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FINAL WORK PLAN FOR SITE INSPECTION AT OUTLYING LANDING FIELD BARIN NAS WHITING FIELD FL

3/1/1990

E C JORDAN

FINAL WORK PLAN

SITE INSPECTION
OUTLYING LANDING FIELD (OLF) BARIN
FOLEY, ALABAMA

UIC: N60508

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This work plan presents the scope of work to be undertaken to conduct a Site Inspection (SI) at the Outlying Landing Field (OLF) Barin, Foley, Alabama. The purpose of the SI is to eliminate from further consideration those releases that pose no threat to human health or the environment, and to collect data to characterize releases for the rapid and effective initiation of an RI/FS. The SI at OLF Barin will be conducted in accordance with the Navy's Installation Restoration Program (IRP).

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EXECUTIVE SUMMARY

This Work Plan presents the Scope of Work to be undertaken to conduct a Site Inspection (SI) at the Outlying Landing Field (OLF) Barin, Foley, Alabama. The purpose of the Site Inspection at OLF Barin is to:

- eliminate from further consideration those releases that pose no threat or potential threat to public health or the environment, and

- collect data to characterize other release for the effective and rapid initiation of an RI/FS.

The SI to be conducted at OLF Barin will be in accordance with the Navy's Installation Restoration Program. The following sites at OLF Barin are included in this SI Work Plan:

- Site 19B - Maintenance area around the hangars,
- Site 20B - Abandoned underground storage tanks and fuel pits,
- Site 21B - Rubble landfill,
- Site 22B - Old fire fighting demonstration area, and
- Site 23B - Drainage ditch leading to Sandy Creek.

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APPENDIX D - HEALTH AND SAFETY PLAN

LIST OF ACRONYMS

ACL	Alternate Concentration Limits
AIC	Acceptable Intake, Chronic
AIS	Acceptable Intake, Subchronic
ARAR	Applicable or Relevant and Appropriate Requirement
AWQC	Ambient Water Quality Criteria
BLS	Below Land Surface
CAA	Clean Air Act
CAS	Chemical Abstracts Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980, also known as Superfund: amended in 1986 by the Superfund Amendments and Reauthorization Act (SARA).
CFR	Code of Federal Regulations
CIP	Caucus Inorganic Protocol
CLP	Contract Laboratory Program
CO	Corporate Office
COP	Caucus Organic Protocol
CWA	Clean Water Act
DEM	Alabama Department of Environmental Management
DON	Department of the Navy
DOT	Department of Transportation
DQO	Data Quality Objectives: statements that specify the data needed to support decisions regarding remedial response activities
EIC	Engineer in Charge
FS	Feasibility Study
GAC	Granulated Activated Carbon
GC	Gas Chromatograph

LIST OF ACRONYMS (Cont.)

gpm	gallons per minute
HASO	Health and Safety Officer
HASP	Health and Safety Plan
HEA	Health Effects Assessment
HRS	Hazard Ranking System
IAS	Initial Assessment Study
IR	Installation Restoration
Lead Agency	The agency, either the USEPA, Federal agency, or appropriate State agency having primary responsibility and authority for planning and executing the remediation at a site
LSI	Listed Site Inspection
MCL	Maximum Contaminant Level: established under the Safe Drinking Water Act.
MCLG	Maximum Contaminant Level Goal: established under the Safe Drinking Water Act.
MPR	Monthly Progress Report
NAAQS	National Ambient Air Quality Standards
NAAS	Naval Auxiliary Air Station
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Contingency Plan
NCR	NEESA Contract Representative
NEESA	Naval Energy and Environmental Support Activity
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List: a list of sites identified for remediation under CERCLA

LIST OF ACRONYMS (Cont.)

OLF	Outlying Landing Field
OSHA	Occupational Safety and Health Administration
OVA	Organic Vapor Analyzer
PA	Preliminary Assessment
PM	Program Manager
PrM	Project Manager
PRP	Potentially Responsible Party
QA	Quality Assurance
QAPP	Quality Assurance Project Plan: a plan that describes protocols necessary to achieve the data quality objectives defined for an RI
QC	Quality control
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
RfD	Risk Reference Doses
RI/FS	Remedial Investigation/Feasibility Study
SARA	Superfund Amendments and Reauthorization Act of 1986 (See CERCLA)
SDWA	Safe Drinking Water Act
Southern Division	Southern Division, Naval Facilities Engineering Command
SI	Site Inspection
SOP	Standard Operating Procedure
SOW	Statement of Work
SSI	Screening Site Inspection
SWDA	Solid Waste Disposal Act
TBC	To Be Considered Materials: federal and state non-promulgated Advisories or guidance documents that do not have ARAR status

LIST OF ACRONYMS (Cont.)

