 ppm of any contaminant. This includes soil or water, including ground water, surface water, well water, river or ditch water, or water from leachate springs.

5.1.2 Medium Level Samples

Samples are classified as medium level if they consist of:

- Medium-hazard materials, containing 20 ppm to 15% of a single contaminant. This includes on-site water-soil, surface materials from lagoons, on-site impoundments, leachate collection pools, on-site ditches, or from beside drums; from areas of direct but diluted contamination. Dioxin samples are designated as medium level.

5.1.3 High Level Samples

Samples are classified as high level if they consist of:

- High or unknown hazard materials, containing 15% or more of a single contaminant. This includes materials from drums, surface impoundments, storage tanks, or spills, direct discharges from impoundments, and where there is little or no evidence of dilution.

5.2 Sample Analyses, Containers, Preservation and Holding Time Requirements

Organic samples are divided into the following groups: Volatile (or purgeable), Base/Neutral/Acid extractable (BNAs), and Chlorinated Pesticides/ PCBs. Inorganic samples include metals and cyanide. Special analyses can be requested for compounds of interest outside of CLP Routine Analytical Services (RAS), such as Dioxin. It is always good to check with the lab, especially non-CLP, to determine the containers type and volumes required.

A summary of required volumes and container types for sample collection is provided in Figure 5-1. A summary of sample preservation requirements and holding times is provided in Table 5-1. Special

FIGURE 5-1

ORGANIC SAMPLE COLLECTION REQUIREMENTS

WATER SAMPLES	REQUIRED VOLUME	CONTAINER TYPE
EXTRACTABLE ANALYSIS (LOW LEVEL)	1 GALLON	1 x 4-LITER AMBER GLASS BOTTLES OR 2 x 80-OZ. AMBER GLASS BOTTLES OR 4 x 1-LITER AMBER GLASS BOTTLES
EXTRACTABLE ANALYSIS (MEDIUM LEVEL*)	1 GALLON	4 x 32-OZ. WIDE-MOUTH GLASS JARS
VOLATILE ANALYSIS (LOW OR MEDIUM LEVEL*)	80 ML	2 x 40-ML GLASS VIALS

SOIL/SEDIMENT SAMPLES	REQUIRED VOLUME	CONTAINER TYPE
EXTRACTABLE ANALYSIS (LOW OR MEDIUM LEVEL*)	6 OZ.	1 x 8-OZ. WIDE-MOUTH GLASS JAR OR 2 x 4-OZ. WIDE-MOUTH GLASS JARS
VOLATILE ANALYSIS (LOW OR MEDIUM LEVEL*)	240 ML	2 x 120-ML WIDE-MOUTH GLASS VIALS

*ALL MEDIUM LEVEL SAMPLES TO BE SEALED IN METAL PAINT CAN FOR SHIPMENT

INORGANIC SAMPLE COLLECTION REQUIREMENTS

WATER SAMPLES	REQUIRED VOLUME	CONTAINER TYPE
METALS ANALYSIS (LOW LEVEL)	1 LITER	1 x 1-LITER POLYETHYLENE BOTTLE
METALS ANALYSIS (MEDIUM LEVEL*)	16 OZ.	1 x 16-OZ. WIDE-MOUTH GLASS JAR
CYANIDE (CN^-) ANALYSIS (LOW LEVEL)	1 LITER	1 x 1-LITER POLYETHYLENE BOTTLE
CYANIDE (CN^-) ANALYSIS (MEDIUM LEVEL*)	16 OZ.	1 x 16-OZ. WIDE-MOUTH GLASS JAR

SOIL/SEDIMENT SAMPLES	REQUIRED VOLUME	CONTAINER TYPE
METALS AND CYANIDE (CN^-) ANALYSIS (LOW OR MEDIUM LEVEL*)	6 OZ.	1 x 8-OZ. WIDE-MOUTH GLASS JAR OR 2 x 4-OZ. WIDE-MOUTH GLASS JARS

*ALL MEDIUM LEVEL SAMPLES TO BE SEALED IN METAL PAINT CAN FOR SHIPMENT

DIOXIN SAMPLE COLLECTION REQUIREMENTS

WATER SAMPLES	REQUIRED VOLUME	CONTAINER TYPE
2,3,7,8-TCDD ANALYSIS (MULTI-CONCENTRATION)	2 LITERS	2 x 1-LITER AMBER GLASS BOTTLES

SOIL/SEDIMENT SAMPLES	REQUIRED VOLUME	CONTAINER TYPE
2,3,7,8-TCDD ANALYSIS (MULTI-CONCENTRATION)	4 OZ.	1 x 4-OZ. WIDE-MOUTH GLASS JAR OR 1 x 8-OZ. WIDE-MOUTH GLASS JAR

HIGH HAZARD SAMPLE COLLECTION REQUIREMENTS

LIQUID OR SOLID SAMPLES	REQUIRED VOLUME	CONTAINER TYPE
ORGANIC AND INORGANIC ANALYSIS	6 OZ.	1 x 8-OZ. WIDE-MOUTH GLASS JAR

*ALL MEDIUM LEVEL SAMPLES TO BE SEALED IN METAL PAINT CAN FOR SHIPMENT

TABLE 5-1

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES

Name	Container[1]	Preservation	Maximum holding time
Bacterial Tests:			
Coliform, fecal and total	P, G	Cool, 4°C, 0.008% $Na_2S_2O_3$	6 hours
Fecal streptococci	P, G	Cool, 4°C, 0.008% $Na_2S_2O_3$	6 hours
Inorganic Tests:			
Acidity	P, G	Cool, 4°C	14 days
Alkalinity	P, G	Cool, 4°C	14 days
Ammonia	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Biochemical oxygen demand	P, G	Cool, 4°C	48 hours
Bromide	P, G	None required	28 days
Biochemical oxygen demand, carbonaceous	P, G	Cool, 4°C	48 hours
Chemical oxygen demand	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Chloride	P, G	None required	28 days
Chlorine, total residual	P, G	None required	Analyze immediately
Color	P, G	Cool, 4°C	48 hours
Cyanide, total and amenable to chlorination	P, G	Cool, 4°C, NaOH to pH>12, 0.6g ascorbic acid	14 days
Fluoride	P	None required	28 days
Hardness	P, G	HNO_3 to pH<2, H_2SO_4 to pH<2	6 months
Hydrogen ion (pH)	P, G	None required	Analyze immediately
Kjeldahl and organic nitrogen	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Metals:			
Chromium VI	P, G	Cool, 4°C	24 hours
Mercury	P, G	HNO_3 to pH<2	28 days
Metals, except chromium VI and mercury	P, G	HNO_3 to pH<2	6 months
Nitrate	P, G	Cool, 4°C	48 hours
Nitrate-nitrite	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Nitrite	P, G	Cool, 4°C	48 hours
Oil and grease	G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Organic carbon	P, G	Cool, 4°C, HCl or H_2SO_4 to pH<2	28 days
Orthophosphate	P, G	Filter immediately, cool, 4°C	48 hours
Oxygen, Dissolved Probe	G Bottle and top	None required	Analyze immediately
Winkler	do	Fix on site and store in dark	8 hours
Phenols	G only	Cool, 4°C, H_2SO_4 to pH<2	28 days
Phosphorus (elemental)	G	Cool, 4°C	48 hours
Phosphorus, total	P, G	Cool, 4°C, H_2SO_4 to pH<2	28 days
Residue, total	P, G	Cool, 4°C	7 days
Residue, Filterable	P, G	Cool, 4°C	7 days
Residue, Nonfilterable (TSS)	P, G	Cool, 4°C	7 days
Residue, Settleable	P, G	Cool, 4°C	48 hours
Residue, volatile	P, G	Cool, 4°C	7 days
Silica	P	Cool, 4°C	28 days
Specific conductance	P, G	Cool, 4°C	28 days

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES (CONTINUED)

Name	Container[1]	Preservation	Maximum holding time
Sulfate	P, G	Cool, 4°C	28 days
Sulfide	P, G	Cool, 4°C, add zinc acetate plus sodium hydroxide to pH>9	7 days
Sulfite	P, G	None required	Analyze immediately
Surfactants	P, G	Cool, 4°C	48 hours
Temperature	P, G	None required	Analyze
Turbidity	P, G	Cool, 4°C	48 hours
Organic Tests:			
Purgeable Halocarbons	G, Teflon-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$	14 days
Purgeable aromatic hydrocarbons	G, Teflon-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$, HCl to pH2	14 days
Acrolein and acrylonitrile	G, Teflon-lined septum	Cool, 4°C, 0.008% $Na_2S_2O_3$, Adjust pH to 4-5	14 days
Phenols	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$	7 days until extraction, 40 days after extraction
Benzidines	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$	7 days until extraction
Phthalate esters	G, Teflon-lined cap	Cool, 4°C	7 days until extraction 40 days after extraction
Nitrosamines	G, Teflon-lined cap	Cool, 4°C, store in dark, 0.008% $Na_2S_2O_3$	40 days after extraction
PCBs, acrylonitrile	G, Teflon-lined cap	Cool, 4°C	40 days after extraction
Nitroaromatics and isophorone	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$ store in dark	40 days after extraction
Polynuclear aromatic hydrocarbons	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$ store in dark	40 days after extraction
Haloethers	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$	40 days after extraction
Chlorinated hydrocarbons	G, Teflon-lined cap	Cool, 4°C	40 days after extraction
TCDD	G, Teflon-lined cap	Cool, 4°C, 0.008% $Na_2S_2O_3$	40 days after extraction
Total organic halogens	G, Teflon-lined cap	Cool, 4°C, H_2SO_4 to pH<2	7 days
Pesticides Tests:			
Pesticides	G, Teflon-lined cap	Cool, 4°C, pH 5-9	40 days after extraction
Radiological Tests:			
Alpha, beta and radium	P, G	HNO_3 to pH<2	6 months

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

TABLE 5-1 (CONT)

RECOMMENDED SAMPLE CONTAINERS,
PRESERVATION TECHNIQUES, AND HOLDING TIMES

Parameter	Container	Preservative	Holding Time
Semivolatile Organics			
Concentrated Waste Samples	8-oz. widemouth glass with Teflon liner	None	14 days
Liquid Samples			
No Residual Chlorine Present	1-gal. or 2 1/2-gal. amber glass with Teflon liner	Cool, 4°C	Samples must be extracted within 7 days and extracts analyzed within 40 days
Residual Chlorine Present	1-gal. or 2 1/2-gal. amber glass with Teflon liner	Add 3 mL 10% sodium thiosulfate per gallon, Cool, 4°C	Samples must be extracted within 7 days and extracts analyzed within 40 days
Soil/Sediments and Sludges	8-oz. widemouth glass with Teflon liner	Cool, 4°C	14 days

sample preparation steps follows:

- Aqueous volatile organic sample jars must be filled completely, with no visible air bubbles;
- Soil volatile organic sample jars should be filled completely to minimize jar headspace;
- All organics samples must be iced to 4°C following collection until received by the laboratory;
- Aqueous metals samples must be preserved with nitric acid (HNO_3) to a pH less than or equal to 2;
- Aqueous cyanide samples must be preserved with sodium hydroxide (NaOH) to a pH greater than or equal to 12;
- Do not cool dioxin, medium level, or high level water and soil samples;
- Protect dioxin samples from sunlight.
- Protect Tenax/CMS sample tubes from UV light (i.e. sunlight) and keep on ice until analysis.

All samples should be held for a minimal time in the field (less than 24 hours) prior to shipping. Recommended holding times for different analyses refer to the maximum periods before extraction or analysis can be performed. Maximum recommended holding times are listed in Table 5-1.

The laboratory is required to perform matrix spike and matrix spike duplicate analyses on a minimum of 5% of all samples (or one sample per sample event, whichever is higher). An increased volume requirement of three (3) times normal must be provided for the chosen sample (water only). Twice the volume may be required for soil samples (consult the designated laboratory coordinator). Additionally, for water samples, one field blank should be supplied per Case, and one volatile trip blank should be supplied per shipment. No soil blanks are required.

5.2.1 Analysis of Petroleum Product Samples

The GC fingerprint analysis allows comparison of the ratios of individual hydrocarbons present in the product. Depending on the boiling point range (cut) of the product, certain indicator ratios are scrutinized. The GC fingerprint analysis can determine the type of crude oil (paraffinic, asphaltic, naphthenic) or the refined product type (gasoline, aviation fuel, kerosene, diesel, fuel oil, lube oil, grease, asphalt, etc.). This analysis is still valid after the sample has undergone weathering from either water/air exposure or through fire.

Examples of additional analyses available to characterize the petroleum product are included below (source: Control of Oil and Other

Hazardous Material, U.S. EPA, EPA-430/1-74/005).

1. Solubility in organic solvents - Used to differentiate greases and asphalts from other petroleum products, and to distinguish between crude oils and residual fuel oils from different locations.

2. Specific gravity or API gravity - The gravity or density is a distinguishing characteristic of oils. However, since the loss of volatiles, which occurs in the early stages of environmental exposure with volatile distillate fuels and crude oils results in a change of this parameter, it is of limited value.

3. Infrared spectroscopy - Indicates the relative content of aromatic or carbon-ring-type compounds. May also indicate presence of additives such as silicones. Generally employed to characterize materials less volatile than #2 fuel oil, such as #4 and residual fuels.

4. Distillation range - Defined as the temperature difference between high and low boiling compounds in an oil observed during distillation. Actual procedures are specified by ASTM D 86-56, ASTM D 850, and ASTM D 216.

5. Viscosity - A measure of the resistance to flow. May be expressed as (a) Saybolt second units (SSU), the time required for a standard volume of oil to pass through a standard orifice, as specified by ASTM D 445-54T and ASTM D 446-53; (b) kinematic viscosity at 100°F or 212°F in centistokes (ASTM D 445-65) or in Saybolt Furol units at 122°F. ASTM 2161-63T gives the relationships between the different viscosity units.

6. Vanadium is analyzed according to ASTM D 1548-63.

7. Nickel is analyzed either in the final solution from the vanadium procedure by atomic absorption (AAS) or by dissolving 5g oil in 100 ml of xylene for determination by AAS.

5.3 Sample Custody

Maintaining an unbroken sample chain-of-custody from the time the sample is obtained through its arrival in the designated laboratory is essential if the data results are to be admissible in court.

A sample is considered to be in custody if the following criteria are met:

- It is in the sampler's or other authorized person's possession;
- It is in view after being in someone's possession;
- It is locked up and an authorized individual maintains sole access;

- It is in a designated and identified secure area.

The following steps during sample packaging and shipment should assure that the samples will arrive at the laboratory under proper chain-of-custody:

- Samples are always accompanied by a properly completed chain-of-custody form. When transferring the possession of samples, both the person relinquishing and the person receiving will sign, date, and note the time on the record. This record can document the transfer of samples from person to person or from an individual to a secure holding area.

- A chain-of-custody record must accompany each sample cooler and numbered custody seals must be affixed to the front left and back right of the cooler. These seals should be covered with clear plastic tape. Strapping tape must encircle the cooler on at least two locations. As long as custody forms are sealed inside the sample cooler and custody seals remain intact, commercial carriers are not required to sign off on the custody form. For further assurance of chain of custody one may "seal" the trash bag containing the samples within the cooler with a custody seal, if this or the bag is broken then custody has been compromised.

- Whenever samples are split with a site representative or other personnel, this information is recorded on the chain-of-custody form in the space provided. The site representative should sign the chain-of-custody record indicating whether or not splits were accepted. If the representative refuses to sign, this should be noted.

5.4 Sample Documentation

5.4.1 Low Level Samples

- Organic Traffic Reports (for CLP only). A single organics traffic report is used to request all extractable and VOA analyses from a single sample location. Complete the form as illustrated in Figures 5-2 (old) and 5-3 (new). The bottom two copies accompany the sample. Include sample container Lot Numbers and EPA Tag Numbers on the report form. The top copy is mailed to the Sample Management Office (SMO), and the second copy is for the Regional Office Files. Field duplicates require a separate traffic report, although it is not necessary to complete a separate traffic report for matrix spike duplicates (indicate increased volume under section 6 of the traffic report and specify matrix spike duplicate).

FIGURE 5-2

ORGANIC TRAFFIC REPORT

USEPA CONTRACT LABORATORY PROGRAM
SAMPLE MANAGEMENT OFFICE
P.O. BOX 818 ALEXANDRIA, VA 22313
703/557-2490 FTS 557-2490

CASE NO: 10000 | SAS NO: (IF APPLICABLE) 5000H

ORGANIC TRAFFIC REPORT

FOR CLP USE ONLY

TYPE OF ACTIVITY (CIRCLE ONE) ①
SUPERFUND—PA SI ESI RIFS RD RA ER
NPLD O&M OTHER _____
NON-SUPERFUND— _____ PROGRAM

SITE NAME: Johns Backyard

CITY, STATE: Denver, CO | SITE SPILL ID: AA

REGION NO: 08 | SAMPLING COMPANY ② EPA

SAMPLER: (NAME) John Doe

SHIP TO: ③
ABC Labs
123 Lane Way
Denver, Colorado Zip

ATTN: Sample Custodian

SAMPLING DATE: ④
BEGIN: 2/22/89 END: 2/22/89

DATE SHIPPED: 2/22/89 CARRIER: Fed Ex ⑤

AIRBILL NO: 123-456-7890

SAMPLE DESCRIPTION ⑥
(ENTER IN BOX A)
1. SURFACE WATER
2. GROUND WATER
3. LEACHATE
4. SOIL
5. SEDIMENT
6. OIL (SAS)
7. WASTE (SAS)

TRIPLE VOLUME REQUIRED FOR MATRIX SPIKE/DUPLICATE AQUEOUS SAMPLE

SHIP MEDIUM AND HIGH CONCENTRATION SAMPLES IN PAINT CANS

SEE REVERSE FOR ADDITIONAL INSTRUCTIONS

CLP SAMPLE NUMBER (FROM LABELS)	SAMPLE DESCRIPTION (FROM BOX 1) 1 2 3 4 5 6 7	CONCENTRATION L = LOW/MED H = HIGH (SAS)	RAS ANALYSIS VOLATILE	BASE/NEUT /ACID	PESTICIDE /PCB's		SPECIAL HANDLING	STATION LOCATION
HM-001	4	L	X	X	X			SO-01
HM-002	4	L	X	X	X			SO-02
HM-003	4	L	X	X	X			SO-03
HM-004	4	L	X	X	X			SO-04
HM-005	1	L	X	X	X			SW-01

EPA Form 2075-7 (8-87)

WHITE — SMO COPY PINK — CLIENT COPY WHITE — LAB COPY FOR RETURN TO SMO YELLOW — LAB COPY

FIGURE 5-13

ORGANIC TRAFFIC REPORT (NEW)

EPA

United States Environmental Protection Agency
Contract Laboratory Program Sample Management Office
PO Box 818 Alexandria, VA 22313
703-557-2490 FTS 557-2490

Organic Traffic Report
(For CLP Use Only)

Case Number: 10000

SAS No. (if applicable):

1. Type of Activity (Check one)
   - [ ] ENF [ ] NPLD [ ] RA [✓] SI [ ] STSI
   - [ ] ER [ ] O&M [ ] RD [ ] ST [ ] Other (Specify)
   - [ ] ESI [ ] PA [ ] RIFS [ ] STPA
   - Non-Superfund Program

2. Region Number: I
   Sampling Co.: Acme
   Sampler (Name): John Doe

3. Ship To:
   ABC Labs
   123 Arrow WAY
   Hope VA
   ATTN: Sample custodian

4. Date Shipped: 12/10/88
   Airbill Number: 123-456-789
   Carrier: F

   Triple volume required for matrix spike/duplicate aqueous sample.

   Ship medium and high concentration samples in paint cans.

   See reverse for additional instructions

5. Sample Description (Enter in Column A)
   1. Surface Water
   2. Ground Water
   3. Leachate
   4. Rinsate
   5. Soil/Sediment
   6. Oil (SAS)
   7. Waste (SAS)
   8. Other (SAS) (Specify)

Site Name: Cheer's Dump

City, State: Boston MA

Site Spill ID: ZZ

CLP Sample Number (From labels)	(A) Sample Description (From box 5)	(B) Concentration L=low M=med H=high	(C) RAS Analysis VOA	BNA	Pest/PCB	(D) Special Handling	(E) Station Location	(F) Date/Time of Sample Collection	(G) Corresponding CLP Inorganic Sample Number
AA123	2	L	X	X	X		02/A	12/9 1300hrs	MAA123
AA124	4	L	X	X	X		02/A	12/9 1300hrs	MAA124
AA125	3	L	X			BLANK		12/9 1300hrs	MAA125

- Inorganic Traffic Reports (for CLP only). A single inorganic traffic report is used to request metals and/or cyanide analyses from a single sample location. Complete the form as illustrated in Figures 5-4 (old) and 5-5 (new). Include sample container Lot Numbers and EPA Tag Numbers on the report form. The bottom two copies accompany the sample. The top copy is mailed to the SMO, and the second copy is for the Regional Office Files. Provide the sample location in section 7 of the traffic report.

- Chain-of-Custody Forms. One chain-of-custody form is used to document each sample shipment container (i.e., one form per cooler) from one site. Complete the form as illustrated in Figure 5-6. The top copy accompanies the samples, the bottom two copies are returned to the office. Under project name, use the TDD, case number, or other code identifier (not the site name) as some CLP labs may have a conflict of interest at certain sites. Sample numbers are preassigned by the Regional Sample Coordinator.

- Sample Tags. One sample tag must be prepared for each sample container. Complete the tag as illustrated in Figure 5-7. Use only indelible ink on all labels and tags.

5.4.2 Medium Level Samples

- Organic and Inorganic Traffic Reports (for CLP only). Traffic reports for medium level samples are completed similarly to those for low level samples (Figures 5-2, 5-3, 5-4 and 5-5), except that medium concentration is specified where appropriate.

- Chain-of-Custody Forms. Chain-of-custody forms for medium level samples are completed similar to those for low level samples (Figure 5-6), except that medium concentration is specified where appropriate.

- Sample Tags. Completed the sample tags in the same manner as for low level samples (Figure 5-7).

5.4.3 High Level Samples

- Organic and Inorganic Traffic Reports (for CLP only). It is extremely important that "known or suspected hazards" be specified on the form. Traffic reports for high level samples are completed similarly to those for low level samples (Figures 5-2, 5-3, 5-4 and 5-5), except that high concentration is specified where appropriate.

- Chain-of-Custody Forms. Complete as illustrated in Figure 5-6.