TCL	Target Compound List
TD	Technical Director
TRB	Technical Review Board
TSCA	Toxic Substances Control Act
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank

1.0 INTRODUCTION

Outlying Landing Field (OLF) Barin is a 490 acre airfield located in southwest Alabama, approximately 40 miles southeast of Mobile and 35 miles west of Pensacola, Florida (Figure 1-1). On December 5, 1942, the Foley, Alabama, municipal airport was leased and commissioned by the U.S. Navy as Naval Auxiliary Air Station (NAAS) Barin. After commissioning, NAAS Barin was used for basic and advanced flight training as well as an indoctrination center for enlisted personnel. During World War II, NAAS Barin grew and by war's end, four large hangers, a fuel system with 60 fuel pits, approximately 65 structures used to support station personnel, and six airstrips were located here.

NAAS Barin was deactivated on January 5, 1947 and remained closed until the Korean conflict. Reopening in early 1952, the airfield once again functioned as a training facility until 1959. After closing in 1959, the original airfield, on the west side of the facility, was transferred back to the City of Foley. The administration and housing area north of the hangers was sold to private parties. The four large hangers and all other buildings left on the remaining Navy property were dismantled.

Flight operations returned to Barin in 1985 when pilots from Naval Air Station (NAS) Whiting Field, Milton, Florida, began using the old runways for touch and go landings. NAS Whiting Field began construction of a crash crew building in 1985. The station was officially reopened in May 1988 and renamed Outlying Landing Field (OLF) Barin.

Under the command of NAS Whiting Field, OLF Barin functions as a practice landing strip for pilots training at NAS Whiting Field. The majority of land at OLF Barin is covered with grass and three active airstrips. A small contingent of fire fighters is assigned to the base to be on hand in case of an airplane accident.

1.1 THE NAVY'S INSTALLATION RESTORATION (IR) PROGRAM AND OLF BARIN. During World War II, and again during the Korean conflict, NAAS Barin was utilized to train pilots and for aircraft maintenance. Numerous types of solvents, oils, and fuels were used by maintenance personnel in these operations. Little, if any, hazardous materials are used, generated, or disposed of by OLF Barin at the present time. In 1988, a drinking water supply well located at OLF Barin was discovered to be contaminated with trans-1,2-dichloroethylene, tetrachloroethylene, and trichloroethylene. At this time, the source of contamination is not known.

In accordance with the Department of the Navy's (DON) Installation Restoration (IR) Program, OLF Barin is being investigated to determine the extent of soil and groundwater contamination. The IR Program is implemented in several phases, each of which uses information obtained during the previous phase. The first phase is Site Discovery and Notification and consists of recognizing the potential for the existence of a problem. Subsequent to Site Discovery, a Preliminary Assessment (PA) is conducted. The PA consists of a records search and personnel interviews to collect and evaluate evidence supporting the existence of any potential contamination problems. A Preliminary Assessment for OLF Barin was conducted by the Naval Energy and Environmental Support Activity