- Sample Tags. Complete the sample tags in the same manner as for low level samples (Figure 5-7).

FIGURE 5-4

INORGANIC TRAFFIC REPORT

USEPA CONTRACT LABORATORY PROGRAM
SAMPLE MANAGEMENT OFFICE
P.O. BOX 818 ALEXANDRIA, VA 22313
703/557-2490 FTS-557-2490

CASE NO: 10000 | SAS NO: (IF APPLICABLE) 5000H

INORGANIC TRAFFIC REPORT

(FOR CLP USE ONLY)

TYPE OF ACTIVITY (CIRCLE ONE) ①
SUPERFUND—PA SI ESI RIFS RD RA ER NPLD O&M OTHER _____
NON-SUPERFUND— _____ PROGRAM

SITE NAME: Johns Backyard
CITY, STATE: Denver, CO
SITE SPILL ID: AA

REGION NO: VIII
SAMPLING COMPANY ②: EPA
SAMPLER: (NAME) John Doe

SHIP TO: ③
ZY Labs
987 Lane Avenue
Denver, Colorado ZIP
ATTN: Sample Custodian

SAMPLING DATE: ④
BEGIN: 2/22/89 END: 2/22/89
DATE SHIPPED: 2/22/89 CARRIER: Fed Ex
AIRBILL NO: 987-654-3210

SAMPLE DESCRIPTION ⑤
(ENTER IN BOX A)
1. SURFACE WATER
2. GROUND WATER
3. LEACHATE
4. SOIL
5. SEDIMENT
6. OIL (SAS)
7. WASTE (SAS)

DOUBLE VOLUME REQUIRED FOR MATRIX SPIKE/DUPLICATE AQUEOUS SAMPLE

SHIP MEDIUM AND HIGH CONCENTRATION SAMPLES IN PAINT CANS

SEE REVERSE FOR ADDITIONAL INSTRUCTIONS

CLP SAMPLE NUMBER (FROM LABELS)	Ⓐ SAMPLE DESCRIPTION (FROM BOX 1) 1 2 3 4 5 6 7	Ⓑ CONCENTRATION L = LOW M = MED H = HIGH (SAS)	Ⓒ RAS ANALYSIS: TOTAL METALS	CYANIDE	DISSOLVED METALS	HIGH ONLY (SAS): SULFATE	pH	CONDUCTIVITY	ORGANICS	Ⓓ SPECIAL HANDLING	Ⓔ STATION LOCATION
MHM001	4	L	X	X							SO-01
MHM002	4	L	X	X							SO-02
MHM003	4	L	X	X							SO-03
MHM004	4	L	X	X							SO-04
MHM005	1	L	X	X							SW-01

EPA Form 2075-6 (3-87)

WHITE — SMO COPY PINK — CLIENT COPY WHITE — LAB COPY FOR RETURN TO SMO YELLOW — LAB COPY

FIGURE 5-5

INORGANIC TRAFFIC REPORT (NEW)

EPA

United States Environmental Protection Agency
Contract Laboratory Program Sample Management Office
PO Box 818 Alexandria, VA 22313
703-557-2490 FTS 557-2490

Inorganic Traffic Report
(For CLP Use Only)

Case Number: 10100

SAS No. (if applicable):

1. Type of Activity (Check one): ENF, ER, ESI, NPLD, O&M, PA, RA, RD, RIFS, SI, ST, STPA, STSI, Other (Specify)

Non-Superfund Program

Site Name: Cheers Dump

City, State: Boston MA

Site Spill ID: ZZ

2. Region Number: I

Sampling Co.: Acme

Sampler (Name): John Doe

3. Ship To: LAB A
100 April WAY
Boston MA
ATTN: LAB SUPERVISOR

4. Date Shipped: 12/10/88

Airbill Number: 321-687-1234

Carrier: F

Double volume required for matrix spike/duplicate aqueous sample.

Ship medium and high concentration samples in paint cans.

See reverse for additional instructions

5. Sample Description (Enter in Column A)
1. Surface Water
2. Ground Water
3. Leachate
4. Rinsate
5. Soil/Sediment
6. Oil (SAS)
7. Waste (SAS)
8. Other (SAS) (Specify)

CLP Sample Number (From labels)	(A) Sample Description (From box 5)	(B) Concentration L=low M=med H=high	(C) RAS Analysis: Total Metals	(C) RAS Analysis: Cyanide	(D) Special Handling	(E) Station Location	(F) Date/Time of Sample Collection	(G) Corresponding Organic Sample Number
MAA123	1	M	X	X		01	12/9 1330hrs	AA123
MAA124	5	M	X	X		02	12/9 1330hrs	AA124
MAA125	3	L	X	X	BLANK		12/9 1330hrs	AA125

EPA Form 9110-1 (8-88) Replaces EPA Form 2075-6, which may be used. Green - SMO Copy Pink - Region Copy White - Lab Copy for Return to SMO Yellow - Lab Copy

U S ENVIRONMENTAL PROTECTION AGENCY
Environmental Services Division

CHAIN OF CUSTODY RECORD

REGION VIII, ONE DENVER PLACE
999 18TH STREET
DENVER, CO. 80202-2413

PROJ NO: 108-8902-002
PROJECT NAME: Johns Backyard
SAMPLERS (Signature): John Doe

STAT NO	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	120 mL bottles (VOA)	8-oz. jar (BNA)	8-oz. jar (Pest/PCB)	40mL VOA vials	1-L Amber (BNA)	1-L Amber (Pest/PCB)	REMARKS TRØ, TAG Øs
SO-01	/22/89	1250	X		Just inside S. Gate	4	2	1	1				
SO-02	/22/89	1305	X		Just inside E. Gate	4	2	1	1				
SO-03	/22/89	1320	X		Next to fire hydrant at 6th & main	4	2	1	1				
SO-04	/22/89	1335	X		10'W,15'N of fire hydrant at 6th & Main	4	2	1	1				HM-004, 8-84862
SW-01	/22/89	1400		X	From fire hydrant	4				2	1	1	

Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by: (Signature)
John Doe	02/22/89 1500	Fed Ex Employee			
Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks	

Distribution: Original Accompanies Shipment; First Copy to Coordinator Field Files, Second Copy to Representative of Inspected Facility

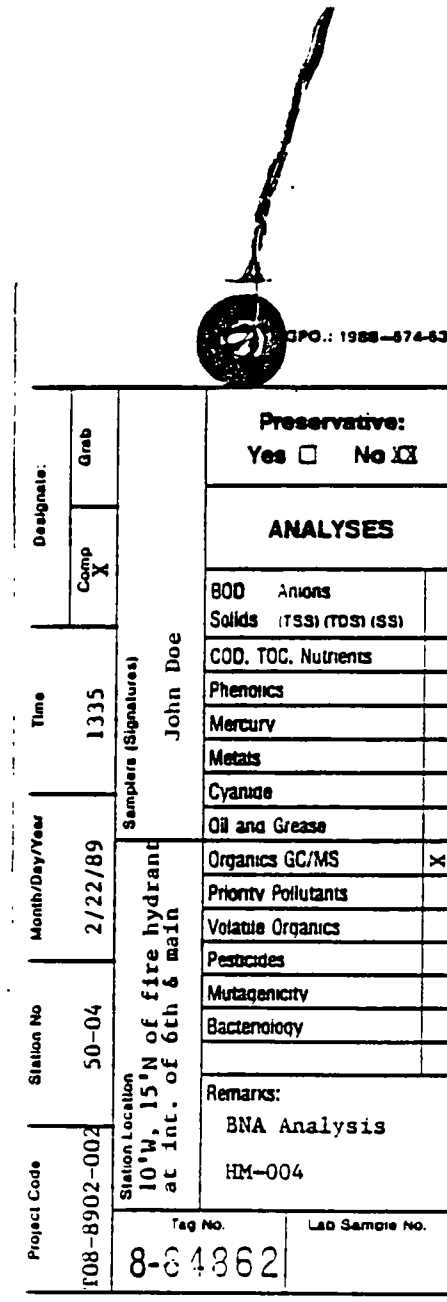
Split Samples: ☐ Accepted ☒ Declined — Signature: John Doe

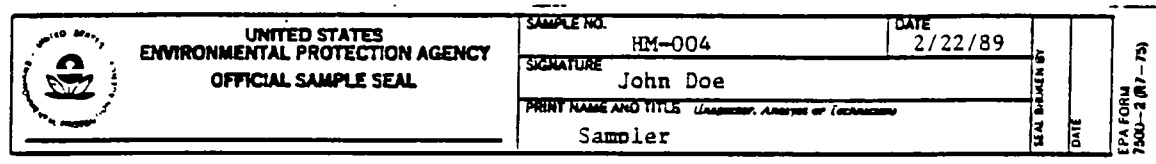
HB EPA 014B

FIGURE 5-6
CHAIN OF CUSTODY RECORD

FIGURE 5-7

SAMPLE TAG and SAMPLE SEAL





5.4.4 Dioxin Samples

- CLP Dioxin Shipment Records. A shipment record is used for dioxin samples in place of traffic report forms. Complete as illustrated in Figure 5-8. The top two copies of the shipment record are returned to the regional office, the bottom two copies accompany the sample. Dioxin sample numbers are pre-assigned. Multiple samples from a single site may appear on a single shipment record.

- Chain-of-Custody Forms. Use the dioxin sample number in place of the traffic report number. Complete as illustrated in Figure 5-6.

- Labels/Tags. Dioxin sample numbers are available as pre-assigned labels from the CLP. One label must appear on the sample container, and a duplicate label must be affixed to the metal paint can in which the sample will be shipped. EPA sample tags must be affixed to the sample container. Labels indicating the site name, sample location, date, and time of collection must also be affixed to the sample container.

5.4.5 Special Analytical Services (for CLP only)

Special Analytical Services are required under the following conditions:

- For organic and/or inorganic analysis of oils or other atypical matrices such as fish, mammal tissues, or air;

- For parameters other than the 150 Target Compound List (TCL) organics or inorganics;

- For lower detection limits or for quality control that is more extensive than available through the routine CLP Invitation For Bid (IFB) process;

- For quicker turnaround times than the normal 30 days;

- For EP toxicity, flashpoint, and other RCRA solid waste parameters;

- For dioxin/furan analysis which is not provided by Routine Anaytical Services (RAS);

- For high level samples.

The following documentation is required for SAS samples:

- Paperwork Requirements. Figure 5-9 is an example of an SAS packing list. This form is used in place of a traffic report. Up to 20 sample locations may be listed on a single packing list. Each sample number corresponds to a specific sample loca-

FIGURE 5-8

CLP DIOXIN SHIPMENT RECORD

USEPA Contract Laboratory Program
Sample Management Office
P.O. Box 818 Alexandria, Virginia 22313
FTS 8-557-2490 703/557-2490

CASE NO: 5000H	BATCH NO: 34

CLP DIOXIN SHIPMENT RECORD

Site Name: Johns Backyard	Sampling Office: EPA	Ship To:
City & State: Denver, Colorado	City & State: Denver, Colorado	Date Shipped:
EPA Site No:	Sampling Contact: John Doe (name)	
Latitude:	Sampling Date: 2/22/89	
Longitude:		
Tier: 1 2 3 4 5 6 7 (circle one)	Data Turnaround: 15-Day ____ 30-Day X	

SAMPLE NUMBERS	MATRIX: SOIL/SEDIMENT	MATRIX: OTHER:	DESCRIPTION: FIELD SAMPLE	DESCRIPTION: SAMPLE TO DUPLICATE	DESCRIPTION: SAMPLE TO SPIKE	DESCRIPTION: BLANK	DESCRIPTION: EQUIPMENT RINSATE	DESCRIPTION: OTHER: (SAS ONLY)	ADD'L ANALYSIS: SPECIFY: (SAS ONLY)
5000H-34-001	X		X						
5000H-34-002	X				X				
5000H-34-003	X					X			
5000H-34-004	X						X		
5000H-34-005	X		X						

WHITE—SMO Copy YELLOW—Region Copy PINK—Lab Copy for Return to SMO GOLD—Lab Copy

FIGURE 5-9

SPECIAL ANALYTICAL
SERVICES PACKING LIST

U.S. ENVIRONMENTAL PROTECTION AGENCY
CLP Sample Management Office
P.O. Box 818 - Alexandria, Virginia 22313
Phone: 703/557-2490 - FTS/557-2490

SAS Number
5000H

SPECIAL ANALYTICAL SERVICE
PACKING LIST

Sampling Office:	Sampling Date(s):	Ship To:	For Lab Use Only
EPA	2/22/89	MMM Labs 555 Lane Road Denver, Colorado ZIP	Date Samples Rec'd:
Sampling Contact: John Doe (name)	Date Shipped: 2/22/89		Received By:
294-7061 (phone)	Site Name/Code: Johns Backyard/AA	Attn: Sample custodian	

	Sample Numbers	Sample Description i.e., Analysis, Matrix, Concentration	Sample Condition on Receipt at Lab
1.	5000H-01	Medium soil - VOA, BAN, Pest./BNA	
2.	5000H-02	Medium soil - VOA, BNA, Pest./BNA	
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			

For Lab Use Only

White - SMO Copy, Yellow - Region Copy, Pink - Lab Copy for return to SMO, Gold - Lab Copy

tion. The top two copies of the packing list are returned to the TAT office, and the bottom two accompany the shipment. If both Routine Analytical Services (RAS) and SAS parameters are requested, it may be possible to simply list the additional SAS parameters requested on the appropriate traffic reports, thus eliminating the need for the packing list.

- Chain-of-Custody Forms. Chain-of-custody forms are required per unit shipped. SAS numbers will replace traffic report numbers in all places (Figure 5-6).

- Labels/Tags. Labels and tags are required on all sample containers. The SAS number will be used in place of the traffic report number where appropriate.

5.5 Sample Packaging Procedures

5.5.1 Low Level Samples

The following guidelines should be followed to package low level samples.

1. Decontaminate the outside of all sample containers;

2. Affix the traffic report number to the sample container and cover with clear plastic tape.

3. Affix the tags to the sample bottles;

4. Secure bottle caps with tape or a chain-of-custody seal;

5. Mark level of sample material on each bottle (except VOA samples) with a grease pencil;

6. Place each sample in a plastic self-sealing bag (Ziplock), and wrap with bubble wrap, or other packing material (2 VOA containers per bag), polyethylene bottles do not require padding;

7. Place samples in an ice cooler lined with two large plastic bags with a layer of vermiculite (non-combustible absorbent packaging material) in the bottom of the inside bag;

8. Samples must be placed in cooler in a way as to prevent breakage; do not over-pack;

9. Fill the remainder of the inside bag with vermiculite and seal the inner bag with strapping tape, place shipping ice contained in sealed plastic bags between the large bags, tape the outer plastic bag closed;

10. Place the proper sections of the traffic reports and chain-of-custody forms in a clear plastic bag and tape to the inside lid of the cooler;

11. Secure each cooler with strapping tape at two locations and tape the outside cooler drain shut;

12. Label the outside of the cooler in indelible ink with the proper laboratory address, cover this and other shipping labels with clear plastic tape; and

13. Affix signed and dated chain-of-custody seals to the front left and back right of the cooler, cover with clear plastic tape.

5.5.2 Medium and High Level Samples

The following procedures should be followed to package medium and high level samples.

1. Decontaminate the outside of all sample containers;

2. Affix the traffic report number to the outside of the container and cover with clear plastic tape;

3. Affix the tags to the sample bottles;

4. Secure bottle caps, place in clear self-sealing plastic bags;

5. Pack each sample container in a metal paint can, filled with a vermiculite cushion. The can lid must be secured with three metal clips;

6. Apply appropriate hazard warning and shipping labels and laboratory address label to the lid of the metal paint can; and

7. Place samples in ice coolers and complete packaging according to low level procedures.

5.5.3 Dioxin Samples

The following procedures should be followed to package dioxin samples:

- Package according to medium level soil sample procedures;

- Dioxin sample numbers must appear on the sample container and a duplicate label must be affixed to the metal paint can;

- Labels indicating site name, sample location, date, and time of collection must be affixed to the sample jar or bottle;

- Protect from sunlight.

5.6 Federal Express Shipping Requirements

Samples may be shipped via Federal Express using the following two forms:

- Federal Express Airbill. A regular airbill is used for all low level samples. Complete the airbill as illustrated in Figure 5-10. Record the airbill number on corresponding traffic report and chain-of-custody forms.

- Federal Express Restricted Articles Airbill. A Restricted Articles airbill is used for medium and high level samples classified as hazardous materials, flammable liquid N.O.S. (Not Otherwise Specified), or flammable solid N.O.S. Complete the airbill as illustrated in Figure 5-11. Dioxin samples are shipped as medium level, flammable solid N.O.S.

It should be noted that these regulations change with time and the shipper should be called prior to shipping to verify any changes.

5.7 DOT Shipping Requirements

Samples must be transported in a manner that protects their integrity, as well as protecting against any detrimental effects from possible leakage. Regulations for packaging, marking, labeling, and shipping of hazardous materials and wastes are promulgated by the U.S. Department of Transportation (DOT) and described in the Code of Federal Regulations (49 CFR 171 through 177). In general, these regulations were not intended to cover shipment of samples collected at hazardous waste sites or samples collected at emergency responses. However, EPA has deemed it prudent to observe DOT procedures. The information presented here is for general guidance, Figure 5-12 and Table 5-2. For specific details of DOT regulations for shipping and marking, see Appendices B and C.

A distinction must be made between environmental and hazardous samples to determine the appropriate procedures for transportation. Packaging requirements for hazardous samples are more rigorous than those for environmental samples. If there is any doubt, a sample should be considered hazardous and shipped accordingly. In addition, consideration should be taken to protect the health and safety of laboratory personnel receiving the samples. Special precautions are used at laboratories when hazardous samples are received. Again, if there is doubt, samples should be considered hazardous rather than environmental.

It should be noted that these regulations change with time and the shipper should be called prior to shipping to verify any changes.

5.7.1 Low Level Samples

Low level (environmental) samples are exempt from DOT Hazardous Materials Regulations even though some preservatives are classified as hazardous. A letter of understanding between EPA and DOT states that

FIGURE 5-10

FEDERAL EXPRESS FORM

FEDERAL EXPRESS

AIRBILL

USE THIS AIRBILL FOR DOMESTIC SHIPMENTS WITHIN THE CONTINENTAL U.S.A. ALASKA AND HAWAII.
USE THE INTERNATIONAL AIR WAYBILL FOR SHIPMENTS TO PUERTO RICO
QUESTIONS? CALL 800-238-5355 TOLL FREE

PACKAGE TRACKING NUMBER 9887414036

9887414036

Sender's Federal Express Account Number: 1111-2222-3

Date:

1 From (Your Name) Please Print: Your Name

Your Phone Number (Very Important): ( )

Company: Company

Department/Floor No:

Street Address:

City: State: ZIP Required

2 To (Recipient's Name) Please Print: Lab Contact

Recipient's Phone Number (Very Important): ( )

Company: Laboratory

Department/Floor No.:

Exact Street Address (We Cannot Deliver to P.O. Boxes or P.O. • Zip Codes.):

City: State: ZIP Required

3 YOUR BILLING REFERENCE INFORMATION (FIRST 24 CHARACTERS WILL APPEAR ON INVOICE.)
Any Information Concerning the Project

PAYMENT ☐ Bill Sender ☐ Bill Recipient's FedEx Acct. No. Fill in Account Number below ☒ Bill 3rd Party FedEx Acct. No. Fill in Account Number below ☐ Bill Credit Card Fill in Credit Card Number below ☐ Cash

123-456-789-0

4 IF HOLD FOR PICK-UP, Print FEDEX Address Here
Street Address:
City: State: ZIP Required

4 SERVICES

1 ☐ PRIORITY 1 Overnight Delivery
2 ☐ COURIER-PAK OVERNIGHT ENVELOPE*
3 ☐ OVERNIGHT BOX
4 ☐ OVERNIGHT TUBE
5 ☐ STANDARD AIR Delivery not later than second business day
6 ☐ OVERNIGHT LETTER*
7 ☐
8 ☐
9 ☐
10 ☐

* Declared Value Limit $100

DELIVERY AND SPECIAL HANDLING

1 ☐ HOLD FOR PICK-UP
2 ☐ DELIVER WEEKDAY
3 DELIVER SATURDAY ☐
4 ☐ DANGEROUS GOODS (Extra Charge)
5 ☐ CONSTANT SURVEILLANCE SERVICE (CSS) (Extra Charge; Overnight Signature Not Applicable)
6 ☐ DRY ICE _____ LBS
7 ☐ OTHER SPECIAL SERVICE _____
8 ☐
9 ☐ SATURDAY PICK-UP (Extra Charge)
10 ☐
11 ☐
12 ☐ HOLIDAY DELIVERY (If Offered) (Extra Charge)

PACKAGES	WEIGHT	YOUR DECLARED VALUE (See right)	OVER SIZE
Total	Total	Total	

Received At
1 ☐ Regular Stop
2 ☐ On-Call Stop
3 ☐ Drop Box 4 ☐ BSC 5 ☐ Station

FEDEX Corp. Employee No.

Date/Time for FEDEX Use

SERVICE CONDITIONS, DECLARED VALUE AND LIMIT OF LIABILITY

Use of this airbill constitutes your agreement to the service conditions in our current Service Guide which is available upon request. See back of sender's copy of this airbill for further information.

We will not be responsible for any claim in excess of $100 per package, whether the result of loss, damage, delay or non-delivery unless you specify a higher amount in the space to the left, pay 40¢ per additional $100 specified and document your actual loss in the event of a claim. Maximum amount limitations found in the current Federal Express Service Guide apply. Your rights to recover from Federal Express for loss of the intrinsic value of the package as well as for loss of sales, income, interest, profit, attorney's fees, costs and any other form of damage whether direct, incidental, consequential or special is limited to the greater of $100 or the declared value specified to the left. In no event shall your recovery exceed your actual loss.

In the event of untimely delivery, Federal Express will at your request and with some limitations refund all transportation charges paid. See Service Guide for further information.

5 Sender authorizes Federal Express to deliver this shipment without obtaining a delivery signature and shall indemnify and hold harmless Federal Express from any claims resulting therefrom.