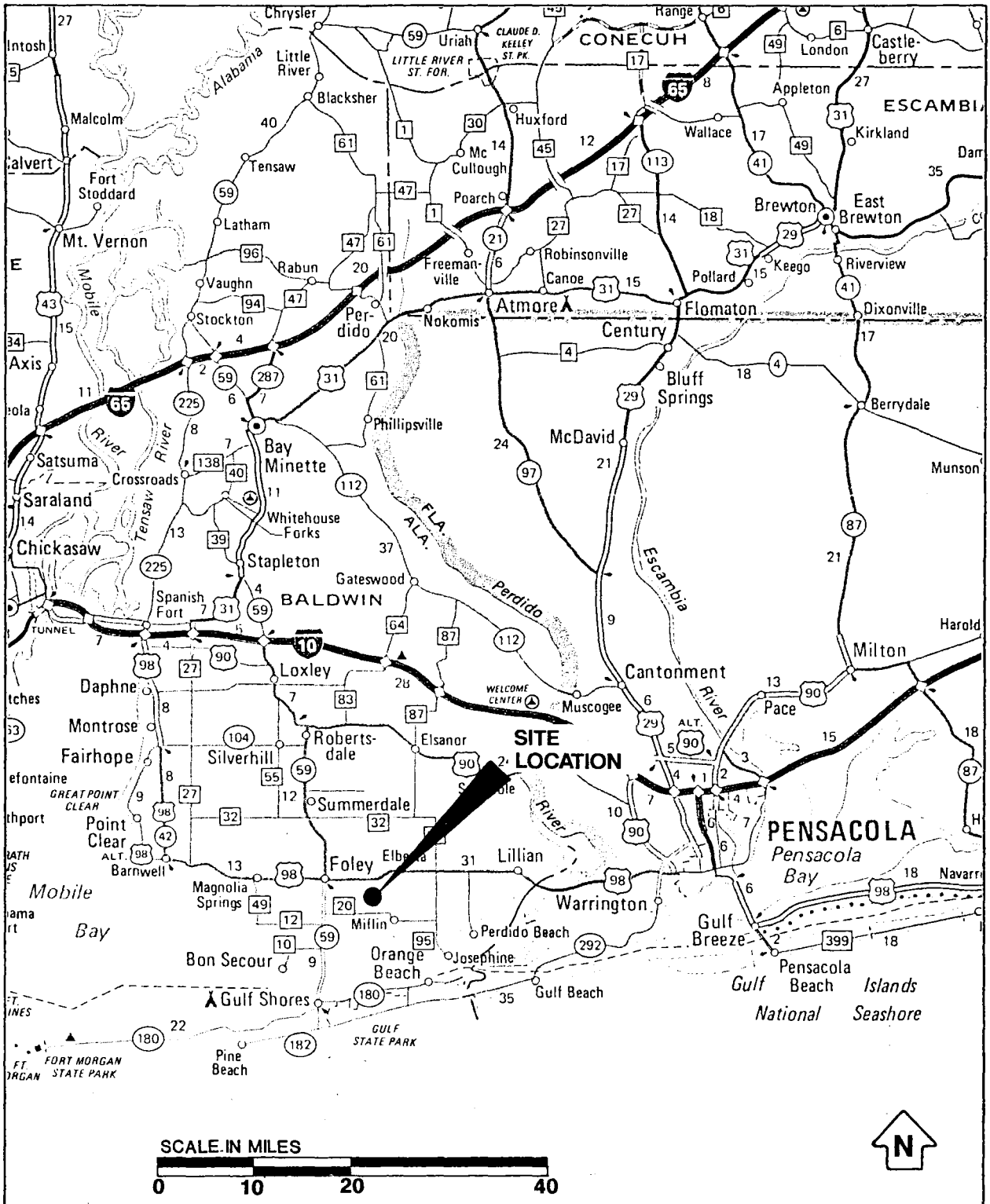


FIGURE 1-1

LOCATION OF OLF BARIN
FOLEY, ALABAMA

WORK PLAN
SITE INSPECTION

OLF BARIN
FOLEY, ALABAMA

(NEESA) in December 1988. Five potential contaminant sources were identified in the PA, and a Site Inspection (SI) was recommended. This work plan presents investigatory operations that will be completed during the SI. The objectives of the SI are as follows:

- verify the existence of contamination,
- gather information to be used in determining a future course of action, and
- gather information pertinent to the Hazard Ranking System (HRS) scoring.

1.1.1 OLF Barin Preliminary Assessment The site visit for the PA at OLF Barin was conducted from September 27 to October 4, 1988. The PA was conducted at OLF Barin in response to the discovery that the two production wells at OLF Barin are contaminated with trans-1,2-dichloroethylene, tetrachloethylene, and trichloroethylene. The goal of the PA was to identify the potential source or sources of the contamination and determine if other areas of OLF Barin may also be contaminated.

Three possible sources of groundwater contamination were identified during the PA. They are the abandoned underground tanks near the dismantled hangars, run-off from small spills and maintenance operations conducted at the airfield during WW II and the Korean conflict, and the county landfill located west of the airfield. It is unlikely that the contamination came from the county landfill due to the expected direction of local groundwater flow.

OLF Barin is now a small Naval facility. Little if any hazardous materials are used, generated, or disposed of by the airfield. OLF Barin does not conduct airplane or vehicle maintenance and has no capability to fuel either airplanes or ground support vehicles. OLF Barin has no active underground storage tanks (UST) and no active landfills on station property. In addition, no known inactive landfills with hazardous wastes were reported to exist at OLF Barin.

The PA recommended that an SI be undertaken at five sites at OLF Barin to: (1) gather more information on the extent of groundwater contamination as noted in groundwater samples obtained from the facility's two, not in use, production wells, (2) determine the status of the underground storage tanks and associated piping system, and (3) ascertain if three of the identified past disposal or spill sites received hazardous wastes or are contaminated.

The five sites, which are described in detail in Sections 2.2.1 through 2.2.4, include:

Site 19B - Maintenance Area Around the Hangars,
Site 20B - Abandoned Underground Storage Tanks and Fuel Pits,
Site 21B - Rubble Landfill,
Site 22B - Old Fire Fighting Demonstration Area, and
Site 23B - Drainage Ditch leading to Sandy Creek.

The locations of these sites are indicated on Figure 1-2 (Appendix A). As specified by Southern Division, the identification numbers for the five OLF Barin sites reflect the continuation of the numbering scheme established at NAS Whiting Field, which has 18 identified sites.

1.2 WORK PLAN OVERVIEW. On January 20, 1989, E.C. Jordan Co. (Jordan) was contracted by Southern Division, Naval Facilities Engineering Command, to develop a Work Plan to conduct an SI at OLF Barin. This investigation will concentrate on the five sites identified in the PA compiled by NEESA in their February 1989 report.

As identified in the PA, Sites 19B and 20B appear as separate and distinct sites. In terms of the operations that historically occurred at NAAS Barin, this distinction is correct. However, when considering these sites as potential sources of groundwater contamination, their close proximity to one another makes this distinction less clear. In addition, by concurrently conducting the exploration of Sites 19B and 20B, a more cost-effective program will be implemented. Nevertheless, it will be the intent of this SI to identify the potential of each individual site to contribute to groundwater contamination, if any.

1.2.1 Task Summary This work plan document describes the scope of work and methodology to conduct the SI. The scope of work for the SI includes six tasks. These tasks are:

- Task 1 - Exploration and Sampling Program,
- Task 2 - Elevation Survey,
- Task 3 - Analytical Program,
- Task 4 - Evaluation and Preliminary Draft Report,
- Task 5 - Final Site Inspection Report, and
- Task 6 - Meetings

In addition, the field program Quality Assurance Program Plan (QAPP) and a Health and Safety Plan (HASP) have been prepared as appendices to this Work Plan.

1.2.2 Quality Assurance Program Plan The QAPP provides methods, criteria, and guidelines by which the field and laboratory programs will be conducted. The plan establishes the methods of quality assurance/quality control (QA/QC) for sampling and laboratory analysis. The site-specific Quality Assurance Plan Addendum specific to the program for OLF Barin is presented in Appendix B. The field program Quality Assurance Plan is presented as Appendix C to this Work Plan.

1.2.3 Health and Safety Plan The HASP describes Jordan's health monitoring and safety training program and presents the site-specific health and safety requirements for conducting the field operations of the SI. The HASP also includes a presentation of the training experience for the personnel scheduled to work at OLF Barin. The HASP for this project is included as Appendix D to this Work Plan.

1.3 INITIAL IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS. Applicable federal and state public health and environmental regulatory requirements must be identified and compiled when developing and implementing Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remedial actions. Section 121 of CERCLA, as amended by Superfund Amendments and Reauthorization Act (SARA), requires that CERCLA-mandated hazardous waste remedial actions comply with not only applicable requirements, but also relevant and appropriate requirements. While not legally applicable, these relevant and appropriate requirements address situations sufficiently similar to those encountered at a site so that their use is well-suited to the particular site. Applicable or relevant and appropriate requirements (ARARs) include federal requirements and those state requirements that are more stringent, legally enforceable, and consistently enforced statewide. The U.S. Environmental Protection Agency (USEPA) has developed procedures for Superfund compliance with ARARs.

ARARs are defined by the USEPA as follows.

- Applicable Requirements: cleanup standards, standards of control, or other substantive environmental requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance at a CERCLA site. An example of an applicable requirement is the use of maximum contaminant levels (MCLs), promulgated under the Safe Drinking Water Act (SDWA), for a site where groundwater contamination is entering a public water supply.

- Relevant and Appropriate Requirements: federal- and state-promulgated cleanup standards, standards of control, or other substantive environmental protection requirements, criteria, or limitations that, while not legally applicable, can be applied if, in the decision-maker's best professional judgement, site circumstances are similar to jurisdictionally covered situations, and use of the requirement makes good sense. The term "relevant" is included so that requirements initially screened out as non-applicable because of jurisdictional restrictions can be reconsidered. For example, MCLs would be relevant and appropriate requirements for use at a site where groundwater contamination could affect a potential, as opposed to an actual, drinking water source. Under CERCLA, relevant and appropriate requirements should be given the same weight for consideration as applicable requirements.

- To Be Considered Materials (TBCs): federal and state non-promulgated advisories or guidance documents that do not have ARAR status. If there are no specific ARARs for a chemical or situation, or if existing ARARs are not deemed sufficiently protective, then guidance or advisory criteria should be identified and used to better ensure public health and environmental protection.