Release Signature _____

Federal Express Use

Base Charges	
Declared Value Charge	
Other 1	
Other 2	
Total Charges	

PART #2041738900
REVISION DATE 7/88
PRINTED IN U.S.A. SACEF

009

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9887414036

FIGURE 5-11

FEDERAL EXPRESS FORM FOR RESTRICTED ARTICLES

FEDERAL EXPRESS

AIRBILL NUMBER 9823408851

99 8293M 1 9823408851

Sender's Federal Express Account Number: 1066-3756-3

1 From (Your Name Please Print): Your Name

Your Phone Number: ( )

Company: ECOLOGY & ENVIRONMENT INC

Street Address: 1776 S JACKSON ST STE 200

City: DENVER State: CO ZIP: 80210

2 To (Recipient's Name Please Print): Lab Contact

Company: Laboratory

City: State:

3 YOUR BILLING REFERENCE INFORMATION (FIRST 24 CHARACTERS WILL APPEAR ON INVOICE)

PAYMENT: Bill Sender / Bill Recipient's Federal Express Acct. No. / Bill Third Party Federal Express Acct. No. / Bill Credit Card / Cash

123-456-789-0

4 SERVICES (CHECK ONLY ONE BOX): 1 Priority 1 / Cargo Aircraft Only / Overnight Express / Standard Air / Service Commitment

DELIVERY AND SPECIAL HANDLING (CHECK SERVICES REQUIRED): 1 Hold for Pick-up / 2 Hold Saturday / 3 Deliver Saturday / 4 Dangerous Goods / 5 Overnight Surveillance Service / 6 Dry Ice / 7 Other Special Handling / 8 / 9 Saturday Pick-up / 10

Total Declared Value / Damage or Loss / Delay / Consequential Damages / Do Not Ship Cash or Currency

Freight Charges / Declared Value Charges / Origin Agent Charges / Other / Total Charges

PART #2041730784 REV. 5/87 PRINTED U.S.A. NCREC'S

008

9823408851 AIRBILL NUMBER

SHIPPER'S CERTIFICATION FOR RESTRICTED ARTICLES/DANGEROUS GOODS

CHECK ONE: 49 CFR / ICAO (TYPE OR PRINT)

NO. OF PKGS	PROPER SHIPPING NAME	CLASS OR DIVISION	UN/NA NO.	SUBSIDIARY RISK	NET QUANTITY	PACKING INSTRUCTIONS	AUTHORIZATION
1	Flammable liquid N.O.S. LIMITED QUANTITY LAB SAMPLES	Flammable Liquid CARGO AIRCRAFT ONLY	UN 1993		16 8-oz.		

ADDITIONAL DESCRIPTION REQUIREMENTS FOR RADIOACTIVE MATERIALS (SEE BACK)

RADIONUCLIDES	FORM	ACTIVITY	CATEGORY OF LABELS	TRANS. INDEX	PACKAGE IDENTIFICATION
			☐ WHITE I ☐ YELLOW II ☐ YELLOW III ☐ NONE		

TRANSPORT DETAILS: THIS SHIPMENT IS WITHIN THE LIMITATIONS PRESCRIBED FOR ▶ PASSENGER AIRCRAFT / CARGO AIRCRAFT ONLY (DELETE-NONAPPLICABLE)

AIRPORT OF DEPARTURE / AIRPORT OF DESTINATION / SHIPMENT TYPE ▶ NON-RADIOACTIVE / RADIOACTIVE (DELETE-NONAPPLICABLE)

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS OR TREATMENT

I HEREBY DECLARE THAT THE CONTENTS OF THIS CONSIGNMENT ARE FULLY AND ACCURATELY DESCRIBED ABOVE BY PROPER SHIPPING NAME AND ARE CLASSIFIED, PACKED, MARKED, AND LABELED, AND ARE IN ALL RESPECTS IN PROPER CONDITION FOR TRANSPORT BY AIR ACCORDING TO THE APPLICABLE INTERNATIONAL AND NATIONAL GOVERNMENT REGULATIONS.

NAME AND TITLE OF SHIPPER: Your name/Title

PLACE AND DATE:

EMERGENCY TELEPHONE NUMBER: Field or office #

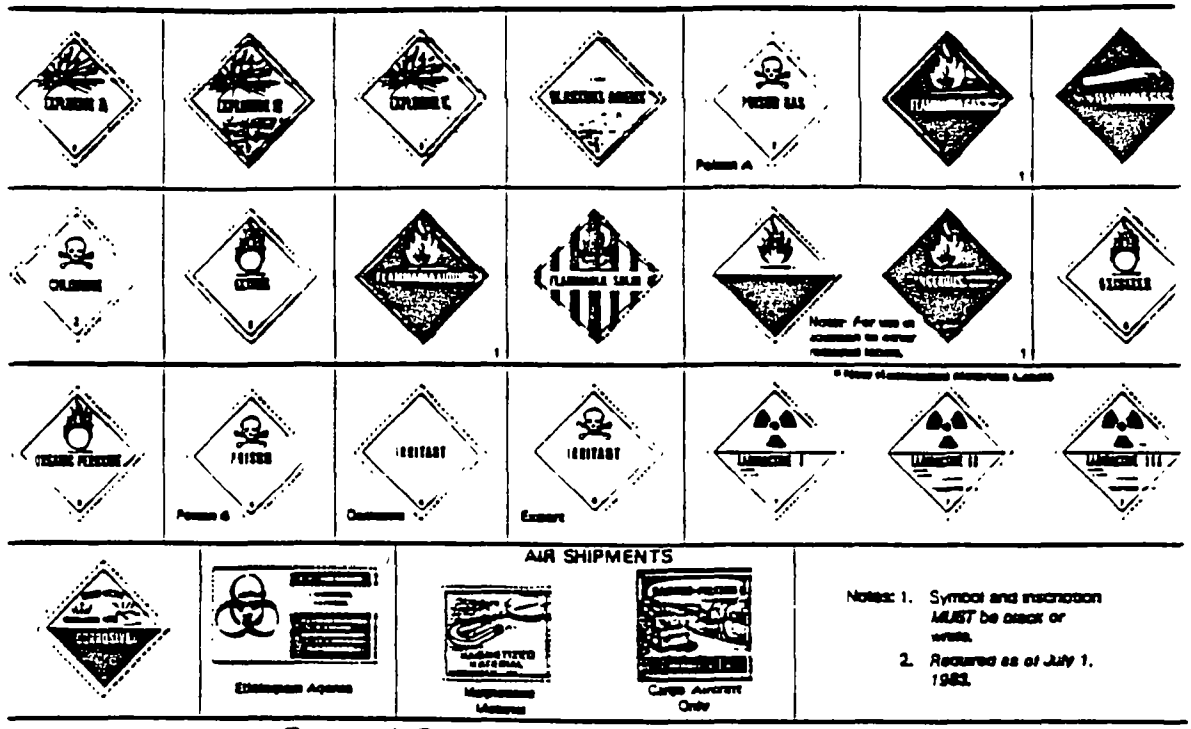
SIGNATURE OF SHIPPER:

SEE WARNING ON BACK

FIGURE 5-12

SAMPLE SHIPMENT LABEL EXAMPLES

DOT Hazardous Materials Warning Labels



Notes: 1. Symbol and inscription *MUST* be black or white.

2. *Required as of July 1, 1983.*

General Guidelines on Use of Labels

1. The Hazardous Materials Tables, Sec. 171.101 and 172.102, identify the proper label(s) for the hazardous materials listed.

2. Any person who offers a hazardous material for shipment *must label* the package, if required. (Sec. 172.400(a))

3. Labels *may* be affixed to packages (even though not required by the regulations) provided *each* label represents a hazard of the material in the package. (Sec. 172.401)

4. Label(s), when required, *must* be printed on or affixed to the surface of the package near the proper shipping name. (Sec. 172.406(a))

5. When two or more different labels are required, display them next to each other. (Sec. 172.406(c))

6. When two or more packages containing corrosive hazardous materials are packaged within the same overpack, the outside container *must* be labeled as required for each class of material contained therein. (Sec. 172.404(b))

7. Material classed as an Explosive A, Poison A, or Radioactive Material also meeting the definition of another hazard class *must* be labeled for *each* class. (Sec. 172.402(a))

8. Material classed as an Oxidizer, Corrosive, Flammable Solid, or Flammable Liquid that also meets the definition of a Poison B *must* be labeled POISON, in addition to the hazard class label. (Sec. 172.402(a)(3) and (5))

9. Material classed as a Flammable Solid that also meets the definition of a water-reactive material *must* be labeled with FLAMMABLE SOLID and DANGEROUS WHEN WET labels (Sec. 172.402(a)(4))

10. Material classed as a Poison B, Flammable Liquid, Flammable Solid, or Oxidizer that also meets the definition of a Corrosive material *must* be labeled CORROSIVE in addition to the class label. (Sec. 172.402(a)(6) through (9))

This Chart does not include all of the labeling requirements. For details, refer to the Code of Federal Regulations, Title 49, Part 172, Sec. 172.400 through 172.448.

U.S. Department of Transportation

Research and Special Programs Administration

Materials Transportation Bureau
Office of Operations and Enforcement
Washington, D.C. 20590

Chart 7 June 1981

Cut Here or Use Punch

TABLE 5-2

DOCUMENTATION AND SHIPPING LABEL SUMMARY

Required Documentation	Low Level Samples	Medium Level Samples	High Level Samples	Dioxin Samples
EPA SampleTags/Labels	X	X	X	X
EPA Sample Seals	X	X	X	X
Traffic Report Forms Organic/Inorganic	X	X	X	
Dioxin Shipment Record				X
Chain-of-Custody	X	X	X	X
EPA Request for Analysis	If applicable	If applicable	If applicable	If Applicable
Federal Express Airbill	X			
Federal Express Restricted Articles Airbill		X	X	X
Chain-of-Custody Seals (on cooler)	X	X	X	X
"Fragile" and "This End Up" Stickers	X	X	X	X
"Danger/Peligro" Stickers		X	X	X
"Flammable Solid, NOS" Stickers		If applicable	If applicable	
"Flammable Liquid, NOS" Stickers		If applicable	If applicable	
"Limited Quantity Lab Samples" (on cooler)		X	X	X

samples containing specific reagents as preservatives are exempt, provided the reagents do not exceed a specified concentration in the sample (Table 5-3).

Sample containers must have a completed sample identification tag. The outside container must be marked "Environmental Samples". The appropriate side of the container must be marked "This End Up" and arrows should be drawn accordingly. No other marking and labeling is required. No DOT shipping papers are required. There are no DOT restrictions on mode of transportation.

5.7.2 Medium and High Level Samples

Samples not determined to be environmental samples or samples known or suspected to contain hazardous materials must be considered hazardous substance samples and be transported according to the DOT requirements. If the material in the sample is known or can be identified, then package, mark, label, and ship according to the specific instructions for that material (if it is listed) in the DOT Hazardous Materials Table, 49 CFR 172.101.

If a hazardous sample is of unknown content, then select the appropriate transportation category according to the DOT Hazardous Materials Classification (Table 5-4), a priority system of transportation categories. The correct shipping classification for an unknown sample is selected through a process of elimination. The sample is classified into one of six hierarchial hazard categories based on the available information concerning the nature of the sample. These categories, in order from highest to lowest hazard, are:

- Radioactive material
- Poison A
- Flammable gas
- Nonflammable gas
- Flammable liquid
- Flammable solid

Each sample is considered to be in the highest possible category until proven otherwise. Although other categories exist below flammable liquids and solids, unless some analytical information is available, all hazardous material samples must be considered at least as being potentially flammable.

The sample is considered radioactive unless it is known or demonstrated to be nonradioactive (through the use of radiation survey instruments), and the appropriate shipping regulations for Radioactive Material are followed. If the Radioactive Material category can be eliminated, the sample is considered to contain Poison A materials (Table 5-5), the next category on the list. Materials classed as Poison A are extremely dangerous poisonous gases or liquids of such a nature that a very small amount of gas, or vapor of the liquid, mixed with air is dangerous to life. Many Poison A materials are gases or compressed gases and would not be found in drum-type containers. Liquid Poison A's would probably be found only in closed containers. However, all samples

TABLE 5-3

CONCENTRATIONS OF HAZARDOUS MATERIALS USED AS PRESERVATIVES IN WATER SAMPLES THAT ARE EXEMPT FROM DOT HAZARDOUS MATERIALS REGULATIONS

1. HCl in water solutions at concentrations of 0.04% by weight or less.

2. $HgCl_2$ in water solutions at concentrations of 0.004% by weight or less.

3. HNO_3 in water solutions at concentrations of 0.15% by weight or less.

4. H_2SO_4 in water solutions at concentrations of 0.35% by weight or less.

5. NaOH in water solutions at concentrations of 0.08% by weight or less.

6. H_3PO_4 in water solutions at concentrations yielding a pH range between 4 and 2.

(From Letter of Understanding Between EPA and DOT, April 11, 1979)

TABLE 5-4

DOT HAZARDOUS MATERIAL CLASSIFICATION (49 CFR 173.2)

1. Radioactive material
2. Poison A
3. Flammable gas
4. Nonflammable gas
5. Flammable liquid
6. Oxidizer
7. Flammable solid
8. Corrosive material (liquid)
9. Poison B
10. Corrosive material (solid)
11. Irritating material
12. Combustible liquid (in containers having capacities exceeding 110 gallons)
13. ORM-B
14. ORM-A
15. Combustible liquid (in containers having capacities of 110 gallons or less)
16. ORM-E

TABLE 5-5

DOT LIST OF CLASS "A" POISONS (49 CFR 172.101)

Material	Physical State at Standard Temperature
Arsine	Gas
Bromoacetone	Liquid
Chloropicrin and methyl chloride mixture	Gas
Chloropicrin and nonflammable, nonliquified compressed gas mixture	Gas
Cyanogen chloride	Gas (>13.1°C)
Cyanogen gas	Gas
Gas identification set	Gas
Gelatin dynamite (H.E. Germaine)	---
Grenade (with Poison "A" gas charge)	---
Hexaethyl tetraphosphate/compressed gas mixture	Gas
Hydrocyanic acid (prussic) solution	Liquid
Hydrocyanic acid, liquefied	Gas
Insecticide liquefied gas containing Poison "A" or Poison "B" material	Gas
Methyldichloroarsine	Liquid
Nitric oxide	Gas
Nitrogen peroxide	Gas
Nitrogen tetroxide	Gas
Nitrogen dioxide, liquid	Gas
Parathion/compressed gas mixture	Gas
Phosgene (diphosgene)	Liquid

taken from closed drums do not have to be shipped as Poison A's, which provides for a "worst case" situation. Based upon available information, a judgment must be made whether a sample from a closed container is a Poison A.

If Poison A can be eliminated as a shipment category, the next two classifications are Flammable or Nonflammable Gases. Gases will be in cylinders and are often labeled as to their flammability. If not labeled, the gases should be shipped as Flammable Gases.

Since few gas samples are collected at hazardous waste sites or responses, Flammable Liquid or Solid would be the next applicable categories. With the elimination of Radioactive Material, Poison A, Flammable Gas, and Nonflammable Gas, the sample can be classified as Flammable Liquid (or Solid) and shipped accordingly. These procedures would also suffice for shipping any other samples potentially classified below Flammable Liquid/Solid in the DOT classification table.

For samples containing unknown materials, the other categories listed below Flammable Liquid/Solid are generally not considered because eliminating other substances as flammable liquids requires flashpoint testing, which may be impractical and possibly dangerous at a site. Thus, unless the sample is known to consist of a material listed below Flammable Liquid/Solid on the table, it should be considered a Flammable Liquid (or Solid) and be shipped as such.

5.7.3 Radioactive Material

DOT regulations require strict procedures for the transportation of radioactive materials. Unknown radioactive samples may not be transported, according to DOT regulations, because radioactive materials must be classified and typed. Radioactive class is based on the amount of fissile material and/or millirem measure. Radioactive type is based on the activity of the particular material. In addition, the name of each radionuclide in the radioactive material must be identified prior to shipment. Prior to the collection of radioactive samples, a radiation specialist should be consulted to provide guidance concerning personnel protection, sampling techniques, and packaging and shipping requirements.

5.7.4 Poison A

Applying the word "poisonous" to a sample does not imply that it is, in fact, poisonous, or indicate how poisonous it might be. It simply describes the class of packaging required by DOT regulations. All samples identified as Poison A materials should be treated by the following procedures.

5.7.4.1 Packaging

Place samples in a polyethylene or glass container with an outer diameter narrower than the valve hole on a DOT specification #3A1800 or #3AA1800 metal cylinder. To prevent leakage, fill the container no more than 90 percent full (at 130°F).

- Attach a string or flexible wire to the neck of the sample container; lower it into a metal cylinder partially filled with noncombustible, absorbent cushioning material (e.g., diatomaceous earth or vermiculite). Place only one container in each metal cylinder. Pack the cylinder with enough absorbing material between the bottom and sides of the sample container and the metal cylinder to prevent breakage and to absorb any leakage. After the cushioning material is in place, drop the end of the string or wire into the cylinder valve hole.

- Replace valve, torque to 250 foot-pound (for 1-inch opening), and replace valve protector on metal cylinder, using Teflon tape.

- Place one or more cylinders in a DOT-approved outside container.

5.7.4.2 Marking/Labeling

- Use abbreviations only where specified.

- Place the following information, either hand printed or in label form, on the side of the cylinder or on a tag wired to the cylinder valve protector:

  - "Poisonous Liquid, n.o.s. NA1955" or "Poisonous Gas, n.o.s. NA1955".

  - Laboratory name and address.

  - DOT label "Poisonous Gas" (even if sample is liquid) on cylinder.

- Put the same information on the outside container as on the metal cylinder.

- Print "Laboratory Sample" and "Inside Packages Comply With Prescribed Specifications" on top and/or front of the outside container. Mark "This Side Up" on top of the container and upward-pointing arrows on all four sides.

5.7.4.3 Shipping Papers

- Use abbreviations only as specified.

- Complete carrier-provided bill-of-lading and sign certification statement (if carrier does not provide, use standard industry form). Provide the following information in order listed (one form may be used for more than one exterior container):

  - "Poisonous Liquid, n.o.s." as proper shipping name.

  - "Poison" just after proper shipping name.

  - UN1955.

- Net weight or net volume (weight or volume may be abbreviated), and type of packaging.

- Include reference to the section of DOT regulations covering the hazardous class (from Hazardous Materials Table 172.101).

- Additional handling information, if applicable.

· Include a chain-of-custody record, properly executed, in the container or with the cylinder if legal use of samples is required or anticipated.

· Accompany shipping container to carrier and, if required, open the outside container(s) for inspection.

5.7.4.4 Transportation

· Transport unknown hazardous substance samples classified as Poison A only by ground transport or government-owned aircraft. Do not use air cargo, other common-carrier aircraft, or rented aircraft.

5.7.5 Flammable Gas

Applying the word "flammable gas" to a sample does not imply that it is in fact flammable, or indicate how flammable it might be. The word describes the class of packaging required by DOT regulations. This DOT classification also is applicable to commercial flammable gas products, therefore handling requirements are identical to those for flammable gas samples. All samples or products identified as flammable gas should be handled with the following procedures.

5.7.5.1 Packaging

· All flammable gas samples and products must be contained in DOT-approved compressed gas cylinders.

· Cylinders must be packed in a strong outside container such as a plastic case or corrugated cardboard box. A means to protect the cylinder valve must also be provided.

5.7.5.2 Marking/Labeling

· Use abbreviations only where specified.

· Place the following information, either hand printed or in label form, on the outside container:

- Name and address of destination.

- "Flammable gas, n.o.s. UN1954".

- Not otherwise specified (n.o.s.) is not used if the flammable

gas is identified. The name of the specific material is listed before the category (e.g., Hydrogen, Flammable Gas) followed by its appropriate United Nations number found in the DOT Hazardous Materials Table (172.101).

- "Cargo Aircraft Only". (Certain commercial flammable gas products granted a DOT exemption may be shipped by passenger aircraft provided the exception notice is transported with the gas and the shipment is approved by the pilot of the aircraft.)

- "Inside containers comply with prescribed regulations".

5.7.5.3 Shipping Papers

- Use abbreviations only where specified.

- Complete carrier-provided bill-of-lading and sign certification statement (if carrier does not provide, use standard industry form). Provide the following information in the order listed (one form may be used for more than one exterior container):

  - "Compressed Gas, n.o.s." (or name of specific compound, if known). If material is being shipped under a DOT exemption, then the DOT exemption number must appear below the proper shipping name.

  - "Flammable Gas" and "Cargo Aircraft Only".

  - "UN1954" or UN number for specific compound if known.

  - Net weight or net volume (weight or volume may be abbreviated) and type of packaging.

  - Include reference to the section of DOT regulations covering the hazard class (from Hazardous Materials Table, 172.101).

  - Additional handling information, if applicable.

- Include chain-of-custody record, properly executed, in outside container if legal use of samples is required or anticipated.

- Accompany shipping containers to carrier and, if required, open outside container(s) for inspection.

5.7.5.4 Transportation

- Transport all flammable gases by rented or common-carrier truck, railroad, or express overnight package service.

- Do not transport by any passenger-carrying air transport system, even if they have cargo-only aircraft. Regulations permit regular airline cargo-only aircraft but difficulties with most suggest avoiding them. Instead, ship by airlines that only

carry cargo.

- When transporting by government-owned vehicle, including aircraft, DOT regulations do not apply. Personnel should still use procedures described here, except for execution of the bill-of-lading with certification.

- For overnight package services, determine weight restrictions - at least one service limits weight to 70 pounds per package.

5.7.6 Nonflammable Gas

Applying the word "nonflammable gas" to a sample implies that it is in fact nonflammable. The word describes the class of packaging required by DOT regulations. This DOT classification also is applicable to commercial nonflammable gas products and handling requirements are identical to nonflammable gas samples. All samples or products identified as nonflammable gas should be handled with the following procedures.

5.7.6.1 Packaging

- All nonflammable gas samples and products must be contained in DOT-approved compressed gas cylinders.

- Cylinders must be packed in a strong outside container such as a plastic case or corrugated cardboard box. A means to protect the cylinder valve must also be provided.

5.7.6.2 Marking/Labeling

- Use abbreviations only where specified.

- Place the following information, either hand printed or in label form, on the outside container:

  - Name and address of destination.

  - "Nonflammable gas, n.o.s. UN1956".

  - Not otherwise specified (n.o.s.) is not used if the nonflammable gas is identified. The name of the specific material is listed before the category (e.g., compressed air, Nonflammable Gas) followed by its appropriate United Nations number found in the DOT Hazardous Materials Table (172.101).

  - Inside containers must comply with prescribed regulations.

5.7.6.3 Shipping Papers

- Use abbreviations only where specified.