ARARs may be characterized as chemical-, location-, or action-specific. Chemical-specific requirements are used to determine the remedial action objectives because they set health- or risk-based concentration limits or discharge limitations in various environmental media for specific hazardous substances, pollutants, and contaminants. They govern the extent of site

remediation by providing either actual clean-up levels or a basis for calculating such levels.

Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific locations. Site features governed by location-specific ARARs may include natural features such as wetlands, floodplains, and sensitive ecosystems. In addition, places of historical or archeological significance may also be governed by regulatory requirements.

Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These requirements are triggered by the particular activities that are selected to accomplish a remedial action. These action-specific requirements do not in themselves determine the remedial action; rather, they indicate how a selected remedial action must be achieved.

ARARs are considered at six decision points during the RI/FS.

- Field Investigation. Consider ARARs when determining the data to be collected in the field investigation.

- Public Health Evaluation. Consider ARARs during the analysis of risk to public health and the environment.

- Development of Remedial Response Objectives. Consider ARARs when developing target clean-up levels.

- Identification of Technologies and Development of Alternative. Identify ARARs so that alternatives developed will be consistent with ARARs, meet target clean-up levels, and consider site conditions and features.

- Initial Screening of Remedial Alternatives. Consider ARARs when assessing the effectiveness of an alternative, as defined in 40 Code of Federal Regulations (CFR) 300.68(f)(3).

- Detailed Analysis of Remedial Alternatives. Evaluate each alternative to the extent it attains or exceeds ARARs, as defined in 40 CFR 300.68-h(2)(iv).

Preliminary ARARs have been identified for the OLF Barin SI and take into account the following factors:

- chemicals suspected to be on site,
- types of media to be sampled, and
- potential transport mechanisms.

The preliminary list of chemical-specific ARARs is presented in Table 1-1 and Table 1-2. The ARARs are listed by the medium potentially requiring remedial action. Because treated groundwater could be discharged to surface water as part of a remedial alternative or there could be air emissions, ARARs for such

TABLE 1-1
PRELIMINARY CHEMICAL-SPECIFIC ARARs

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

ARARs	Requirement synopsis/consideration in the SI
GROUNDWATER	
Federal ARARs	
Safe Drinking Water Act - Maximum Contaminant Levels (MCLs) [as promulgated in the National Primary Drinking Water Regulations (40 CFR 141.11-141.16)]	MCLs have been promulgated for a number of common organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies, and are considered relevant and appropriate for groundwater aquifers used for drinking water. When the risks to human health due to consumption of groundwater are assessed, concentrations of contaminants should be compared to their MCLs. MCLs will be used to set target cleanup levels.
SDWA - Maximum Contaminant Level Goals (MCLGs)	MCLGs are health-based criteria that are relevant and appropriate for drinking water sources, under SARA, when extraordinary risks exist and may be considered relevant and appropriate for remedial actions. These goals are available for a number of organic and inorganic contaminants.
Federal Ambient Water Quality Criteria (AWQC)	Federal AWQC are health-based criteria that have been developed for 95 carcinogenic and noncarcinogenic compounds. AWQC should be used in characterizing human health risks due to contaminant concentrations in groundwater. Under SARA, AWQC should be considered an ARAR.
Resource Conservation and Recovery Act (RCRA) - Subtask F, Groundwater Protection Standards (40 CFR 264.94)	RCRA maximum concentration limits, background concentrations, and alternate concentration limits (ACLs) are three possible standards available under Subpart F for setting a cleanup level for remediating groundwater contamination from a RCRA facility. The standards may be relevant and appropriate and may be used to identify appropriate clean-up levels.

TABLE 1-1 (Cont.)
PRELIMINARY CHEMICAL-SPECIFIC ARARs

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

ARARs	Requirement synopsis/consideration in the SI
Federal Advisories and Guidance To Be Considered	
Health Advisories (USEPA Office of Drinking Water)	Health advisories are estimates of risk due to consumption of contaminated drinking water; they consider noncarcinogenic effects only. They are to be considered in the public health and environmental assessment.
USEPA Risk Reference Doses (RfDs)	RfDs are dose levels developed by USEPA for noncarcinogenic effects. They are used to characterize risk due to exposures to contaminants in groundwater, as well as other media. They are to be considered in the public health and environmental assessments.
EPA Risk Reference Assessment Group - Potency Factors	Potency factors are developed by USEPA from Health Effects Assessments (HEAs) or evaluations by the Carcinogen Assessment Group. USEPA carcinogenic potency factors are used to compute the individual incremental cancer risk resulting from exposure to contaminants. They are to be considered in the public health and environmental assessments.
Acceptable Intake - Chronic (AIC) and Subchronic (AIS) - EPA Health Assessment Documents	AIC and AIS values are developed from RfDs and HEAs for noncarcinogenic compounds and are used to characterize the risk due to several noncarcinogens in various media.
USEPA Office of Water Guidance - Water Related Fate of 129 Priority Pollutants (1979)	This guidance manual gives transport and fate information for 129 priority pollutants and will be used to assess the transport and fate of a variety of contaminants.