- Complete carrier-provided bill-of-lading and sign certification statement (if carrier does not provide, use standard industry

form). Provide the following information in the order listed (one form may be used for more than one exterior container):

- "Compressed Gas, n.o.s." (or name of specific compound, if known). If material is being shipped under a DOT exemption, then the DOT exemption number must appear below the proper shipping name.

- "Nonflammable Gas".

- "UN1956" or UN number for specific compound if known.

- Net weight or net volume (weight or volume may be abbreviated) and type of packaging.

- Include reference to the section of DOT regulations covering the hazard class (from Hazardous Materials Table, 172.101).

- Additional handling information, if applicable.

- Include chain-of-custody record, properly executed, in outside container if legal use of samples is required or anticipated.

- Accompany shipping containers to carrier and, if required, open outside container(s) for inspection.

5.7.6.4 Transportation

- Transport all nonflammable gases by rented or common-carrier truck, railroad, express overnight package service, cargo carrying aircraft, or passenger carrying aircraft.

- Transport by government-owned vehicle, including aircraft. DOT regulations do not apply, but personnel should still use procedures described here, except for execution of the bill-of-lading with certification.

- For overnight package services, determine weight restrictions - at least one service limits weight to 70 pounds per package.

5.7.7 Flammable Liquids/Solids

Applying the word "flammable" to a sample does not imply that it is in fact flammable, or indicate how flammable it might be. The word describes the class of packaging required by DOT regulations. All samples identified as Flammable Liquids or Flammable Solids should be handled with the following procedures.

5.7.7.1 Packaging

- Place sample container in a 2-ml thick (or thicker) polyethylene bag, one sample per bag. Position identification tag so it can be read through the bag. Seal the bag.

- Place the sealed bag inside a metal can and cushion it with enough noncombustible, absorbent material (e.g., vermiculite or diatomaceous earth) between the bottom and sides of the can and the bag to prevent breakage and to absorb any leakage. Pack one bag per can. Use clips, tape, and other positive means to hold the can lid securely, tightly, and permanently.

- Place one or more metal cans into a strong outside container, such as a metal picnic cooler or a DOT-approved fiberboard box. Surround the cans with noncombustible, absorbent, cushioning material for stability during transport.

5.7.7.2 Marking/Labeling

- Use abbreviations only where specified.

- Place the following information, either hand printed or in label form, on the metal can:

  - Laboratory name and address.

  - "Flammable Liquid, n.o.s. UN1993" or "Flammable Solid, n.o.s. UN1325".

  - Not otherwise specified (n.o.s.) is not used if the flammable liquid (or solid) is identified. The name of the specific material is listed before the category (e.g., Acetone, Flammable Liquid) followed by its appropriate United Nations number found in the DOT Hazardous Materials Table (172.101).

- Place the following DOT labels (if applicable) on the outside of the can:

  - "Flammable Liquid" or "Flammable Solid".

  - "Dangerous When Wet" must be used with "Flammable Solid" label if material meets the definition of a water-reactive material or if water reactivity is unknown.

  - "Cargo Aircraft Only". Must be used if net quantity of sample in each package is greater than 1 quart (for "Flammable Liquid, n.o.s.") or 25 pounds (for "Flammable Solid, n.o.s.").

- Place same information on outside shipping container as on the can.

- Print "Laboratory Samples", "This End Up", and "Inside packages comply with prescribed regulations" clearly on top of the shipping container. Put upward pointing arrows on all four sides of the container.

5.7.7.3 Shipping Papers

- Use abbreviations only where specified.

- Complete carrier-provided bill-of-lading and sign certification statement (if carrier does not provide, use standard industry form). Provide the following information in the order listed (one form may be used for more than one exterior container):

  - "Flammable Liquid, n.o.s." or "Flammable Solid, n.o.s." as proper shipping name.

  - "Flammable Liquid" or "Flammable Solid" and "Cargo Aircraft Only" just after the proper shipping name.

  - UN1993 (if flammable liquid) or UN1325 (if flammable solid).

  - Net weight or net volume (weight or volume may be abbreviated) and type of packaging.

  - Include reference to the section of DOT regulations covering the hazard class (from Hazardous Materials Table 172.101).

  - Additional handling information, if applicable.

- Include chain-of-custody record, properly executed, in outside container if legal use of samples is required or anticipated.

- Accompany shipping containers to carrier and, if required, open outside container(s) for inspection.

5.7.7.4 Transportation

- Transport unknown hazardous substance samples classified as flammable liquids by rented or common-carrier truck, railroad, or express overnight package service.

- Do not transport by any passenger-carrying air transport system, even if they have cargo-only aircraft. Regulations permit regular airline cargo-only aircraft but difficulties with most suggest avoiding them. Instead, ship by airlines that only carry cargo.

- When transporting by government-owned vehicle, including aircraft, DOT regulations do not apply. Personnel should still use procedures described here, except for execution of the bill-of-lading with certification.

- For overnight package services, determine weight restrictions - at least one service limits weight to 70 pounds per package.

5.8 References

1. U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response. EPA/540/P-87/001. December 1987.

2. U.S. Environmental Protection Agency. Characterization of Hazardous Waste Sites - A Methods Manual: Volume II Available Sampling Methods, Second Edition. Environmental Monitoring Systems Laboratory. EPA-600/4-84-076. December 1984.

rev. 1/04/90

SECTION 6 - LABORATORIES AND ANALYTICAL REFERENCES

6.1 Program Structure and Utilization

Four avenues for sample analysis are presently available: Contract Laboratory Program (CLP), EPA Laboratories, TAT Special Project Laboratories, and other (Coast Guard, TAT field screening, and ERCS).

6.1.1 Contract Laboratory Program

The Contract Laboratory Program (CLP) is a national program of commercial laboratories used by all ten EPA Regions and run by National Program Officers. The laboratories bid on standardized contracts for routine analyses of regular allotments of samples. Two analytical programs: Routine Analytical Services (RAS) and Special Analytical Services (SAS) are offered through the CLP.

6.1.1.1 Routine Analytical Services

Standardized analytical chemistry protocols, Tables 6-1, 6-2, 6-3, and 6-4, are used to provide routine service for:

- Full organic analysis:
  - Target compound list (TCL) organics
  - Volatile, base/neutral/acid, and pesticide/PCB
- Fast turnaround VOA's (TCL GC/MS only)
- Full inorganic analysis:
  - Total metals
  - Cyanide
- Dioxin analysis:
  - 2,3,7,8- TCDD only
  - Single phase soils and waters
  - Low, medium and high concentrations

on

- Environmental samples
- Single phase water and soil
- Low and medium levels (<15% concentration)

Standard turnaround times are:

• Organics	40 days
• VOA's (Fast Turnaround)	14 days
• Inorganics	35 days
• Dioxin	21 days

TABLE 6-1

LIST OF EPA APPROVED
INORGANIC TEST PROCEDURES

List of EPA Approved Inorganic Test Procedures[1]

Parameter and Method		Reference: EPA 1979[2]	Reference: Std Methods[3]	Reference: SW-846[4]
ICP Metals		200.7		6010
Aluminum	AA flame	202.1	303C	7020
	AA furnace	202.2	304	
Antimony	AA flame	204.1	303A	7040
	AA furnace	204.2	304	7041
Arsenic	AA furnace	206.2	304	7060
	AA gaseous hydride	206.3	303E	7061
Barium	AA flame	208\1	303C	7080
	AA furnace	208.2	304	
Beryllium	AA flame	210.1	303C	7090
	AA furnace	210.2	304	7091
Boron	colorometric	212.3	404A	
Cadmium	AA flame	213.1	303A.B	7130
	AA furnace	213.2	304	7131
Calcium	AA flame	215.1	303A	7140
VI Chrome	AA chelation-extraction	218.4	303B	7197
colorometric	(diphenylcarbazide)			7196
	coprecipitation			7195
differential	pulse polarography			7198
Chromium	AA flame	218.1	303A	7190
	AA chelation-extraction	218.3	303B	
	AA furnace	218.2	304	7191
Cobalt	AA flame	219.1	303A.B	7200
	AA furnace	219.2	304	7201
Copper	AA flame	220.1	303A.B	7210
	AA furnace	220.2	304	
Cyanide, total				
	titration		412C	
	spectrophotometeric, manual	335.2	412D	
	automated	335.3		
Cyanide, amenable				
	titrametric or spectrophotometric	335.1	412F	
Cyanide, total and amenable				
	colorometric, manual			9010
	automated			9012
Gold	AA flame	231.1	303A	
	AA furnace	231.2	304	
Iron	AA flame	236.1	303A.B	7380
	AA furnace	236.6	304	
Lead	AA flame	239.1	303A.B	7420
	AA furnace	239.2	304	7421
Magnesium	AA flame	242.1	303A	7450
Manganese	AA flame	243.1	303A.B	7460
	AA furnace	243.2	304	
Mercury	cold vapor, manual	245.1	303F	7470
	automated	245.2		7471
Molybdenum	AA flame	246.1	303C	7480
	AA furnace	246.2	304	7481
Nickel	AA flame	249.1	303A.B	7520
	AA furnace	249.2	304	
Osmium	AA flame	252.1	303C	7550
	AA furnace	252.2	304	
Selenium	AA furnace	270.2	304	7740
	AA gaseous hydride	270.3	303E	7741
Silica	colorometric	370.1		
Silver	AA flame	272.1	303A.B	7760
	AA furnace	272.2	304	
Sodium	AA flame	273.1	303A	7770
Thallium	AA flame	279.1	303A	7840
	AA furnace	279.2	304	7841
Tin	AA flame	282.1	303A	7870
	AA furnace	282.2	304	

TABLE 6-1 (CONT)

LIST OF EPA APPROVED
INORGANIC TEST PROCEDURES

Parameter and Method		Reference		
		EPA 1979[1]	Std Methods[2]	SW-846[3]
Vanadium	AA flame	286.1	303C	7910
	AA furnace	286.2	304	7911
Zinc	AA flame	289.1	303A.8	7950
	AA furnace	289.2	304	
Extraction Procedure (EP) Toxicity				1310

1. EPA. Methods for Chemical Analysis of Water and Waste. EPA-600/4-79-020. March. 1983.

2. APHA. AWWA. WPCF. Standard Methods for the Examination of Water and Wastewater. 16th Edition. 1985.

3. EPA. Test Methods for Evaluating Solid Wastes. 3rd Edition. SW-846. November. 1986.

4. Lists of additional EPA approved methods are available in 40 CFR. Part 136.3.

TABLE 6-2

List of EPA Approved Organic Test Procedures[6]

Compound Class[1]	CFR40[2]	SW-846[3]	Other
Purgeable Halocarbons	601	8010	
Purgeable Non-halogenated Volatile Organics		8015	
Purgeable Aromatics	602	8020	
Acrolein and Acrylonitrile	603	8030	
Phenols	604	8040	
Benzidenes	605		
Phthlate Esters	606	8060	
Nitrosamines	607		
Organochlorine Pesticides & PCBs	608	8080	617[4], CLP[5]
Nitroaromatics and Cyclic Ketones	609	8090	
Polynuclear Aromatic Hydrocarbons	610	8100, 8310	
Haloethers	611		
Chlorinated Hydrocarbons	612	8120	
Organophosphate Pesticides		8140	614[4], 622[4]
Chlorinated Herbacides			615[4]
Triazine Pesticides			619[4]
Dinitroaniline Pesticides			627[4]
Cyanazine Pesticides			629[4]
Dithiocarbamate Pesticides			630[4]
Benomyl and Carbendazim Pesticides			631[4]
Carbamates and Urea Pesticides			632[4]
Organonitrogen Pesticides			633[4]
Volatile Organics	624	8240	CLP[5]
Semivolatile Organics	625	8250, 8270	CLP[5]
2,3,7,8-Tetrachlorodibenzo-p-dioxin	613		CLP[5]
Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans		8280	

1 - Analytes per compound class are not the same for all methods. See specific method for analytes examined.
2 - 40CFR 136 Appendix A.
3 - EPA. Test Methods for Evaluating Solid Waste. 3rd Edition. SW-846. November. 1986.
4 - EPA. Test Methods for Nonconventional Pesticides Chemicals Analysis of Industrial and Municipal Wastewater. EPA-440/1-81-079C.
5 - Contract Laboratory Program. Statement of Work in effect at time of bid
6 - Lists of additional EPA approved methods may be found in 40 CFR 136.1.

Table 6-3

List of EPA Approved Miscellaneous Test Procedures[4]

Parameter and Method		Reference: EPA 1971[1]	Reference: Std Methods[2]	Reference: SW-846[3]
Acidity, as CaCO3		305.1	402(4a)	
Alkalinity, as CaCO3		310.1	403	
Ammonia (as N)	Nesslerization	350.2	417B	
	titration	350.2	417D	
	electrode	350.3	417E,F	
	automated phenate	350.1	417G	
Biochemical Oxygen Demand		405.1	507	
Bromide	titrimetric	320.1		
Fluoride	electrode	340.2	413B	
	colorometric	340.1	413C	
	automated complexone	340.3	413E	
Hardness	automated colorometric	130.1		
	titrimetric	130.2	314B	
pH	electrometric	150.1	423	9040
	pH paper			9041
	soil pH			9045
Kjeldahl nitrogen (as N)				
	titration	351.3	417D	
	Nesslerization	351.3	417B	
	electrode	351.3	417E,F	
	automated phenate	351.1		
	semi-automated block digester	351.2		
	potentiometric	351.4		
Nitrate (as N)	colorometric	352.1		9200
Nitrate-nitrite (as N) Cd reduction				
	manual	353.3	418C	
	automated	353.2	418F	
	automated hydrazine	353.1		
Nitrite (as N)	spectrophotometric	354.1	419	
Oil and grease	gravimetric	413.1	503A	9070
	extraction for sludge			9071
Total Organic Carbon				
	combustion or oxidation	415.1	505	9060
Orthophosphate ascorbic acid method				
	automated	365.1	424G	
	manual single reagent	365.2	424F	
	manual two reagent	365.3		
Oxygen, dissolved	winkler method	360.2	421B	
	electrode	360.1	421F	
Phenols	colorometric (4AAP)			
	manual	420.1		
	automated	420.2		9066
	spectrophotometric manual (4AAP)			9065
	MBTH			9067
Turbidity	nephelometric	180.1	214A	

1. EPA. Methods for Chemical Analysis of Water and Waste. EPA-600/4-79-020. March, 1983.

2. APHA, AWWA, WPCF. Standard Methods for the Examination of Water and Wastewater, 16th Editon. 1985.

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

4. Lists of additional EPA approved methods are available in 40 CFR 136.3.

TABLE 6-4

TARGET COMPOUND LIST
Elements Identified and Measured

Inorganic Analysis

1. Aluminum
2. Antimony
3. Arsenic
4. Barium
5. Beryllium
6. Cadmium
7. Calcium
8. Chromium
9. Cobalt
10. Copper
11. Iron
12. Lead
13. Magnesium
14. Manganese
15. Mercury
16. Nickel
17. Potassium
18. Selenium
19. Silver
20. Sodium
21. Thallium
22. Vanadium
23. Zinc
24. Cyanide

VOA Compounds

1. Chloromethane
2. Bromomethane
3. Vinyl Chloride
4. Chloroethane
5. Methylene Chloride
6. Acetone
7. Carbon Disulfide
8. 1,1-Dichloroethene
9. 1,1-Dichloroethane
10. trans-1,2-Dichloroethene
11. Chloroform
12. 1,2-Dichloroethane
13. 2-Butanone
14. 1,1,1-Trichloroethane
15. Carbon Tetrachloride
16. Vinyl Acetate
17. Bromodichloromethane
18. 1,2-Dichloropropane
19. trans-1,3-Dichloropropene
20. Trichloroethene
21. Dibromochloromethane
22. 1,1,2-Trichloroethane
23. Benzene
24. cis-1,3-Dichloropropene
25. 2-Chloroethylvinylether
26. Bromoform
27. 4-Methyl-2-Pentanone
28. 2-Hexanone
29. Tetrachloroethene
30. 1,1,2,2-Tetrachloroethane
31. Toluene
32. Chlorobenzene
33. Ethylbenzene
34. Styrene
35. Total Xylenes

TABLE 6-4 (continued)

BNA Compounds

1. Phenol
2. bis(2-Chloroethyl)Ether
3. 2-Chlorophenol
4. 1,3-Dichlorobenzene
5. 1,4-Dichlorobenzene
6. Benzyl Alcohol
7. 1,2-Dichlorobenzene
8. 2-Methylphenol
9. bis(2-Chloroisopropyl)Ether
10. 4-Methylphenol
11. N-Nitroso-Di-n-Propylamine
12. Hexachloroethane
13. Nitrobenzene
14. Isophorone
15. 2-Nitrophenol
16. 2,4-Dimethylphenol
17. Benzoic Acid
18. bis(2-Chloroethoxy)Methane
19. 2,4-Dichlorophenol
20. 1,2,4-Trichlorobenzene
21. Naphthalene
22. 4-Chloroaniline
23. Hexachlorobutadiene
24. 4-Chloro-3-Methylphenol
25. 2-Methylnaphthalene
26. Hexachlorocyclopentadiene
27. 2,4,6-Trichlorophenol
28. 2,4,5-Trichlorophenol
29. 2-Chloronaphthalene
30. 2-Nitroaniline
31. Dimethyl Phthalate
32. Acenaphthylene
33. 3-Nitroaniline
34. Acenaphthene
35. 2,4-Dinitrophenol
36. 4-Nitrophenol
37. Dibenzofuran
38. 2,4-Dinitrotoluene
39. 2,6-Dinitrotoluene
40. Diethylphthalate
41. 4-Chlorophenyl-phenylether
42. Fluorene
43. 4-Nitroaniline
44. 4,6-Dinitro-2-Methylphenol
45. N-Nitrosodiphenylamine(1)
46. 4-Bromophenyl-phenylether
47. Hexachlorobenzene
48. Pentachlorophenol
49. Phenanthrene
50. Anthracene
51. Di-n-Butylphthalate
52. Fluoranthene
53. Pyrene
54. Butylbenzylphthalate
55. 3,3'-Dichlorobenzidene
56. Benzo(a)Anthracene
57. bis(2-Ethylhexyl)Phthalate
58. Chrysene
59. Di-n-Octyl Phthalate
60. Benzo(b)Fluroanthene
61. Benzo(k)Fluroanthene
62. Benzo(a)Pyrene
63. Indeno(1,2,3-cd)Pyrene
64. Dibenz(a,h)Anthracene
65. Benzo(g,h,i)Perylene

Pesticide/PCB Compounds

1. Alpha-BHC
2. Beta-BHC
3. Delta-BHC
4. Gamma-BHC (Lindane)
5. Heptachlor
6. Aldrin
7. Heptachlor Epoxide
8. Endosulfan I
9. Dieldrin
10. 4,4'-DDE
11. Endrin
12. Endosulfan II
13. 4,4'-DDD
14. Endosulfan Sulfate
15. 4,4'-DDT
16. Methoxychlor
17. Endrin Ketone
18. Chlordane
19. Toxaphene
20. Aroclor-1016
21. Aroclor-1221
22. Aroclor-1232
23. Aroclor-1242
24. Aroclor-1248
25. Aroclor-1254
26. Aroclor-1260

6.1.1.2 Special Analytical Services

Any deviation from RAS protocols and deliverables or any analysis not covered under RAS is considered a Special Analytical Services project (SAS). SAS projects are subcontracted by Sample Management Office (SMO). There are no standing analytical contracts or procedures. Therefore, analytical methods and QC requirements must be supplied by the region. SMO can provide feedback on the analytical methods and QC requirements.

The following are examples of SAS projects:

- Unusual matrices:
  - Oils and tars
  - Air samples
  - Biological tissues
- Organics:
  - 2,4-D, 2,4,5-T only
  - Malathion, parathion
- Inorganics:
  - Sulfate only
  - Hexavalent chromium only
- Dioxins:
  - Tetra - octa CDD's and CDF's
  - "Normal" 2,3,7,8-TCDD using high-res mass spectrometry
- Others:
  - Asbestos
  - Physical soil parameters
  - Ignitability

6.1.2 EPA Laboratories

The Region VIII Environmental Services Division (ESD) Laboratory will perform the same analyses as a CLP would perform but only in small amounts. The ESD lab will analyze up to 20 samples for VOA's, BNA's and metals. The only matrices accepted by ESD are low level waters and soils.

The Environmental Response Team (ERT) in Edison, New Jersey can aso perform all types of analyses except dioxins. In order to utilize this lab, the ERT must be involved with the entire project including the sample collection.

6.1.3 Special Project Laboratory

TAT is able to subcontract for all types of organic and inorganic analyses. Laboratories are solicited to competitively submit bids on individual projects. Rapid turnaround times are available at a premium cost.

6.1.4 Other Laboratories

Other analytical service sources include: US Coast Guard Central Oil ID Laboratory (COIL), TAT field screening, and ERCS.

The COIL laboratory in Groton, CT can provide oil spill source identification using GC, HPLC, IR, and fluorescence. Normal turnaround times are between 2 and 7 days, although quicker turnaround is avalilable on a priority cases. A call to the Commanding Officer or a Senior Technician must be made to initiate the priority assignment. Routine services should follow the "Oil Spill Sample Handling and Transmittal Guide" available through the lab.

TAT field screening includes the use of a Photovac GC for soil vapor analysis, and x-ray flourescence (XRF) for metals in soil. The photovac can be used to screen soil vapor samples for a variety of chlorinated compounds and BTX. The XRF is capable of screening soil samples for most metals with the exception of mercury.

Once the Action Memorandum has been approved, laboratory analysis can be arranged through ERCS by subcontract. Turn around times can be specified and data quality objectives should be indicated.

6.2 Analysis Initiation/ Request Procedures

It is at all times the responsibility of the OSC to determine data quality objectives and to specify the level of data quality required when initiating an analysis request. For TAT, a sample plan check list with laboratory parameters for each sample must be signed by the OSC, indicating approval of the selected analytical parameters for each sample.

Once the number and type of samples, turnaround times and analyses to be performed have been decided, the initiation of sample analysis may begin.

6.2.1 CLP

The CLP should be used if the analyses are RAS or SAS and the deliverable turnaround times as stated in Section 6.1.1.1 are acceptable.

6.2.1.1 RAS

To initiate an RAS request, the OSC must contact the TAT and relay the desired analysis requirements. A lead time of one week is required for processing through SMO. If a change in sampling dates, sample analysis or number of samples occurs, SMO must be kept informed of the changes. If the changes become extreme, a new subcontract may be required with another one week lead time.

SMO requires the following information to initiate a RAS request:

- Name of RSCC Authorized Requester.

- Name(s), association, and telephone number(s) of sampling personnel.

- Name, city and state of the site to be sampled.

- Superfund site/spill ID (2 digit alpha-numeric code).

- Dioxin tier assignment, where applicable.

- Number and matrix of samples to be collected.

- Type of analyses required.

  Organics: full (VOA, B/N/A and pesticides/PCB) or VOA and/or B/N/A and/or pesticides/PCB.

  Inorganic: metals and/or cyanide.

  Dioxin: 2,3,7,8-TCDD.

- Scheduled sample collection and shipment dates.

- Nature of sampling event (i.e., investigation, monitoring, enforcement, remedial, drilling project, CERCLA Cooperative Agreements).

- Suspected hazards associated with the sample and/or site.

- Other pertinent information which may affect sample scheduling or shipment (i.e., anticipated delays due to site access, weather conditions, sampling equipment).

- Name(s) of Regional or contractor contacts for immediate problem resolution.

Follow up the verbal request with a written Routine Analysis Request Form (Figure 6-1).

6.2.1.2 SAS

Lead time requirements for SAS are two weeks minimum for straightforward analytical chemistry and six weeks minimum for large or complex projects. A longer lead time is suggested if possible.

In addition to the information required for a RAS request, SMO requires the following information to initiate a SAS request:

- Specific analyses required and appropriate protocols and QA/QC.

- Required detection limits.

ENVIRONMENTAL PROTECTION AGENCY
REGION VIII, DENVER, COLORADO

LABORATORY SERVICES REQUEST

PROJECT NAME _____ PROJECT CODE _____ SAMPLES COLL. BY _____ DATE _____

SAMPLES RECEIVED AT LABORATORY BY _____ DATE _____ DATA REVIEWED BY _____

ANALYST INITIALS																			
	STATION CODE																		
	SAMPLE COLL. TIME																		
	STATION DESCRIPTION AND REMARKS																		
	CODE	PARAMETER																	

All results in mg/l unless otherwise indicated, heavy metals in ug/l, pH in units turbidity in JTU, specific conductance in µ mhos/cm, as per STORET

☆ GPO 1979-680-570

REEPA-012
(Rev 11-82)

FIGURE 6-1
EPA LABORATORY SERVICES REQUEST SHEET

- Matrix spike and duplicate frequency.

- Data turnaround and data format.

- Justification for fast turnaround request, if appropriate.

Follow up the verbal request with a written SAS Client Request Form (Figure 6-2).

6.2.2 EPA Laboratories

Initiation of the ESD laboratory services may be done two ways. The OSC may follow the same procedures as for the CLP, or the OSC can contact the Regional Sample Control Center (RSCC) directly, Figures 6-3 and 6-4. The RSCC will need the same information as for a CLP request. The same lead time requirements apply.

The ERT laboratory may be accessed by calling directly to the laboratory in Edison, New Jersey.

6.2.3 Special Project Laboratory

The OSC can initiate a special project laboratory request by contacting TAT with information equivalent to a CLP request. If any changes occur, TAT should be informed promptly in order that the laboratory can be kept up-to-date. There are no set lead time requirements, although it is advantageous for all parties to have the lead time as long as possible.

6.2.4 Other Laboratories

The COIL laboratory in Groton, Connecticut must be accessed by calling the Commanding Officer or a Senior Technician directly.

The TAT field screening is arranged by contacting the TAT leader.

ERCS can be contacted to arrange for laboratory analysis through a subcontract, similar to TAT special project laboratories (Section 6.2.3).

Information equivalent to a CLP request should be included and lead times should be as long as possible.

6.3 References

1. U.S. Environmental Protection Agency. A Compendium of Superfund Field Operations Methods. Office of Emergency and Remedial Response. EPA/540/P-87/001. December 1987.

2. U.S. Environmental Protection Agency. Test Methods for Evaluating Solid Wastes (SW 846). Volume I, Section A: Metals, Section B: Organics, Section C: Miscellaneous. September 1986.

Environmental Protection Agency
Office of Enforcement

National Enforcement Investigations Center
Denver Federal Center, Bldg. 53, Box 25227
Denver, Colorado 80225

HAZARDOUS WASTE SAMPLE PREPARATION REQUEST

Region no.	Regional contact	phone no.
Project name		

Region sample no.	SAMPLE DESCRIPTION	Collection Date	Collection Time	A Total Metals	B Acid Extractable Metals	C Total Mercury	D Strong Acid Anions	E Base/Neutral Organics	F Acidic, Phenolic Organics	G General Organic Extract	H Volatile Organics	I Other (Specify)	KNOWN OR SUSPECTED HAZARDS	NEIC sample no.

CHECK PREPARATIONS REQUESTED

NEIC project no.

Ship extracts to: _____

Date samples received at NEIC _____ By _____

Attention:

FIGURE 6-2
NEIC HAZARDOUS WASTE
SAMPLE PREPARATION REQUEST SHEET

FIGURE 6-3

ROUTINE ANALYSIS REQUEST

REGION VIII
SAMPLE CONTROL COORDINATION
DCN: 89-_____.

RAS/SAS No.: _____
Contractor: _____
CSCC: _____

Form I

ROUTINE ANALYSIS and/or SPECIAL ANALYTICAL SERVICES REQUEST SUMMARY

Filled out by Project Manager or Contractor Sample Control Coordinator.

SITE NAME _____ SITE SPILL CODE _____ OPERABLE UNIT _____

ACTIVITY TYPE _____ CITY/STATE _____ PROGRAM (' '=SUPERFUND 'R'=RCRA 'S'=STATE) ____

EPA RPM _____ PHONE NO. _____ CONTRACTOR PROJECT MANAGER _____

SHIPPING CONTACT/
SAMPLING TEAM LEADER _____ PHONE _____

ANTICIPATED SAMPLING
DATE RAS:_____ SAS:_____

ANTICIPATED SHIPPING
DATE(S) RAS:_____ SAS:_____

RAS ANALYSES REQUESTED: (SUBMIT TO RSCC BY THE TUESDAY OF WEEK PRIOR TO SAMPLING)

INORGANICS	ANALYSIS (CHECK)	NO. OF SAMPLES	CONC (L,M,H)
Soil	Metals____ CN____	_____	_____
Water	Metals____ CN____	_____	_____

ORGANICS	ANALYSIS (CHECK)	NO. OF SAMPLES	CONC (L,M,H)
Soil	VOA____ BNA____ PEST____ PCB____	_____	_____
	Fast VOA (turn around days) ____	_____	_____
Water	VOA____ BNA____ PEST____ PCB____	_____	_____
	Fast VOA (turn around days) ____	_____	_____

DIOXINS (LIST NUMBER OF SAMPLES)
Soil_____ Water_____ Other_____

SAS ANALYSES REQUESTED:

MATRIX/CONC	ANALYSIS(LIST)	NO. OF SAMPLES
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Is this request being submitted for samples collected under an EPA approved sampling plan? Yes____ No____

Where is plan located: _____

If NO, Contractor Project Manager must sign this request and provide written explanation.

Project Manager (signature)_____

Submitted to RSCC_____ RSCC Rec'd _____ Submitted to SMO_____ SMO Contact_____

FIGURE 6-3 (CONT)

ROUTINE ANALYSIS REQUEST

Form II

LABORATORY ASSIGNMENT and SAMPLE SHIPPING INFORMATION

ANALYSIS REQUEST INFORMATION

A. LABORATORY ASSIGNMENT. To be completed by RSCC upon notification from SMO.

(R = RAS, S = SAS) DATE RSCC RECEIVED LAB ASSIGNMENTS FROM SMO_____

INORGANIC			ORGANIC		
(a)_____	R	S	(g)_____	R	S
(b)_____	R	S	(h)_____	R	S
(c)_____	R	S	(i)_____	R	S
(d)_____	R	S	(j)_____	R	S
(e)_____	R	S	(k)_____	R	S
(f)_____	R	S	(l)_____	R	S

B. SAMPLE SHIPPING INFORMATION. To be completed by Field Team, CSCC, or sample shipper and called into RSCC as soon as samples are shipped (no later that the following morning, if shipping is completed after 5:00 EST). More than one shipping day can be included on form if space allows.

Lab	No. Shipped	Conc/ Matrix	RAS (I or O)/SAS Analyses	Date Shipped	# Days Data Due	Airbill No.

SHIPPING INFO CALLED INTO SMO/RSCC(date)_____ SAMPLE SHIPPER (signature)_____

DATE COMPLETED FORM SENT TO CSCC_____ CSCC (initials)_____

DATE COMPLETED FORM RETURNED TO RSCC_____ DATE RSCC RECEIVED FORM_____

Notes:_____

FIGURE 6-4

SPECIAL ANALYTICAL
SERVICES CLIENT REQUEST

U.S. ENVIRONMENTAL PROTECTION AGENCY
CLP Sample Management Office
209 Madison Street - Alexandria, Virginia 22314
Phone: 703/557-2490 - FTS/557-2490

SAS Number

SPECIAL ANALYTICAL SERVICES
Client Request

☐ Regional Transmittal ☐ Telephone Request

A. EPA Region/Client: _____

B. RSCC Representative: _____

C. Telephone Number: _____

D. Date of Request: _____

E. Site Name: _____

F. City, State: _____

G. Spill code: _____

H. EPA RPO: _____

I. Date of Sample Plan completion: _____

Please provide below description of your request for Special Analytical Services under the Contract Laboratory Program. In order to most efficiently obtain laboratory capability for your request, please address the following considerations, if applicable. Incomplete or erroneous information may results in a delay in the processing of your request. Please continue response on additional sheets, or attach supplementary information as needed.

1. General description of analytical service requested: _____

2. Definition and number of work units involved (specify whether whole samples or fractions; whether organics or inorganics; whether aqueous or soil and sediments; and whether low, medium or high concentration):

FIGURE 6-4 (CONT)

SPECIAL ANALYTICAL
SERVICES CLIENT REQUEST

3. Purpose of analysis (specify whether Superfund (enforcement or remedial action), RCRA, NPDES, etc.):

_____
_____
_____

4. Estimated date(s) of collection: _____
_____

5. Estimated Date(s) and method of shipment: _____
_____
_____

6. Number of days analysis and data required after laboratory receipt of samples: _____
_____

7. Analytical protocol required (attach copy if other than a protocol currently used in this program): _____
_____
_____
_____

8. Special technical instructions (if outside protocol requirements, specify compound names, CAS numbers, detection limits, etc.):

_____
_____
_____
_____
_____
_____

9. Analytical results required (if known, specify format for data sheets, QA/QC reports, Chain-of-Custody documentation, etc.). If not completed, format of results will be left to program discretion.

_____
_____
_____
_____

10. Other (use additional sheets or attach supplementary information, as needed):

_____
_____

11. Name of sampling/shipping contact: _____
Phone: _____

FIGURE 6-4 (CONT)

SPECIAL ANALYTICAL
SERVICES CLIENT REQUEST

12. Data Requirements

Parameter	Detection Limit	Precision Desired (±% or Concentration)

13. QC Requirements

Audits Required	Frequency of Audits	Limits (Percent/Concentration)

14. Action Required if Limits are Exceeded

Please return this request to the Sample Management Office as soon as possible to expedite processing of your request for special analytical services. Should you have any questions or need any assistance, please contact your Regional representative at the Sample Management Office.

3. U.S. Environmental Protection Agency. Test Methods for Evaluating Solid Wastes (SW 846). Volume II. September 1986.

4. U.S. Environmental Protection Agency. User's Guide to the Contract Laboratory Program (CLP). Attachment A, Statement of Work (SOW): Inorganics Analysis/Organics Analysis/Dioxin Analysis. December 1987.

rev. 1/10/90

APPENDIX A

SITE SAFETY PLAN FORMAT

ecology and environment, inc.

SITE SAFETY PLAN

Version 988

A. GENERAL INFORMATION

Project Title: _____ Project No.: _____

TDD/Pan No.: _____

Project Manager: _____ Project Dir.: _____

Location(s): _____

Prepared by: _____ Date Prepared: _____

Approval by: _____ Date Approved: _____

Site Safety Officer Review: _____ Date Reviewed: _____

Scope/Objective of Work: _____

_____

Proposed Date of Field Activities: _____

Background Info: Complete: [ ] Preliminary (No analytical data available) [ ]

Documentation/Summary:

Overall Chemical Hazard: Serious [ ] Moderate [ ] Low [ ] Unknown [ ]

Overall Physical Hazard Serious [ ] Moderate [ ] Low [ ] Unknown [ ]

B. SITE/WASTE CHARACTERISTICS

Waste Type(s):

Liquid [ ] Solid [ ] Sludge [ ] Gas/Vapor [ ]

Characteristic(s):

Flammable/ Ignitable [ ] Volatile [ ] Corrosive [ ] Acutely Toxic [ ]

Explosive [ ] Reactive [ ] Carcinogen [ ] Radioactive* [ ]

Other: _____

Physical Hazards:

Overhead [ ] Confined* Space [ ] Below Grade [ ] Trip/Fall [ ]

Puncture [ ] Burn [ ] Cut [ ] Splash [ ]

Noise [ ] Other: _____

*Requires completion of additional form and special approval from the Corporate Health/Safety group. Contact RSC or HQ.

Site History/Description and Unusual Features (see Sampling Plan for detailed description): ____________

____

____

Locations of Chemicals/Wastes: ____

____

Estimated Volume of Chemicals/Wastes: ____

____

____

Site Currently in Operation Yes: [ ] No: [ ]

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C. HAZARD EVALUATION

List Hazards by Task (i.e., drum sampling, drilling, etc.) and number them. (Task numbers are cross-referenced in Section D)

Physical Hazard Evaluation: ____

____

____

____

____

____

____

____

Chemical Hazard Evaluation:

Compound	PEL/TWA	Route of Exposure	Acute Symptoms	Odor Threshold	Odor Description

Note: Complete and attach a Hazard Evaluation Sheet for major known contaminant.

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D. SITE SAFETY WORK PLAN

Site Control: Attach map, use back of this page, or sketch of site showing hot zone, contamination reduction, zone, etc.

Perimeter identified? [ ] Site secured? [ ]

Work Areas Designated? [ ] Zone(s) of Contamination Identified? [ ]

Personel Protection (TLD badges required for all field personnel):

Anticipated Level of Protection (Cross-reference task numbers to Section C):

	A	B	C	D
Task 1				
Task 2				
Task 3				
Task 4				

(Expand if necessary)

Modifications: _____

_____

Action Levels for Evacuation of Work Zone Pending Reassessment of Conditions:

- Level D: O_2 <19.5% or >25%, explosive atmosphere >10% LEL, organic vapors above background levels, particulates >_____ mg/m^3, other _____.
- Level C: O_2 <19.5% or >25%, explosive atmosphere >25% LEL (California-20%), unknown organic vapor (in breathing zone) >5 ppm, particulates >_____ mg/m^3, other _____.
- Level B: O_2 <19.5% or >25%, explosive atmosphere >25% LEL (California-20%), unknown organic vapors (in breathing zone) >500 ppm, particulates >_____ mg/m^3, other _____.
- Level A: O_2 <19.5% or >25%, explosive atmosphere >25% LEL (California-20%), unknown organic vapors >500 ppm, particulates >_____ mg/m^3, other _____.

Air Monitoring (daily calibration unless otherwise noted):

Contaminant of Interest	Type of Sample (area, personal)	Monitoring Equipment	Frequency of Sampling

(Expand if necessary)

Decontamination Solutions and Procedures for Equipment, Sampling Gear, etc.:

_____

_____

_____

_____

_____

_____

Personnel Decon Protocol: _____

Decon Solution Monitoring Procedures, if Applicable: _____

Special Site Equipment, Facilities, or Procedures (Sanitary Facilities and Lighting Must Meet 29 CFR 1910.120):

Site Entry Procedures and Special Considerations: _____

Work Limitations (time of day, weather conditions, etc.) and Heat/Cold Stress Requirements:

General Spill Control, if applicable: _____

Investigation-Derived Material Disposal (i.e., expendables, decon waste, cuttings):

Sample Handling Procedures Including Protective Wear:

Team Member*	Responsibility
	Team Leader
	Site Safety Officer

*All entries into exclusion zone require Buddy System use. All E & E field staff participate in medical monitoring program and have completed applicable training per 29 CFR 1910.120. Respiratory protection program meets requirements of 29 CFR 1910.134, and ANSI Z88.2 (1980).

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E. EMERGENCY INFORMATION

(Use supplemental sheets, if necessary)

LOCAL RESOURCES

(Obtain a local telephone book from your hotel, if possible)

Ambulance _____

Hospital Emergency Room _____

Poison Control Center _____

Police (include local, county sheriff, state) _____

_____

Fire Department _____

Airport _____

Agency Contact (EPA, State, Local USCG, etc.) _____

Local Laboratory _____

UPS/Fed. Express _____

Client/EPA Contact _____

Site Contact _____

SITE RESOURCES

Site Emergency Evacuation Alarm Method _____

Water Supply Source _____

Telephone Location, Number _____

Cellular Phone, if available _____

Radio _____

Other _____

EMERGENCY CONTACTS

1. Dr. Raymond Harbison (Univ. of Florida) ..... (501) 221-0465 or (904) 462-3277, 3281
   Alachua, Florida (501) 370-8263 (24 hours)

2. Ecology and Environment, Inc., Safety Director
   Paul Jonmaire ..... (716) 684-8060 (office)
   (716) 655-1260 (home)

3. Regional Office Contact ..... _____ (home)

   _____ (office)

4. FITOM, TATOM, or Office Manager ..... _____ (home)

MEDTOX HOTLINE

1. Twenty-four hour answering service: (501) 370-8263

   What to report:

   - State: "this is an emergency.
   - Your name, region, and site.
   - Telephone number to reach you.
   - Your location.
   - Name of person injured or exposed.
   - Nature of emergency.
   - Action taken.

2. A toxicologist, (Drs. Raymond Harbison or associate) will contact you. Repeat the information given to the answering service.

3. If a toxicologist does not return your call within 15 minutes, call the following persons in order until contact is made:

   a. 24 hour hotline - (716) 684-8940
   b. Corporate Safety Director - Paul Jonmaire - home # (716) 655-1260
   c. Assistant Corp. Safety Officer - Steven Sherman - home # (716) 688-0084

EMERGENCY ROUTES

(NOTE: Field Team must Know Route(s) Prior to Start of Work)

Directions to hospital (include map) ______________________________

____

____

____

____

Emergency Egress Routes to Get Off-Site ______________________________

____

____

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F. EQUIPMENT CHECKLIST

PROTECTIVE GEAR

Level A	No.	Level B	No.
SCBA		SCBA	
SPARE AIR TANKS		SPARE AIR TANKS	
ENCAPSULATING SUIT (Type _____)		PROTECTIVE COVERALL (Type _____)	
SURGICAL GLOVES		RAIN SUIT	
NEOPRENE SAFETY BOOTS		BUTYL APRON	
BOOTIES		SURGICAL GLOVES	
GLOVES (Type _____)		GLOVES (Type _____)	
OUTER WORK GLOVES		OUTER WORK GLOVES	
HARD HAT		NEOPRENE SAFETY BOOTS	
CASCADE SYSTEM		BOOTIES	
5-MINUTE ESCAPE COOLING VEST		HARD HAT WITH FACE SHIELD	
		CASCADE SYSTEM	
		MANIFOLD SYSTEM	
Level C		**Level D**	
ULTRA-TWIN RESPIRATOR		ULTRA-TWIN RESPIRATOR (Available)	
POWER AIR PURIFYING RESPIRATOR		CARTRIDGES (Type _____)	
CARTRIDGES (Type _____)		5-MINUTE ESCAPE MASK (Available)	
5-MINUTE ESCAPE MASK		PROTECTIVE COVERALL (Type _____)	
PROTECTIVE COVERALL (Type _____)		RAIN SUIT	
RAIN SUIT		NEOPRENE SAFETY BONDS	
BUTYL APRON		BOOTIES	
SURGICAL GLOVES		WORK GLOVES	
GLOVES (Type _____)		HARD HAT WITH FACE SHIELD	
OUTER WORK GLOVES		SAFETY GLASSES	
NEOPRENE SAFETY BOOTS			
HARD HAT WITH FACE SHIELD			
BOOTIES			
HARDHAT			

INSTRUMENTATION	No.	DECON EQUIPMENT	No.
OVA		WASH TUBS	
THERMAL DESORBER		BUCKETS	
O2/EXPLOSIMETER W/CAL. KIT		SCRUB BRUSHES	
PHOTOVAC TIP		PRESSURIZED SPRAYER	
HNu (Probe _____)		DETERGENT (Type _____)	
MAGNETOMETER		SOLVENT (Type _____)	
PIPE LOCATOR		PLASTIC SHEETING	
WEATHER STATION		TARPS AND POLES	
DRAEGER PUMP, TUBES _____		TRASH BAGS	
BRUNTON COMPASS		TRASH CANS	
MONITOX CYANIDE		MASKING TAPE	
HEAT STRESS MONITOR		DUCT TAPE	
NOISE EQUIPMENT _____		PAPER TOWELS	
PERSONAL SAMPLING PUMPS		FACE MASK	
		FACE MASK SANITIZER	
		FOLDING CHAIRS	
		STEP LADDERS	
RADIATION EQUIPMENT		DISTILLED WATER	
DOCUMENTATION FORMS			
PORTABLE RATEMETER			
SCALER/RATEMETER		SAMPLING EQUIPMENT	
NaI Probe		8 OZ. BOTTLES	
ZnS Probe		HALF-GALLON BOTTLES	
GM Pancake Probe		VOA BOTTLES	
GM Side Window Probe		STRING	
MICRO R METER		HAND BAILERS	
ION CHAMBER		THIEVING RODS WITH BULBS	
ALERT DOSIMETER		SPOONS	
POCKET DOSIMETER		KNIVES	
		FILTER PAPER	
FIRST AID EQUIPMENT		PERSONAL SAMPLING PUMP SUPPLIES	
FIRST AID KIT			
OXYGEN ADMINISTRATOR			
STRETCHER			
PORTABLE EYE WASH			
BLOOD PRESSURE MONITOR			
FIRE EXTINGUISHER			