TABLE 1-1 (Cont.)
PRELIMINARY CHEMICAL-SPECIFIC ARARs

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

ARARs	Requirement synopsis/consideration in the SI
DISCHARGE TO SURFACE WATER	
Federal Guidance and Criteria To Be Considered	
Federal Ambient Water Quality Criteria	Federal AWQC are health-based criteria that have been developed for 95 carcinogenic compounds. AWQC may be used for setting limits for discharge to surface water.
SOILS	
Federal Guidance and Criteria To Be Considered	
Toxic Substance Control Act (TSCA) (15 USC 2601)	
PCB Requirements (40 CFR 761)	This portion of TSCA sets allowable limits for the concentration of PCBs in soils. TSCA may set cleanup limits for PCBs found in soils.
TSCA Health Data, Chemical Advisories, and Compliance Program Policy	This portion of TSCA contains health data and chemical advisories for contaminants that may be found at the site. These advisories and health data will be considered in the public health assessment.

TABLE 1-2
CHEMICAL-SPECIFIC ARARS
USEPA TARGET COMPOUND LIST

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

	Federal MCL[1] (ug/l)	Federal MCLG[1] (ug/l)	Federal AWQC aquatic orgnaisms[2] (ug/l)	Federal AWQC human health[3] (ug/l)	Federal proposed MCL[4] (ug/l)	Federal proposed MCLG[4] (ug/l)
VOLATILE ORGANIC COMPOUNDS						
Chloromethane				0(0.19)		
Bromomethane				0(0.19)		
Vinyl Chloride	2	0		0(2.0)		
Chloroethane			IND	IND		
Methylene Chloride			11,000[a]	0(0.19)		
Acetone						
Carbon Disulfide						
1,1-Dichloroethene	7	7	11,600[a]	0(0.003)	7	7
1,1-Dichloroethane						
1,2-Dichloroethene (total)		70	IND	IND	70	70
Chloroform	100		1,240[b]	0(0.19)		
1,2-Dichloroethane	5	0	20,000	0(0.94)		
2-Butanone						
1,1,1-Trichloroethane	200	200	18,000[a]	18,400		
Carbon Tetrachloride	5	0	35,200[a]	0(0.4)		
Vinyl Acetate						
Bromodichloromethane	100		11,000[a]			
1,2-Dichloropropane		6	5,700[b]	IND	5	0
Trans-1,3-Dichloropropene			244[b]	87		
Trichloroethene	5	0	21,900[b]	0(2.78)		
Dibromochloromethane	100		11,000[a]	0(0.19)		
1,1,2-Trichloroethane			9,400[b]	0(0.6)		
Benzene	5		5,300[a]	0(0.66)		1
Cis-1,3-Dichloropropene			244[b]	87		
2-Chloroethylbinylether						
Bromoform	100		11,000[a]			
4-Methyl-2-Pentanone						
2-Hexanone						
Tetrachloroethene		0	840[b]	0(0.80)	5	0
1,1,2,2-Tetrachloroethane			9,320[a]	0(0.17)		
Toluene			17,500[a]	18,300	2,000	2,000
Ethylbenzene		680	32,00[a]	14,000	700	700
Chlorobenzene		60	50[b]	488	100	100
Styrene		140			5	0
Xylenes (Total)		440			10,000	10,000
INORGANIC COMPOUNDS						
Aluminum			87[e]	146		
Antimony			1,600[b]			
Arsenic	50	50	190[e]	0.0022	0	30
Barium	1,500	1,000		1,000	5,000	5,000
Beryllium			5.3[b]	0(0.0068)		
Cadmium	10	5	1.1[c]	10	5	5
Calcium						
Chromium	50	12			100	100
Chromium VI	50	12	11	50		
Chromium III			210[c]	170,000		
Cobalt						
Copper		1,300	12[c]	1,000[f]		
Iron			1,000			
Lead	50	20	3.2[c]	50	5	0
Magnesium						
Manganese				50		
Mercury	3	2	0.012[e]	0.144	2	2
Nickel			160[c]	13.4		
Potassium						
Selenium	45	10	5[e]	10	50	50
Silver	50		0.12[e]	50	90	
Sodium						
Thallium			40[b]	13		
Vanadium						
Zinc			110[c]	5,000[f]		