VAN EQUIPMENT	No.	MISCELLANEOUS (Cont.)	No.
TOOL KIT			
HYDRAULIC JACK			
LUG WRENCH			
TOW CHAIN			
VAN CHECK OUT			
Gas			
Oil			
Antifreeze			
Battery			
Windshield Wash			
Tire Pressure			
		SHIPPING EQUIPMENT	
MISCELLANEOUS		COOLERS	
PITCHER PUMP		PAINT CANS WITH LIDS, 7 CLIPS EACH	
SURVEYOR'S TAPE		VERMICULITE	
100 FIBERGLASS TAPE		SHIPPING LABELS	
300 NYLON ROPE		DOT LABELS: "DANGER"	
NYLON STRING		"UP"	
SURVEYING FLAGS		"INSIDE CONTAINER COMPLIES ..."	
FILM		"HAZARD GROUP"	
WHEEL BARROW		STRAPPING TAPE	
BUNG WRENCH		BOTTLE LABELS	
SOIL AUGER		BAGGIES	
PICK		CUSTODY SEALS	
SHOVEL		CHAIN-OF-CUSTODY FORMS	
CATALYTIC HEATER		FEDERAL EXPRESS FORMS	
PROPANE GAS		CLEAR PACKING TAPE	
BANNER TAPE			
SURVEYING METER STICK			
CHAINING PINS & RING			
TABLES			
WEATHER RADIO			
BINOCULARS			
MAGAPHONE			

APPENDIX B

DEPARTMENT OF TRANSPORTATION
GUIDE FOR
HAZARDOUS MATERIALS SHIPPING PAPERS

US Department of Transportation

Research and Special Programs Administration

GUIDE FOR
HAZARDOUS MATERIALS SHIPPING PAPERS

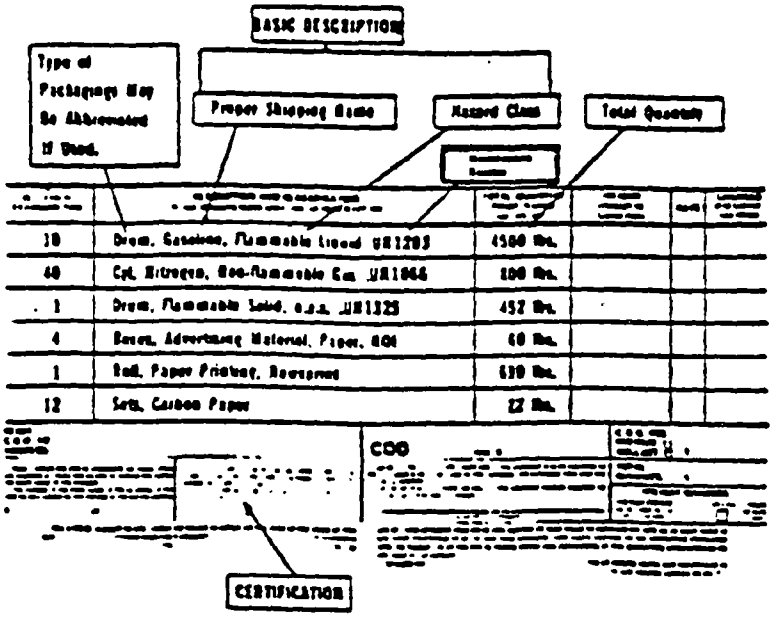
The following information has been abstracted from the Code of Federal Regulations, Title 49, Parts 100-177

1. DEFINITIONS
   A. SHIPPING PAPER (Sec. 171.8) A shipping paper may be a shipping order, bill of lading, manifest, or other shipping document serving a similar purpose containing the information required by Sec. 172.202, 172.203 and 172.204.

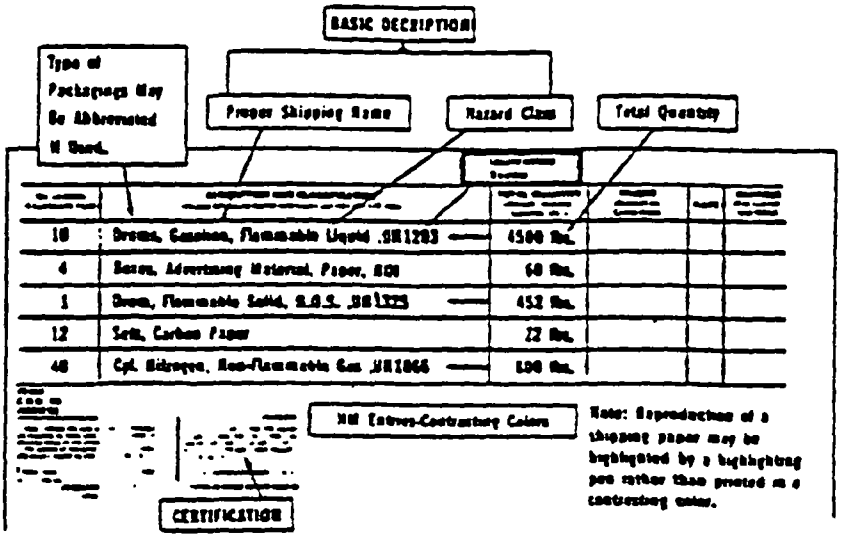
   B. HAZARDOUS WASTE MANIFEST (CFR, Title 40, Sec. 262.20) A hazardous waste manifest is a document (shipping paper) on which all hazardous waste is identified. A copy of the manifest must accompany each shipment of waste from the point of pick-up to the destination (CFR, Title 49, Sec. 172.205)

2. SHIPPERS RESPONSIBILITY [Sec. 172.200(a)] The shipper has the responsibility to properly prepare the shipping paper when offering a hazardous material for transport.
   NOTE: For shipments of hazardous waste, the hazardous waste manifest is the only authorized documentation. (CFR, Title 40, Sec. 262.23)

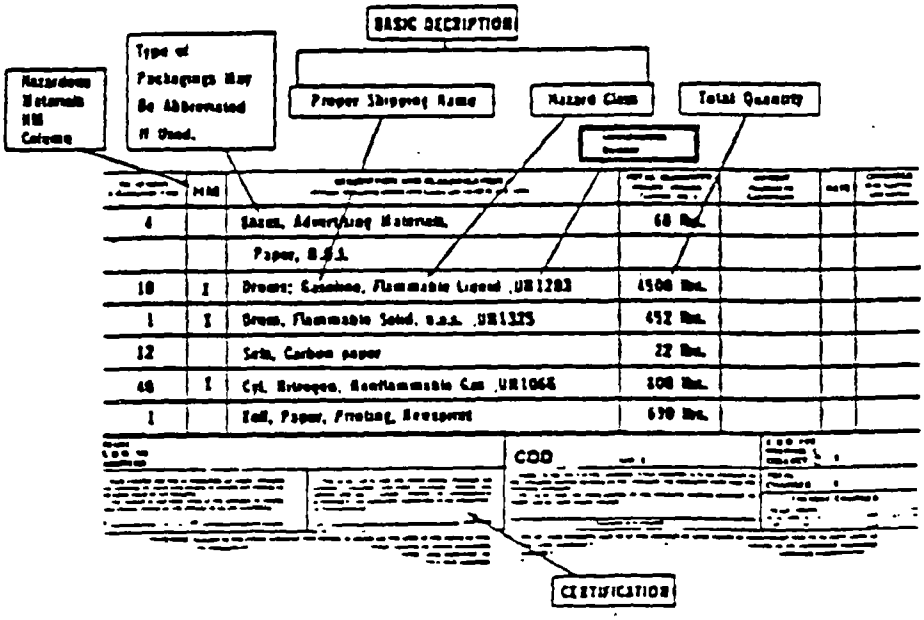
3. HAZARDOUS MATERIALS DESCRIPTION (Sec. 172.202) The shipping description of a hazardous material on a shipping paper must include the following information:
   A. Proper shipping name- Sec. 172.101 or Sec. 172.102 (when authorized);
   B. The hazard class prescribed for the material in the same section; [See exceptions Sec. 172.202(a)(2)]
   C. The identification number for the material (preceded by "UN" or "NA" as appropriate); and
   D. Except for empty packagings, the total quantity (by weight, volume, or as otherwise appropriate) of the hazardous materials covered by the description.
   E. Except as otherwise provided in the regulations, the basic description in 3A, B and C above must be shown in sequence. For example "Acetone, Flammable Liquid, UN1090."
   F. The total quantity of the material covered by one description must appear before or after (or both before and after) the basic description as indicated in 3A, B and C above.
      (1) Abbreviations may be used to specify the type of packaging, weight or volume. Example: "40 Cyl. Nitrogen Nonflammable gas UN 1066, 800 pounds"; "1 box Cement liquid, n.o.s., Flammable liquid, NAI133, 25 lbs."
      (2) Type of packaging and destination marks may be entered in any appropriate manner before or after the basic description.
   G. Technical and chemical group names may be entered in parentheses between the proper shipping name and hazard class. Example: Corrosive liquid, n.o.s. (capryrl chloride), corrosive material.
4. GENERAL ENTRIES ON SHIPPING PAPERS (Sec. 172.201)
   A. CONTENTS When describing a hazardous material on the shipping paper(s), that description must conform to the following requirements:
      (1) When a hazardous material, including materials not subject to the regulations, is described on the same shipping paper, the hazardous material description entries required by Sec. 172.202 and those additional entries that may be required by Sec. 172.203.
         a. Must be entered first (See Figure 1), or
         b. Must be entered in a contrasting color, except that a description on a reproduction of a shipping paper may be highlighted, rather than printed, in a contrasting color (these requirements apply only to the basic description required by Sec. 172.202(a)(1), (2) and (3), (See Figure 1); or
         c. Must be identified by the entry "X" placed before the proper shipping name in a column captioned "HM" [the "X" may be replaced by "RQ" (Reportable Quantity), if appropriate] See Figure 1.
      (2) The required shipping description on a shipping paper and all copies that are used for transportation purposes must be legible and printed (manually or mechanically) in English.
      (3) Unless it is specifically authorized or required, the required shipping description may not contain any code or abbreviation.



HAZARDOUS MATERIALS ENTRIES LISTED FIRST



HAZARDOUS MATERIALS ENTRIES-CONTRASTING COLOR



HAZARDOUS MATERIALS PREFIXED BY "X" IN HM COLUMN

FIGURE 1. HAZARDOUS MATERIALS LISTED ON SHIPPING PAPERS

(4) A shipping paper may contain additional information concerning the material provided the information is not inconsistent with the required description. Unless otherwise permitted or required, additional information must be placed after the basic description required by Sec. 172.202(a).

a. When appropriate, the entries "IMCO" or "IMCO Class" may be entered immediately before or immediately following the class entry in the basic description.

b. If a material meets the definition of more than one hazard class, the additional hazard class or classes may be entered after the hazard class in the basic description.

B. NAME OF SHIPPER A shipping paper for a shipment by water must contain the name of the shipper.

5. ADDITIONAL DESCRIPTION REQUIREMENTS (Sec. 172.203) (ALL MODES)

A. Exemptions - Each shipping paper issued in connection with a shipment made under an exemption must bear the notation "DOT-E" followed by the exemption number assigned (Example: DOT-E 4648) and so located that the exemption number is clearly associated with the description to which the exemption applies.

B. Limited Quantities - Descriptions for materials defined as "Limited Quantities"...must include the words "Limited Quantities" or "Ltd. Qty." following the basic description.

C. Hazardous Substances

(1) If the proper shipping name for a mixture or solution that is a hazardous substance does not identify the constituents making it a hazardous substance, the name or names of such constituents shall be entered in association with the basic description.

(2) The letters "RQ" (Reportable Quantity) shall be entered on the shipping paper either before or after the basic description required by Sec. 172.202 for each hazardous substance. (See definition Sec. 171.8) Example: RQ, Cresol, Corrosive Material, NA2076; or Adipic Acid, ORM-E, NA9077, RQ.

D. Radioactive Materials - For additional description for radioactive materials, refer to Sec. 172.203(d).

E. Empty Packagings

(1) Except for a tank car, or any packaging that still contains a hazardous substance, the description on the shipping paper for an empty packaging containing the residue of a hazardous material may include the word(s) "EMPTY" or "EMPTY: Last Contained (Name of Substance)" as appropriate in association with the basic description of the hazardous material last contained in the packaging.

(2) For empty tank cars, see Sec. 174.25(c).

(3) If a packaging, including a tank car, contains a residue that is a hazardous substance the description on the shipping paper shall be prefaced with the phrase "EMPTY: Last Contained (Name of Substance)" and shall have "RQ" entered before or after the basic description.

F. Dangerous When Wet - The words "Dangerous When Wet" shall be entered on the shipping paper in association with the basic description when a package covered by the basic description is required to be labeled with a "DANGEROUS WHEN WET" label.

G. Poisonous Materials - Notwithstanding the class to which a material is assigned:

(1) If the name of the compound or principal constituent that causes the material to meet the definition of a poison is not included in the proper shipping name for the material, the name of that compound or constituent shall be entered on the shipping paper in association with the shipping description for the material.

(2) The name of the compound or principal constituent may be either a technical name or any name for the material that is listed in the NIOSH Registry. (Registry of Toxic Effects of Chemical Substances, 1978 Edition) [Sec. 172.203(k)]

NOTE: For additional details, see Sec. 172.203(k)

H. Exceptions: OTHER REGULATED MATERIAL (ORM - A, B, C, AND D)

(1) Shipping paper requirements do not apply to any material other than a hazardous waste or a hazardous substance that is:

a. An ORM-A, B or C unless it is offered or intended for transportation by air or water when it is subject to the regulations pertaining to transportation by air or water as specified in Sec. 172.101 (Hazardous Materials Table); or

b. An ORM-D unless it is offered or intended for transportation by air.

MODAL REQUIREMENTS
(ADDITIONAL INFORMATION)

NOTE: In addition to the basic requirements for shipping papers, additional information is listed for each mode.

TRANSPORTATION BY RAIL

A. SHIPPING PAPERS (Sec. 174.24)

(1) Except as provided in paragraph (b) of this section, no person may accept for transportation by rail any hazardous material which is subject to this subchapter unless he has received a shipping paper prepared in a manner specified in Sec. 172.200. In addition, the shipping paper must include a certificate, if required by Sec. 172.204. However, no member of the train crew of a train transporting the hazardous material is required to have a shippers certificate on the shipping paper in his possession if the original shipping paper containing the certificate is in the originating carriers possession.

(2) This subpart does not apply to materials classed as ORM-A, B, C or D.

B. ADDITIONAL DESCRIPTION FOR SHIPPING PAPERS [Sec. 172.203(g)]

(1) The shipping paper for a rail car containing a hazardous material must contain the notation "Placarded" followed by the name of the placard required for the rail car.

(2) The shipping paper for each specification DOT 112A or 114A tank car (without head shields) containing a flammable compressed gas must contain the notation "DOT 112A" or "DOT 114A", as appropriate, and either "Must be handled in accordance with FRA E.O. No. 5" or "Shove to rest per E.O. No. 5."

NOTE: For additional details, refer to Part 174.

7. TRANSPORTATION BY AIR

A. SHIPPING PAPERS ABOARD AIRCRAFT (Sec. 175.35) A copy of the shipping papers required by Sec. 175.30(a)(2) must accompany the shipment it covers during transportation aboard an aircraft.

NOTE: The documents required (shipping papers and notification of pilot-in-command) may be combined into one document if it is given to the pilot-in-command before departure of the aircraft. [Sec. 175.35(b)].

B. NOTIFICATION OF PILOT-IN-COMMAND (Sec. 175.33) The operator of the aircraft shall give the pilot-in-command the following information in writing before takeoff (Sec. 175.35):

(1) Description of hazardous material on shipping papers (Sec. 172.202 and 172.203);

(2) Location of the hazardous material in the aircraft; and

(3) The results of the inspection requirements by Sec. 175.30(b).

NOTE: For additional details, refer to Part 175.

8. TRANSPORTATION BY WATER

A. SHIPPING PAPERS (Sec. 176.24) A carrier may not transport a hazardous material by vessel unless the material is properly described on the shipping paper in the manner prescribed in Part 172.

B. CERTIFICATE (Sec. 176.27)

(1) A carrier may not transport a hazardous material by vessel unless he has received a certificate prepared in accordance with Sec. 172.204.

(2) In the case of an import or export shipment of hazardous materials which will not be transported by rail, highway, or air, the shipper may certify on the bill of lading or other shipping paper that the hazardous material is properly classed, described, marked, packaged and labeled according to Part 172 or in accordance with the requirements of the IMCO Code. (See Sec. 171.12)

C. DANGEROUS CARGO MANIFEST (Sec. 176.30) The master of a vessel transporting hazardous materials or his authorized representative shall prepare a dangerous cargo manifest, list, or stowage plan. This document may not include a material which is not subject to the requirements of CFR, Title 49, or the IMCO Code. This document must be kept in a designated holder on or near the vessel's bridge. (See Sec. 176.30 for details)

D. EXEMPTIONS (Sec. 176.31) If a hazardous material is being transported by vessel under the authority of an exemption and a copy of the exemption is required to be on board the vessel, it must be kept with the dangerous cargo manifest.

NOTE: For additional details, refer to Part 176.

E. ADDITIONAL DESCRIPTION FOR SHIPPING PAPERS [Sec. 172.203(i)]

(1) Each shipment by water must have the following additional shipping paper entries:

a. Indentification of the type of packages such as barrels, drums, cylinders, and boxes,

b. The number of each type of packages including those in freight container or on a pallet, and

c. The gross weight of each type of package or the individual gross weight of each package.

(2) The shipping papers for a hazardous material offered for transportation by water to any country outside the United States must have in parenthesis the technical name of the material following the proper shipping name when the material is described by a "n.o.s." entry in Sec. 172.101 (Hazardous Materials Table). For example: Corrosive liquid, n.o.s. (caprylyl chloride), Corrosive material. However, for a mixture, only the technical name of any hazardous material giving the mixture its hazardous properties must be identified.

9. TRANSPORTATION BY HIGHWAY

A. SHIPPING PAPERS (Sec. 177.817)

(1) General - A carrier may not transport a hazardous material unless it is accompanied by a shipping paper that is prepared in accordance with Sec. 172.201, 172.202 and 172.203.

(2) Shipper's certification - An initial carrier may not accept hazardous materials offered for transportation unless the shipping paper describing the material includes a shipper's certification which meets the requirements in Sec. 172.204 of this subchapter. The certification is not required for shipments to be transported entirely by private carriage and for bulk shipments to be transported in a cargo tank supplied by the carrier. [Sec. 177.817(c)]

(3) Interlining with carriers by rail - A motor carrier shall mark on the shipping paper required by this section, if it offers or delivers a freight container or transport vehicle to a rail carrier for further transportation: [Sec. 177.817(c)]

a. A description of the freight container or transport vehicle; and

b. The kind of placard affixed to the freight container or transport vehicle.

(4) This subpart does not apply to materials classed as an ORM-A, B, C or D.

(5) Accessibility of shipping papers: The driver and each carrier using the vehicle shall ensure that the shipping paper is readily available and recognizable by authorities in the case of an accident or inspection. [See Sec. 177.817(e) for details]

B. ADDITIONAL DESCRIPTION FOR SHIPPING PAPERS [Sec. 172.203(h)] For additional descriptions for Anhydrous ammonia see Sec. 172.203(h)(1); Liquefied petroleum gas see Sec. 172.203(h)(2) and Exemptions see Sec. 172.203(a).

10. SHIPPER'S CERTIFICATION (Sec. 172.204)

A. GENERAL (Except B and D below)

(1) Except as provided in paragraphs (b) and (c) of Sec. 172.204, each person who offers a hazardous material for transportation shall certify that the material offered for transportation is in accordance with the regulations by printing (manually or mechanically) the following statement on the shipping paper containing the required description:

> This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.*

NOTE: The works "herein-named" may be substituted for the words "above named".

*NOTE: For hazardous waste shipments, the words "and the EPA" must be added to the end of the certification. [See CFR, Title 40, Sec. 262.21(b)]

a. AIR TRANSPORTATION

(1) General - Certification containing the following language may be used in place of the certification required by paragraph A(1) above:

> I hereby certify that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked and labeled, and in proper condition for carriage by air according to applicable national governmental regulations.

(2) Duplicate Certificate - Each person who offers a hazardous material to an aircraft operator for transportation by air shall provide two (2) copies of the certificate. (Sec. 175.30)

(3) Passenger and Cargo Aircraft - If hazardous materials are offered for transportatic by air, add to the certificate the following statement:

> This shipment is within the limitations prescribed for passenger/cargo-only aircraft. (delete non-applicable)

(4) Radioactive Material - Each person who offers any radioactive material for transportation aboard a passenger-carrying aircraft shall sign (mechanically or manually) a printed certificate stating that the shipment contains radioactive material intended for use in, or incident to, research, medical diagnosis or treatment. NOTE: See Sec. 175.10 for exceptions.

C. SIGNATURE - The certifications required above must be legibly signed (mechanically or manually) by a principal, officer, partner or employee of the shipper or his agent. [Sec. 172.204(d)]

D. EXCEPTIONS - Except for a hazardous waste, no certification is required for hazardous material offered for transportation by motor vehicle and transported:

(1) In a cargo tank supplied by the carrier, or

(2) By the shipper as a private carrier except for a hazardous material that is to be reshipped or transferred from one carrier to another.

(3) No certification is required for the return of an empty tank car which previously contained a hazardous material and which has not been cleaned or purged.

HAZARDOUS WASTE MANIFEST INFORMATION

The following information has been abstracted from the Code of Federal Regulations (CFR), Title 49, Parts 100-177 and CFR, Title 40, Part 262.

1. DEFINITIONS

A. HAZARDOUS WASTE MANIFEST (CFR Title 40, §262.20)
A hazardous waste manifest is a shipping document on which all hazardous wastes are identified.

B. SHIPPING PAPER - A shipping order, bill of lading, manifest, or other shipping document serving a similar purpose and containing the information required by §172.202, §172.203 and §172.204.

2. DOT HAZARDOUS MATERIALS MANIFEST REQUIREMENTS (§172.205)

A. No person may offer, transport, transfer or deliver a hazardous waste unless a hazardous waste manifest is prepared, signed, carried and given as required of that person by §172.205.

B. The shipper (generator) must prepare the manifest in accordance with the EPA Regulations, CFR Title 40, Part 262.

C. The original copy of the manifest must be dated by, and bear the handwritten signature of the person representing the:

(1) Shipper (generator) of waste at the time it is offered for transportation, and

(2) Initial carrier accepting the waste for transportation.

D. A copy of the manifest must be dated by, and bear the handwritten signature of the person representing:

(1) Each subsequent carrier accepting the waste for transportation, at the time of acceptance, and

(2) The designated facility receiving the waste, upon receipt.

E. A copy of the manifest bearing all required dates and signatures must be:
   (1) Given to a person representing each carrier accepting the waste for transportation.
   (2) Carried during transportation in the same manner as required for shipping papers,
   (3) Given to a person representing the designated facility receiving the waste,
   (4) Returned to the shipper (generator) by the carrier that transported the waste from the United States to a foreign destination with a notation of the date of departure from the United States, and
   (5) Retained by the shipper (generator) and by the initial and each subsequent carrier for three (3) years from the date the waste was accepted by the initial carrier. Each retained copy must bear all required signatures and dates up to and including those entered by the next person who received the waste.

F. The requirements of §172.205(d) and (3) do not apply to a rail carrier when waste is delivered to a designated facility by railroad if:
   (1) All of the information required to be entered on the manifest (except generator and carrier identification numbers and the generator's certification) is entered on the shipping paper carried in accordance with §174.26(c);
   (2) The delivering rail carrier obtains and retains a receipt for the waste that is dated by and bears the handwritten signature of the person representing the designated facility; and
   (3) A copy of the shipping paper is retained for three (3) years by each railroad transporting the waste.

G. The person delivering a hazardous waste to an initial rail carrier shall send a copy of the manifest, dated and signed by a representative of the rail carrier, to the person representing the designated facility.

H. A hazardous waste manifest required by CFR, Title 40, Part 262 containing all the information required by CFR, Title 49, Subpart C, may be used as the shipping paper.

3. THE MANIFEST-GENERAL REQUIREMENTS (§262.20)

A. A generator (shipper) who transports, or offers for transportation, hazardous waste for off-site treatment, storage, or disposal must prepare a manifest before transporting the waste off-site.

B. A generator (shipper) must designate on the manifest one facility which is permitted to handle the waste described on the manifest.

C. A generator (shipper) may also designate on the manifest one alternate facility which is permitted to handle his waste in the event an emergency prevents delivery of the waste to the primary designated facility.

D. If the transporter (carrier) is unable to deliver the waste to the designated facility, the generator must either designate another facility or instruct the transporter to return the waste.

4. MANIFEST INFORMATION (§262.21)

A. The manifest must contain:
   (1) Manifest document number;
   (2) Generator's (Shipper's) name, mailing address, telephone number, and the EPA identification number;
   (3) Name and EPA identification number of each transporter (carrier);
   (4) Name, address and EPA identification number of the designated facility and an alternate facility, if any;
   (5) Description of the waste(s) (e.g. proper shipping name required by the Department of Transportation Hazardous Materials Regulations CFR, Title 49, §172.101, §172.202 and §172.203); and
   (6) Total quantity of each hazardous waste by units of weight or volume, and the type and number of containers loaded into or onto the transport vehicle.

B. Certification [§262.21(b)] The following certification must appear on the manifest: "This is to certify that the above named materials are properly classified, described, packaged, marked, labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation and the EPA"

5. COPIES OF MANIFEST REQUIRED (§262.22)
The manifest must consist of at least the number of copies to provide the generator, each transporter and the owner or operator of the designated facility with one copy each for their records and another copy to be returned to the generator.

6. USE OF THE MANIFEST (§262.23)
   A. The generator must:
      (1) Sign the manifest certification by hand;
      (2) Obtain the handwritten signature of the initial transporter and date of acceptance of manifest; and
      (3) Retain one copy in accordance with §262.40(a).
   B. The generator must give the transporter the remaining copies of the manifest.
   C. Shipment of hazardous waste within the United States solely by railroad or water (bulk shipments only); the generator must send three (3) copies of the manifest dated and signed in accordance with §262.20 to the owner or operator of the designated facility. NOTE: Copies of the manifest are not required for each transporter. For special provisions for rail or water (bulk shipment) transporters see §263.20(e).

7. PREPARATION OF HAZARDOUS WASTE FOR SHIPMENT (§262.30)
   A. Packaging Hazardous Waste - The generator (shipper) has the responsibility for the classification and packaging of hazardous waste prior to offering for transportation. The requirements for packaging will be found in the Department of Transportation Regulations CFR, Title 49, Parts 172, 173, 178 and 179.
   B. Labeling Requirements (§262.31) - Prior to offering a hazardous waste for transportation off-site, the generator (shipper) must label each package in accordance with CFR Title 49, Part 172, Subpart E.
   C. Marking Requirements (§262.32) - Prior to offering hazardous waste for transportation off-site, the generator must:
      (1) Mark each package of the hazardous waste; and
      (2) Mark each container 110 gallons or less offered for transportation with the following words and information displayed in accordance with the requirements of CFR, Title 49, Sec. 172.304.
         "HAZARDOUS WASTE-Federal Law Prohibits Improper Disposal. If found, contact the nearest police or public safety authority or the United States Environmental Protection Agency"
         Generator's Name and Address _____
         Manifest Document Number _____
   D. Placarding Requirements (§262.33) - Prior to offering a hazardous waste for transportation off-site, the generator must:
      (1) Placard the shipment; or
      (2) Offer the initial transporter (carrier) the appropriate placards. (CFR Title 49, Part 172, Subpart F)

NOTE: This handout is designed as a training aid only. It does not relieve persons from complying with the Department of Transportation's Hazardous Materials Regulations. Final authority for use of shipping papers is found in the Code of Federal Regulations, Title 49, Part 100-177.

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DEPARTMENT OF TRANSPORTATION
RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION
MATERIALS TRANSPORTATION BUREAU
OFFICE OF OPERATIONS AND ENFORCEMENT
INFORMATION SERVICES DIVISION, DMT-11
WASHINGTON, D.C. 20590

REVISED MAY 1981

APPENDIX C

DEPARTMENT OF TRANSPORTATION
GUIDE FOR MARKINGS

U.S. Department of Transportation
Research and Special Programs Administration

GUIDE FOR MARKINGS

The following information has been abstracted from the Code of Federal Regulations (CFR), Title 49 Transportation, Parts 100-199. Refer to the appropriate Sections for details.

NOTE: Rulemaking proposals are outstanding or are contemplated concerning the regulations. Keep up to date with the changes.

MARKING - means the application of the descriptive name, proper shipping name, hazard class, identification number (when authorized), instructions, cautions, weight or a combination thereof on the outside shipping container. Marking also includes the specification marks for both the inside and outside shipping containers required by the Hazardous Materials Regulations.

DESCRIPTIVE INFORMATION

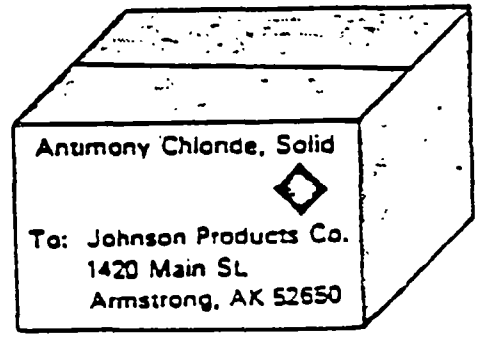
GENERAL REQUIREMENTS (§172.300-172.304)

All containers of hazardous materials, i.e. packages, freight containers, or transport vehicles, must, unless specifically exempted, be marked with the proper shipping name(s) of the contents and the name and address of either the consignee or consignor. All markings must be:

1. Durable, in English, and printed on or affixed to the surface of the package or on a label, tag or sign.

2. On a background of a sharply contrasting color and unobscured by labels or attachments.

3. Away from other markings that could reduce its effectiveness.

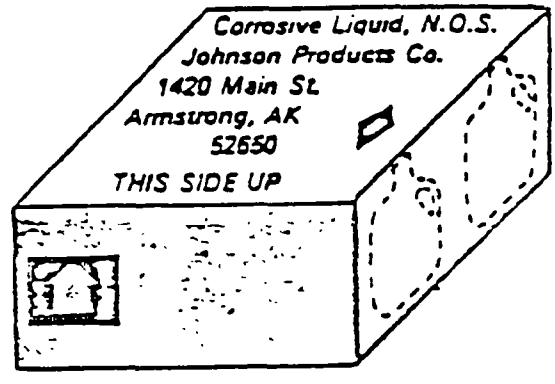


LIQUIDS - INSIDE CONTAINERS (§172.312)

1. Inside containers must be packed with closures in the upright position.

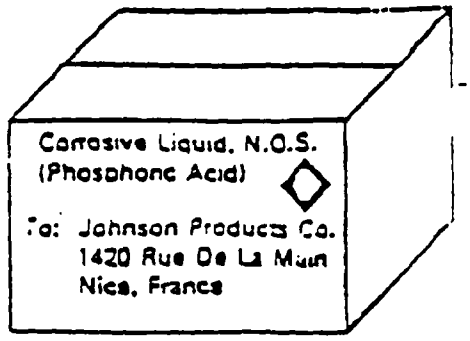
2. Must be marked on the outside with "THIS END UP" or "THIS SIDE UP".

3. Arrows must be used only to show orientation of package. An arrow symbol indicated by ANSI Standard MH6.11968 "THIS WAY UP". Pictorial (arrows) of goods is recommended.



EXPORT BY WATER (§172.302)

All n.o.s. entries, when authorized in §172.101 or §172.102, must have the technical name(s) of the material immediately following the proper shipping name for export by water. For mixtures (two or more) hazardous materials, the technical name of at least two components must be identified.

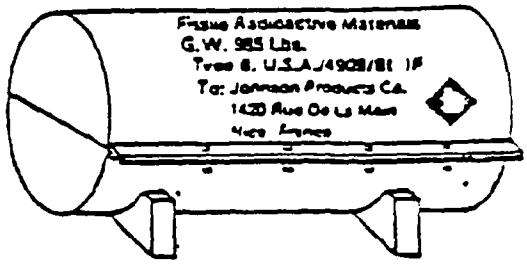


RADIOACTIVE MATERIALS (§172.310)

1. Containers weighing over 110 pounds (gross weight) must be marked on the container.

2. Must be marked "TYPE A" or "TYPE B" as required in letters at least 1/2" high.

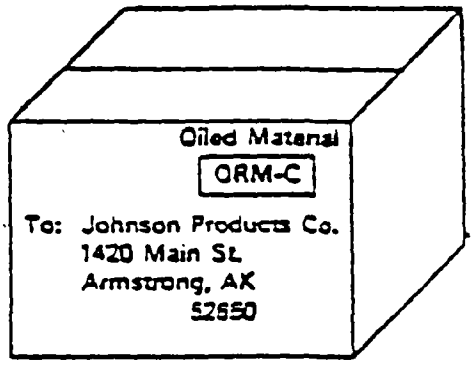
3. For export, the letters "USA" must follow the specification markings or package certification.



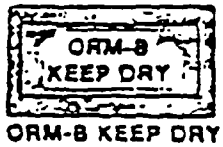
OTHER REGULATED MATERIALS (ORM'S) (§172.316)

ORM materials must be designated immediately following or below the proper shipping name marking within a rectangular border approximately 1/4 inch larger on each side of the designation. The appropriate designation must be one of the following:

1. ORM-A
2. ORM-B -KEEP DRY
3. ORM-B
4. ORM-C
5. ORM-D
6. ORM-D-AIR
7. ORM-E



NOTE: These markings serve as the certification by the shipper that the material is properly described, classed, packaged, marked and labeled (when appropriate) and in proper condition for transportation. Use of this type of certification does not preclude the requirement for a certificate on the shipping paper [§172.316(c)].



ORM-B KEEP DRY

EXAMPLE

AUTHORIZED CONTAINERS IN OUTSIDE CONTAINERS

When a DOT specification container is required for a hazardous material and that container is overpacked in another container meeting the requirements of §173.21 and §173.24, the outside container must be marked in accordance with §173.25.
EXAMPLES: "THIS SIDE UP" or "THIS END UP" or "INSIDE PACKAGES COMPLY WITH PRESCRIBED SPECIFICATIONS"

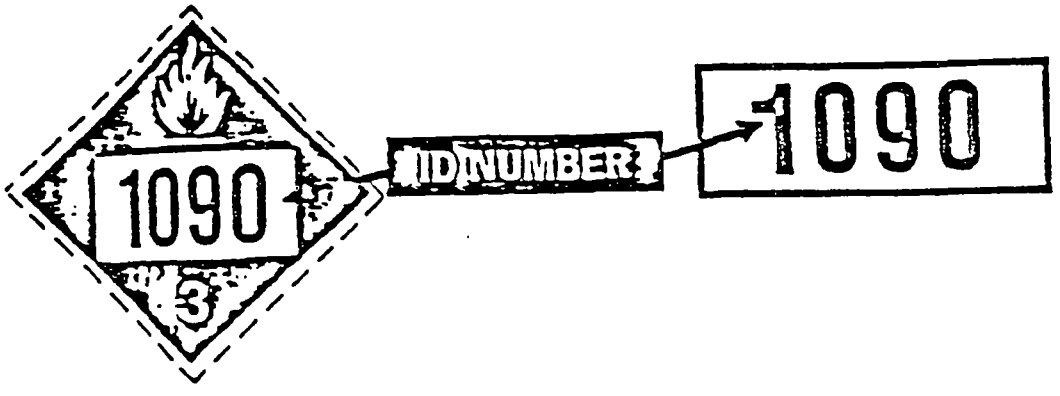
CYLINDERS - All cylinders must be marked in accordance with §173.34 and §§173.301 through 173.306. Cylinders passing reinspection and retesting must be marked in accordance with §173.34(e)(6).

PORTABLE TANKS (§172.326 and §172.332) - Portable tanks must display the proper shipping name in letters at least 2 inches high and placed on two opposite sides. Identification numbers [§§171.101 and 171.102 (when authorized)] are required on each side and each end for capacities of 1,000 gallons or more and on two opposing sides in association with the proper shipping name for capacities of less than 1,000 gallons. The name of the owner or lessee must be displayed. Tanks carrying compressed gases (DOT-51) must have all inlets and outlets, except safety relief valves, marked to designate whether or not they communicate with vapor or liquid. [§178.245-6(b)].
NOTE: When different hazardous materials are transported in marked portable tanks, the shipping name and the identification number displayed must identify the material.

CARGO TANKS - HIGHWAY (COMPRESSED GASES) (§172.328) - Cargo tanks must be marked, in letters no less than 2 inches high, with either the proper shipping name of the gas or an appropriate common name, such as "Refrigerant Gas". Cargo tanks must only be marked, i.e. proper shipping name and identification number [when authorized (§§171.101 and 171.102)] for the material contained therein. DOT MC 331 tanks must have inlets and outlets, except safety relief valves, marked to designate whether they communicate with liquid or vapor when the tank is filled to its maximum permitted silling density. [§178.337-9(c)].

TANK CARS - RAIL (§172.330) - Tank cars, when required to be marked with the proper shipping name by Parts 173 and 179, must be marked in letters at least 4 inches high with at least 5/8 inch stroke with the proper shipping name or the appropriate common name. Identification number markings (when authorized) must be displayed on each side and each end [§§171.101 and 171.102 (when authorized)]. Tank cars must only be marked for the material contained therein.
NOTE: See referenced Sections for requirements for DOT-106 and DOT 110 tank car tanks.

EXAMPLE OF PLACARD AND PANEL WITH IDENTIFICATION NUMBER



NOTE: The Identification Number (ID No.) may be displayed on placards or on orange panels on tanks. Check the sides of the transport vehicle if the ID number is not displayed on the ends of the vehicle.

OTHER MARKING REQUIREMENTS

REQUALIFIED CONTAINERS - Reusable cylinders, portable tanks, cargo tanks and tank cars are required to be either visually inspected or retested at periodic intervals. When this is accomplished, the date of the requalification must be shown on the container as required in §§173.24, 173.31, 173.32, 173.33 and 173.34.

REUSE OF CONTAINERS - Some steel containers in the DOT Series (DOT-17C, 17E and 17H) may be qualified for reuse by a reconditioner of drums who is registered with the Department of Transportation. These drums must meet the requirements of §173.28(m) i.e. old labels removed, exemption number (if any) and descriptive markings removed and the drum reconditioned. Other containers may be reused under varying conditions. See §173.28 for details.

CARGO HEATERS - Cargo heaters authorized for use with flammable liquid or gas must be marked in accordance with §177.834(1)(2)(e) and (f).

MOTOR VEHICLES - Marking of motor vehicles and special requirements are found in §§177.823 and 177.824.

SPECIFICATION CONTAINERS

Markings on specification containers must generally identify: (1) the DOT specification number to which the container is made (Parts 178 and 179); (2) the manufacturers name and address or symbol (registered with the Associate Director for the Office of Hazardous Material Regulation). Duplicate symbols are not authorized. All containers must comply with the marking requirements of §173.24 and the appropriate Section(s) of Parts 178 and 179. Exceptions for Canadian and other import/export situations may be found in §§171.12 and 173.8.
NOTE: For certain containers, specific detailed information such as original test date information and type of material which may be required can be found in Parts 178 and 179.

APPENDIX B

ERT Computerized Sampling QA/QC Plan

SAMPLING QA/QC PLAN

GENERIC

Prepared by
(CONTRACTOR)

EPA Project No.:
Contractor Work Order No.:
EPA Contract No.:

APPROVALS

(CONTRACTOR)		EPA	
_____	_____	_____	_____
(CTL) Task Leader	DATE	(EPAOSC) On-Scene Coordinator	DATE
_____	_____	_____	_____
(CPM) Project Manager	DATE	(Name) (Title)	DATE

1.0 BACKGROUND

The [suspected] contamination is a result of:

The following information is known about the site:

The site is located in the city of in the County of , in the State of . See attached map, Figure 1.1.
The nearest residents are located within (ft/mi) of the site, in a (compass) direction.
Other residents or significant environments in proximity to this site are located (ft/mi) due (compass direction) of the site.
It is a (type of facility on .(No.) acres which has/had been operating for (No.) of years and is now abandoned since (date).
The types of material(s) handled by this facility were/are:

__ radioactives
__ acids
__ unknown
__ organic solvents
__ bases
__ petroleum
__ inorganics
__ (specify other)

The volume(s) of contaminated materials to be addressed are: (specify in acreage, drum count volume of liquids or waste)

The contaminants of concern are:	concentration ranges
_____	_____ to _____
_____	_____ to _____
_____	_____ to _____
_____	_____ to _____
_____	_____ to _____

The basis of this information/data may be found in:

2.0 OBJECTIVES

The objective of this project/sampling event is to determine:

__ the presence of contamination
__ the extent of contamination
__ the magnitude of contamination
__ the impact of contamination
__ the effectiveness of new sampling methods or instrumentation
__ (specify other)

For the purpose of:

__ site characterization
__ monitoring data
__ engineering design
__ risk assessment
__ enforcement action
__ disposal
__ field personnel health & safety
__ bioassessment
__ compatibility
__ (specify other)

The data will be evaluated against:

__ an existing data base (specify)
__ federal/state action levels (specify)
__ permit levels (specify)
__ (specify other)

3.0 QUALITY ASSURANCE OBJECTIVES

As identified in Sections 1.0 and 2.0 the objective of this project/event applies to [all] [the following] parameters:

Parameters	Matrix	INTENDED USE OF DATA	QA OBJECTIVE
VOA			
BNA			
PEST			
PCB			
METALS			
CN			
PHENOLS			
[TOT HYDROCARB]			
[TOT CHLORIDES]			
[TOX]			
[COD]			
[THM]			
[OTHER]			

[For QA-1 data, results may be non-qualitative to semi-qualitative, non-definitive (without confirmed) identification, in addition, they may have gross quantitation and no confidence limits.]

Methods to be employed during this event include:

__ spot tests
__ indicator tubes
__ paper strip tests
__ chemical reactions producing colors, gases, or precipitates
__ electronic meters (e.g. pH, conduct)
__ electronic detectors
    __ photoionization

__ electron capture
__ flame ionization
__ flame photometric
__ electron capture
__ infrared
__ gas chromatography
__ mass spectroscopy (single ion monitoring)
__ GC/MS
__ atomic adsorption
__ ICP
__ X-ray fluorescence
__ other

[For QA-2 data, verification of preliminary screening results will be achieved by: [choose one of the following, delete the others]

- Definitive identification (for organics only)- On at least 10% of the samples collected, analyte identification will be confirmed by a second method, such as mass spectroscopy.

- Definitive quantitation - On at least 10% of the samples collected, analyte quantitation will be verified by alternate method or repeat of preliminary procedure; and a determination of precision, accuracy, and confidence limits will be made on at least 1% of the samples collected using the verification method. (This is the only verification option for inorganic parameters).

- Definitive identification and quantitation (for organics only)-On at least 10% of the samples collected, analyte identification will be confirmed by a second method, such as mass spectroscopy and analyte quantitation will be verified by alternate method or repeat of preliminary procedure; and a determination of precision, accuracy, and confidence limits will be made on at least 1% of the samples collected using the verification method. determination.

[For QA-2 data, methods for confirmed identification on organics include:]

__ GC/photoionization
__ GC/electron capture
__ GC/flame ionization
__ GC/flame photometric
__ infrared
__ gas chromatography
__ mass spectroscopy
__ GC/MS
__ [other]

[For QA-2 and/or QA-3 data, methods for definitive quantitation and determination of confidence limits will include matrix spike duplicates.]

[For QA-3 data, the results will have definitive identification, definitive quantitation and determination of confidence limits (precision and accuracy) on the parameters of interest for 100% of the samples collected.]

[For QA-3 data, methods to be employed for both analysis and confirmation during this event include:

__ infrared
__ gas chromatography
__ mass spectroscopy
__ GC/MS
__ atomic absorption
__ ICP
__ [other]

For QA-1, QA-2 and/or QA-3 data, results will be representative, comparable, and complete. QA-1, QA-2, and/or QA-3 Objectives are further defined by requirements in Section 6.0.]

4.0 APPROACH AND SAMPLING METHODOLOGIES

4.1 Media/Matrix

This event involves the assessment of the following media/matrix:

__ soil/sediment
__ groundwater
__ surface water
__ air
__ waste material
__ soil gas
__ specify other

4.2 Sampling Equipment

The following equipment will be utilized to obtain environmental samples from the respective media/matrix:

Matrix/Media	Sampling Equipment	Fabrication	Dedicated

[4.2.1 Sampling Equipment Decontamination]

[This section is optional depending upon responses under 4.2]

The following decontamination procedure will be employed prior and subsequent to sampling each station in the following sequence:

__ physical removal
__ non-phosphate detergent wash [specify:]
__ potable water rinse
__ distilled/deionized water rinse
__ 10% nitric acid rinse
__ solvent rinse [specify:]
__ solvent rinse [specify:]
__ air dry
__ distilled water rinse
__ organic free water rinse

4.3 *Sampling Design*

The sampling design is depicted on the attached Sample Location Map (Figure 4-1) and is based on the following rationale:

4.4 Standard Operating Procedures

4.4.1 Sample Documentation

All sample documents must be completed legibly, in ink. Any corrections or revisions must be made by lining through the incorrect entry and by initialing the error.