TABLE 1-2 (Continued)
CHEMICAL-SPECIFIC ARARS
USEPA TARGET COMPOUND LIST

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

	Federal MCL[1] (ug/l)	Federal MCLG[1] (ug/l)	Federal AWQC aquatic orgnaisms[2] (ug/l)	Federal AWQC human health[3] (ug/l)	Federal proposed MCL[4] (ug/l)	Federal proposed MCLG[4] (ug/l)
SEMIVOLATILE ORGANIC COMPOUNDS						
3-Nitroaniline				0.0028		
Acenaphthene			520b	70		
2,4-Dinitrophenol						
4-Nitrophenol						
Dibenzofuran						
2,4-Dinitrotoluene				0(0.11)		
Diethylphthalate				434,000		
4-Chlorophenyl-phenylether						
Fluorene				0.0028		
4-Nitroaniline						
4,6-Dinitro-2-methylphenol						
N-Nitrosodiphenylamine				0(4.9)		
4-Bromophenyl-phenylether						
Hexachlorobenzene			50[b]	0.021		
Pentachlorophenol		220	13[e]	1010	200	
Phenanthrene				0.0031		
Anthracene			6.3[d]	0.0031		
Di-n-butylphthalate				34,000		
Fluoranthene			3,980[a]	42		
Pyrene				0.0028		
Butylbenzylphthalate						
3,3'-Dichlorobenzidine				470		
Benzo(a)Anthracene				0.0028		
Chrysene				0.0028		
bis(2-Ethylhexyl)phthalate			3[b]			
Di-n-octylphthalate						
Benzo(b)Fluoranthene				0(0.0028)		
Benzo(k)Fluoranthene				0(0.0028)		
Benzo(a)Pyrene				0(0.0028)		
Indeno(1,2,3-cd)pyrene				0(0.0028)		
Dibenz(a,h)anthracene				0(0.0028)		
Benzo(g,h,i)perylene				0(0.0028)		
Phenol			2,560[b]	3,500		
bis(2-Chloroethyl)ether				0(30 ng/l)		
2-Chlorophenol			2,000[b]	0.1[f]		
1,3-Dichlorobenzene	750	750	763[b]	400	75	75
1,4-Dichlorobenzene			763[b]	400		
Benzyl alcohol						
1,2-Dichlorobenzene		620	763[b]	400	600	600
2-Methylphenol						
bis(2-Chloroisopropyl)ether				34.7		
4-Methylphenol						
N-Nitroso-di-n-propylamine						
Hexachloroethane			5,850[b]	0(1.9)		
Nitrobenzene			27,000[a]	19,800		
Isophorone			117,500[a]	5,200		
2-Nitrophenol						
2,4-Dimethylphenol			2,120[a]	400[f]		
Benzoic acid						
bis(2-Chloroethoxy)methane						
2,4-Dichlorbenzene			763[b]	3,090		
Naphthalene			920[b]	IND		
4-Chloroaniline						
Hexacholorobutadiene			9.3[b]	0(0.45)		
4-Chloro-3-Methylphenol			30[a]	3,000		
2-Methylnaphthalene				0.0028		
Hexachlorocyclopentadiene			5.2[b]	206		
2,4,6-Trichlorophenol			970[b]	0(1.8)		
2,4,5-Trichlorophenol				2,600		
2-Chloronaphthalene			IND	IND		
2-Nitroaniline						
Dimethylphthalate				350,000		
Acenaphthylene				0.0028		
2,6-Dinitrotoluene						