1. Field Log Book

The Field Log Book is essentially a descriptive notebook detailing site activities and observations so that an accurate account of field procedures can be reconstructed in the writer's absence. All entries should be dated and signed by the individuals making the entries, and should include (at a minimum) the following:

1. Site name and project number.
2. Name(s) of personnel on-site.
3. Dates and times of all entries (military time preferred).
4. Descriptions of all site activities, including site entry and exit times.

5. Noteworthy events and discussions.
6. Weather conditions.
7. Site observations.
8. Identification and description of samples and locations.
9. Subcontractor information and names of on-site personnel.
10. Date and time of sample collections, along with chain-of-custody information.
11. Record of photographs.
12. Site sketches.

2. Sample Labels

Sample labels must clearly identify the particular sample, and should include the following:

1. Site name and number.
2. Time sample was taken.
3. Sample preservation.
4. Initial of sampler(s).

Optional, but pertinent, information:

1. Analysis requested.
2. Sample location.

Sample labels must be securely affixed to the sample container. Tie-on labels can be used if properly secured.

3. Chain of Custody Record

A Chain of Custody record must be maintained from the time the sample is taken to its final deposition. Every transfer of custody must be noted and signed for, and a copy of this record kept by each individual who has signed. When samples (or groups of samples) are not under direct control of the individual responsible for them, they must be stored in a locked container sealed with a Chain of Custody seal.

The Chain of Custody record should include (at minimum) the following:

1. Sample identification number.
2. Sample information.
3. Sample location.
4. Sample date.
5. Name(s) and signature(s) of sampler(s).
6. Signature(s) off any individual(s) with control over samples.

4. Chain of Custody Seals

Chain of Custody Seals demonstrate that a sample container has not been tampered with, or opened.

The individual in possession of the sample(s) must sign and date the seal, affixing it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sample packaging, must be noted in the Field Logbook.

5. Corrective Action

Corrective actions are those taken in response to nonconformance reports, audit findings, or surveillance findings. The quality assurance representative is responsible for reviewing audit reports and nonconformance reports to determine the significant or repetitious conditions adverse to quality, or failure to implement or adhere to required quality assurance practices. When such problems are identified, the responsible manager must investigate the causes of the problems and define and implement the necessary actions to correct the problems. Documentation that supports major corrective actions must be maintained in the project files.

4.4.2 Sampling

Groundwater Well Sampling

General Air Sampling Guidelines

Drum Sampling

Tank Sampling

Wipe, Chip, and Sweep Sampling

Soil Sampling

Surface Water Sampling

Asbestos Sampling

Sediment Sampling

Waste Pile Sampling

Soil Gas Sampling

Tedlar Bag Sampling

Charcoal Tube Sampling

Tenax Tube Sampling

Indoor Air Sampling

PCBs in Air

Photovac GC Analysis of Soil Gas, Water, and Soil Samples

4.4.3 Sample Handling and Shipment

Each of the sample bottles will be sealed and labeled according to the following protocol. Caps will be secured with custody seals. Bottle labels will contain all required information including

sample number, time and date of collection, analysis requested, and preservative used. Sealed bottles will be placed in large metal or plastic coolers, and padded with an absorbent material such as vermiculite.

All sample documents will be affixed to the underside of each cooler lid. The lid will be sealed and affixed on at least two sides with EPA custody seals so that any sign of tampering is easily visible.

4.5 Schedule of Activities

(See Table 1 attached)

Table 1: Proposed Schedule of Work

Activity	(Time Period)			
1. Laboratory Procurement				
2. Sample Staging				
3. (Sampling - Soil)				
4. (Sampling - Groundwater)				
5. Laboratory Analysis				
6. Data Review				
7. Draft Report				
8. Final Report				

Table 2: Field Sampling Summary

Analytical Parameter	Level of Sensitivity[1]	Matrix*	Container Type and Volume (# container rq'd)	Preservative	Holding Times	Subtotal Samples	QC Extras				Total Field Samples
							Rinsate Blanks[2]	Trip Blanks[3] (VOAs)	QC Positives[4]	Matrix Spikes[5]	
VOA		S	40ml vial (1)	4°C	7day						
VOA		W	40ml vial (3)	4°C**	7day						
BNA		S	8oz glass (1)	4°C	7/40d						
BNA		W	32oz amber glass (2)	4°C	7/40d						
PEST		S	8oz glass (1)	4°C	7/40d						
PCB		S	8oz glass (1)	4°C	7/40d						
PEST		W	32oz amber glass (2)	4°C**	7/40d						
PCB		W	32oz amber glass (2)	4°C**	7/40d						
P.P. METALS		S	8oz glass (1)	4°C	6mon						
P.P. METALS		W	1 liter glass or polyethylene (1)	NO_3 ph<2 4°C	6mon						

* Matrix: S-Soil, W-Water, O-Oil, DS-Drum Solid, DL-Drum Liquid, TS-Tank Solid, TL-Tank Liquid, X-Other, A-Air

** If residual chlorine is present, preserve with 0.008% $Na_2S_2O_2$.

1. The concentration level, specific or generic, that is needed in order to make an evaluation. This level will provide a basis for determining the analytical method to be used.
2. Only required if dedicated sampling tools are not used. One blank required per parameter per 20 samples.
3. One trip blank required per cooler used to ship VOA samples. Each trip blank consists of two 40ml vials filled with distilled/deionized water.
4. Performance check samples; optional for QA-2, mandatory for QA-3 Level. One per parameter.
5. For QA-2: One matrix spike duplicate per lot of 10 samples; therefore, collect two additional environmental sample volumes (water matrix) for every 10 environmental samples. For solid matrix, one additional volume per 10 environmental samples. For QA-3: Two matrix spike duplicates per lot of 10 environmental samples; therefore, collect four additional volumes of environmental samples for every 10 samples. Collect two additional volumes of environmental sample for solid matrix spikes.

Table 2: Field Sampling Summary (continued)

Analytical Parameter	Level of Sensitivity[1]	Matrix*	Container Type and Volume (# container rq'd)	Preservative	Holding Times	Subtotal Samples	QC Extras				Total Field Samples
							Rinsate Blanks[2]	Trip Blanks[3] (VOAs)	QC Positives[4]	Matrix Spikes[5]	
CYANIDE		S	8oz glass (1)	4°C	14day						
CYANIDE		W	1 liter polyethylene (1)	NaOH to pH > 12 4°C	14day						
PHENOLS		S	8oz glass (1)	4°C	28day						
PHENOLS		W	1 liter amber glass (1)	H_2SO_4 to pH < 2 4°C	28day						

* Matrix: S-Soil, W-Water, O-Oil, DS-Drum Solid, DL-Drum Liquid, TS-Tank Solid, TL-Tank Liquid, X-Other, A-Air

** If residual chlorine is present, preserve with 0.008% $Na_2S_2O_2$.

1. The concentration level, specific or generic, that is needed in order to make an evaluation. This level will provide a basis for determining the analytical method to be used.
2. Only required if dedicated sampling tools are not used. One blank required per parameter per 20 samples.
3. One trip blank required per cooler used to ship VOA samples. Each trip blank consists of two 40ml vials filled with distilled/deionized water.
4. Performance check samples; optional for QA-2, mandatory for QA-3 Level. One per parameter.
5. For QA-2: One matrix spike duplicate per lot of 10 samples; therefore, collect two additional environmental sample volumes (water matrix) for every 10 environmental samples. For solid matrix, one additional volume per 10 environmental samples. For QA-3: Two matrix spike duplicates per lot of 10 environmental samples; therefore, collect four additional volumes of environmental samples for every 10 samples. Collect two additional volumes of environmental sample for solid matrix spikes.

5.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The EPA On-Scene Coordinator, (EPAOSC), will provide overall direction to (CONTRACTOR) staff concerning project sampling needs, objectives, and schedule.

The (CONTRACTOR) Task Leader, (CTL), is the primary point of contact with the EPA On-Scene Coordinator. The Task Leader is responsible for the development and completion of the Sampling QA/QC Plan, project team organization, and supervision of all project tasks, including reporting and deliverables.

The (CONTRACTOR) Site QC Coordinator, (COSQCC), is responsible for ensuring field adherence to the Sampling QA/QC Plan and recording any deviations. The Site QC Coordinator is also the primary project team contact with the lab. The following field sampling personnel will work on this project.

Personnel	Responsibility

The (CONTRACTOR) QA Officer, (CQAO), Health and Safety Officer, (Name), and Project Manager, (CHSO), are responsible for auditing and guiding the project team, reviewing the final deliverables and proposing corrective action, if necessary, for nonconformity to the Sampling QA/QC Plan or Health and Safety Plan.

The following laboratories will be providing the following analyses:

Lab Name/Location	Lab Type	Parameters

6.0 QUALITY ASSURANCE REQUIREMENTS

The following requirements apply to the respective QA Objectives and parameters identified in section 3.0:

The following QA protocols apply:
(For QA-1 data)

-instrument calibration and/or performance check of the given test method will be documented (field data sheets or log notebook).
-the detection limit will be determined, unless inappropriate.
-sample documentation will be provided.

(Additional QA Protocols for QA-2 data)

-chain of custody documentation (optional for field analysis)
-sample holding time documentation
-collection and evaluation of blanks and sample replicates (Refer to Tables 2 and 3)
-instrument calibration documentation
-PE samples, if appropriate
-definitive identification: confirmed identification of analytes by a second GC column or mass spectra for 10% of the samples collected (organics only) and provide gas chromatograms and/or mass spectra.
-definitive quantitation: verify preliminary quantitative results by reanalyzing 10% of the samples colleted and make a determination of precision, accuracy, and confidence limits by preparing and analyzing matrix spike duplicates on 1% of the samples collected. If the preliminary method is a field screening procedure, an alternate, EPA approved method will be used to verify the quantitative results.

(Additional QA Protocols for QA-3 data)
-PE samples
-definitive identification: confirmed identification of analytes by a second GC column or mass spectra for 100% of the samples collected (organics only) and provide gas chromatograms and/or mass spectra.
-definitive quantitation: verify quantitative results by reanalyzing 100% of the samples collected by an alternate EPA approved method and make a determination of precision, accuracy, and confidence limits by preparing and analyzing matrix spike duplicates on 2% of the samples collected.

Numbers of samples to be collected for this project/event are entered onto Tables 2 Field Sampling Summary and Table 3 QA/QC Analysis and Objectives Summary to facilitate ready identification of analytical parameters desired, type, volume and number of containers needed, preservation requirements, number of samples required and associated number, and type of QA/QC control samples required based on this QA level.

All project deliverables will receive an internal peer QC review prior to release, as per guidelines established in the (EPA Regional/Branch or Contractor) Quality Assurance Program Plan.

Table 3: QA/QC Analysis and Objectives Summary

Analytical Parameter	Matrix*	Analytical Method Ref.	Spikes		QA/QC	
			Matrix[1]	Surrogate[2]	Detection Limits[3]	QA Objective[4]
VOA	S	8240/SW-846				
VOA	W	624/CLP				
BNA	S	8250 or 8270/ SW-846				
BNA	W	625/CLP				
PEST	S	8080/SW-846				
PCB	S	8080/SW-846				
PEST	W	608				
PCB	W	608				
P.P. METALS	S	SW-846				
P.P. METALS	W	EPA-600/CFR 40				

* Matrix: S-Soil, W-Water, O-Oil, DS-Drum Solid, DL-Drum Liquid, TS-Tank Solid, TL- ank iquid, X-Ot er, A-Air

1 For QA2: One matrix spike duplicate analysis per lot of 10 samples. For QA3: Two matr x spike duplicate analyses per lot of 10 samples.

2 Surrogate spikes analysis to be run (enter yes) for each sample in QA-2 and QA-3.

3 To be determined by the person arranging the analysis.

4 Enter QA Objective desired: QA-1, QA-2, or QA-3.

Table 3: QA/QC Analysis and Objectives Summary (continued)

Analytical Parameter	Matrix*	Analytical Method Ref.	Spikes		QA/QC	
			Matrix[1]	Surrogate[2]	Detection Limits[3]	QA Objective
CYANIDE	S	SW-846				
CYANIDE	W	SW-846				
PHENOLS	S	8040/SW-846				
PHENOLS	W	604/CFR 40				

* Matrix: S-Soil, W-Water, O-Oil, DS-Drum Solid, DL-Drum Liquid, TS-Tank Solid, TL-Tank Liquid, X-Other, A-Air

1 For QA2: One matrix spike duplicate analysis per lot of 10 samples. For QA3: Two matrix spike duplicate analyses per lot of 10 samples.

2 Surrogate spikes analysis to be run (enter yes) for each sample in QA-1 and QA-2.

3 To be determined by the person arranging the analysis.

4 Enter QA Objective desired: QA-1, QA-2, or QA-3.

7.0 DELIVERABLES

The (CONTRACTOR) Task Leader,(CTL), will maintain contact with the EPA On-Scene Coordinator, (EPAOSC), to keep him/her informed about the technical and financial progress of this project. This communication will commence with the issuance of the work assignment and project scoping meeting. Activities under this project will be reported in status or trip reports and other deliverables (e.g., analytical reports, final reports) described herein. Activities will also be summarized in appropriate format for inclusion in monthly and annual reports.

The following deliverables will be provided under this project:

Trip Report

A trip report will be prepared to provide a detailed accounting of what occurred during each sampling mobilization. The trip report will be prepared within [two weeks] of the last day of each sampling mobilization. Information will be provided on time of major events, dates, and personnel on-site (including affiliations and phone numbers). The trip report will be organized into three major section: Background, Observations and Activities, and Conclusions and Recommendations (if appropriate).

Status Reports

A status report will be prepared on a [weekly/monthly/etc]. schedule to provide a detailed accounting of what has occurred, and what is planned to occur for the sampling event. Information will be provided on time and date of major events and personnel on-site (including affiliation and phone numbers). The status report will be organized into three major sections: Background, Observations and Activities, and Future Activities.

Maps/Figures

The following illustrations will be provided:

__ Maps [size specifications _____]
__ Figures [titles/types]
__ Drawings [scale]
__ Well borehole logs

Analysis

This sampling event requires analytical services. Documentation of lab selection, raw data, or results will be provided in the analytical report.

Data Review

A review of the data generated under this plan will be undertaken. The assessment of data acceptability or useability will be provided separately, or as part of the analytical report.

Analytical Report

An analytical report will be prepared for samples analyzed under this plan. Information regarding the analytical methods/procedures employed, sample results, QA/QC results, chain-of-custody documentation, laboratory correspondence, and raw data will be provided within this deliverable.

Draft Final Report

A (draft) final report will be prepared to correlate available background information with data generated under this sampling event and identify supportable conclusions and recommendations which satisfy the objectives of this sampling QA/QC plan.

8.0 DATA VALIDATION

(QA-1 data validation)

QA-1 does not require an extensive review process. Data for this level should be evaluated for calibration and detection limits at a minimum.

(QA-2 data validation)

Data generated under this QA/QC Sampling Plan will be evaluated accordingly with appropriate criteria contained in the Removal Program Data Validation Procedures which accompany OSWER Directive #9360.4-1.

Specific data review activities for QA-2 should be performed by the following approach:

1. Of the samples collected in the field, 10% will be confirmed for identification, precision, accuracy, and error determination.
2. The results of 10% of the samples in the analytical data packages should be evaluated for holding times, blank contamination, spike (surrogate/matrix) recovery, and detection capability.
3. The holding times, blank contamination, and detection capability will be reviewed for the remaining samples.

(QA-3 data validation)

Data generated under this QA/QC Sampling Plan will be evaluated accordingly with appropriate criteria contained in the Removal Program Data Validation Procedures which accompany OSWER Directive #9360.4-1.

Specific data review activities for QA-3 should be performed by the following tiered approach:

1. a. For any one data package, review all data elements for 10% of samples.

b. For the remaining 90% of the samples within the same data package, review holding times, blank contamination, spike (surrogate/matrix) recovery, detection capability, and confirmed identification thoroughly.

2. For every tenth data package, review all data quality elements for all samples in each parameter category (i.e. VOAs and PCBs).

(SITE/PROJECT TITLE)
Figure 1-1 Site Location Map

(SITE/PROJECT TITLE)
Figure 4-1 Sample Location Map

APPENDIX C

Organization and Delegation of QA Responsibilities for the ERB Analytical Data Collection Activities

-instrument calibration and/or performance check of the given test method will be documented (field data sheets or log notebook).
-the detection limit will be determined, unless inappropriate.
-sample documentation will be provided.

(Additional QA Protocols for QA-2 data)

-chain of custody documentation (optional for field analysis)
-sample holding time documentation
-collection and evaluation of blanks and sample replicates (Refer to Tables 2 and 3)
-instrument calibration documentation
-PE samples, if appropriate
-definitive identification: confirmed identification of analytes by a second GC column or mass spectra for 10% of the samples collected (organics only) and provide gas chromatograms and/or mass spectra.
-definitive quantitation: verify preliminary quantitative results by reanalyzing 10% of the samples colleted and make a determination of precision, accuracy, and confidence limits by preparing and analyzing matrix spike duplicates on 1% of the samples collected. If the preliminary method is a field screening procedure, an alternate, EPA approved method will be used to verify the quantitative results.

(Additional QA Protocols for QA-3 data)
-PE samples
-definitive identification: confirmed identification of analytes by a second GC column or mass spectra for 100% of the samples collected (organics only) and provide gas chromatograms and/or mass spectra.
-definitive quantitation: verify quantitative results by reanalyzing 100% of the samples collected by an alternate EPA approved method and make a determination of precision, accuracy, and confidence limits by preparing and analyzing matrix spike duplicates on 2% of the samples collected.

Numbers of samples to be collected for this project/event are entered onto Tables 2 Field Sampling Summary and Table 3 QA/QC Analysis and Objectives Summary to facilitate ready identification of analytical parameters desired, type, volume and number of containers needed, preservation requirements, number of samples required and associated number, and type of QA/QC control samples required based on this QA level.

All project deliverables will receive an internal peer QC review prior to release, as per guidelines established in the (EPA Regional/Branch or Contractor) Quality Assurance Program Plan.

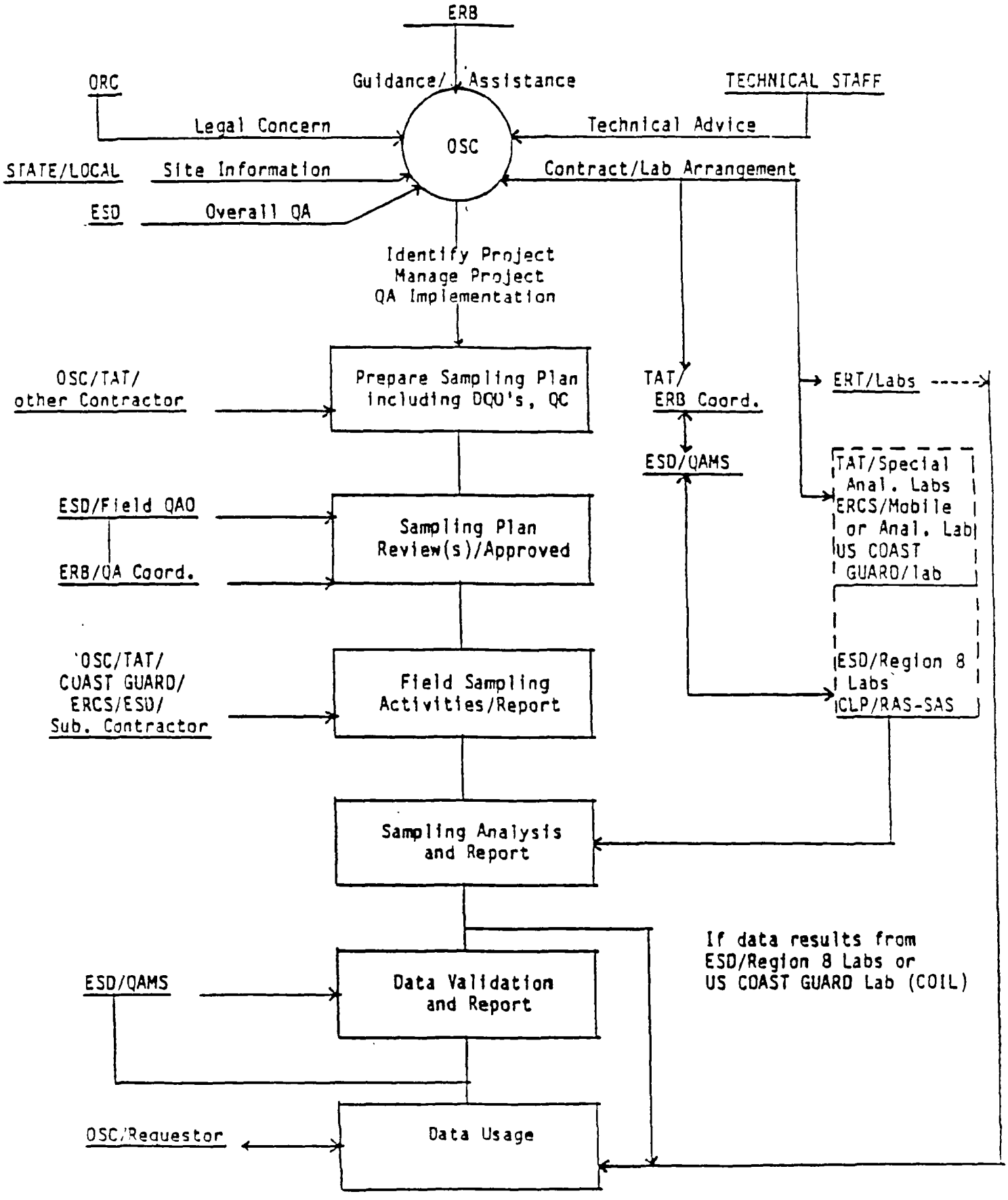



Figure VIII. ORGANIZATION AND DELEGATION OF QA RESPONSIBILITIES FOR THE ERB ANALYTICAL DATA COLLECTION ACTIVITIES