TABLE 1-2 (Continued)
CHEMICAL-SPECIFIC ARARS
USEPA TARGET COMPOUND LIST

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

	Federal MCL[1] (ug/l)	Federal MCLG[1] (ug/l)	Federal AWQC aquatic orgnaisms[2] (ug/l)	Federal AWQC human health[3] (ug/l)	Federal proposed MCL[4] (ug/l)	Federal proposed MCLG[4] (ug/l)
PESTICIDES AND POLYCHLORINATE BIPHENYLS (PCB) COMPOUNDS						
alpha-BHC			100[a]	0.073		
beta-BHC				0.0233		
delta-BHC			IND	IND		
gamma-BHC (lindane)	4	0.2		0.0174	0.2	0.2
Heptachlor			0.0038[e]	0.0011	0.4	0
Aldrin			3.0[d]			
Heptachlor epoxide		0			0.2	0
Ensosulfan I			0.056[d]	138		
Dieldrin			0.0019[d]	0(1.1 ng/l)		
4,4'-DDE			1,050[a]			
Endrin	0.2		0.0023[d]	1		
Endosulfan II						
4,4'-DDD						
Endrin Aldehyde			0.001[d]			
Endosulfan sulfate						
4,4'-DDT			0.001[d]	0(1.2 ng/l)		
Methoxychlor	340	100			400	400
Endrin ketone						
alpha-Chlordane		0	0.0043[d]	0(0.022)	2	0
gamma-Chlordane		0		0(0.022)		
Toxaphene	5	0	0.0002[a]	0(0.026)	5	0
PCBs (as decachlorophenol)						
Aroclor-1016				0(>0.0126)	0.5	0
Aroclor-1221				0(>0.0126)		
Aroclor-1232				0(>0.0126)		
Aroclor-1242				0(>0.0126)		
Aroclor-1248				0(>0.0126)		
Aroclor-1254				0(>0.0126)		
Aroclor-1260				0(>0.0126)		
PCBs (total)			0.014[e]			

NOTES: ug/l - micrograms per liter
MCL - Maximum Contaminant Level
MCLG - Maximum Contaminant Level Goal
AWQC - Ambient Water Quality Criteria
IND - Insufficient data
1 - Taken from Superfund Public Health Evaluation Manual (SPHEM), Oct. 1987 Update on Table 4-7
2 - AWQC for the protection of aquatic life - lowest available number is presented (USEPA, 1986)
3 - AWQC for the protection of human health - from effects through ingestion and contaminated aquatic organisms (USEPA, 1986)
4 - Proposed MCL, MCLGs as reported in Federal Register May 1989
a - Acute lowest observed effect level (LOEL)
b - Chronic LOEL
c - Hardness based criteria (based on 100 mg/l as $CaCO_3$)
d - Acute criteria
e - Chronic criteria
f - Organoleptic, criteria based on odor and taste, not health. No health-based criteria available.

discharges are also listed. Table 1-3 lists the preliminary location-specific ARARs by site features that may be potentially affected by remedial actions (i.e., wetlands).

1.4 DATA QUALITY OBJECTIVES. Data Quality Objectives (DQO) are based on the concept that different data uses may require different quality data. Data quality is the degree of certainty with respect to precision, accuracy, reproducibility, completeness, and comparability of a data base. DQOs are qualitative and quantitative statements specifying the quality of data required to support SI activities (including field screening or site characterization). Five general levels of analytical options to support data collection are identified by Comprehensive Environmental Response, Compensation and Liability Act. The Navy has adopted three of the analytical levels as QC requirements. They are D, C, and E, which correlate with Levels 3, 4, and 5 described in *Data Quality Objectives for Remedial Response Activities Development Process* by the USEPA. These levels are based on the type of site to be investigated, the level of accuracy and precision required, and the intended use of the data. Analytical requirements for USEPA Levels 1 and 2 have not yet been defined by the Navy.

A brief description (as presented in *Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program*, Oak Ridge Gaseous Diffusion Plant, June 1988) of each level is provided below:

USEPA Level I - Field Screening. This level of data quality is the lowest, but provides the most rapid results. It is used to assist in the optimization of sampling locations and for health and safety support. Data generated provides presence or absence of certain constituents and is generally qualitative rather than quantitative.

USEPA Level II - Field Analysis. This level of data quality is characterized by the use of analytical instruments that are carried in the field and the use of mobile laboratories. Depending on factors such as instrumentation and environmental matrix, data may be either qualitative or quantitative.

Navy Level C QC. A site requiring Level C QC would be a site near a populated area, not on the National Priority List (NPL), and not likely to be undergoing litigation. Level C QC includes review and approval of the laboratory QA and the site work plan. The laboratory that performs Level C QC must have passed the performance sample furnished by the Superfund Contract Laboratory Protocol (CLP) in the past year. The laboratory does not need to be receiving CLP bid lots of samples.

Level C allows the use of non-CLP methods but requires that the methods be accepted USEPA methods or be equivalent to USEPA methods. The laboratory must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit, and provide monthly progress reports (MPRs) on QA. These audits will be administered and evaluated by the NEESA Contract Representative (NCR). The Navy audit and performance sample are required in addition to any specified by the USEPA Superfund Program.

TABLE 1-3
PRELIMINARY LOCATION-SPECIFIC ARARs

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

ARARs	Requirement Synopsis/Consideration in the SI
Federal ARARs	
National Environmental Policy Act (NEPA) (40 CFR 6, Appendix A)	Appendix A, Wetlands Executive Order, requires that wetlands assessment be incorporated into the analysis of remedial alternatives. An alternative located in a wetland may not be selected unless a determination is made that no practicable alternative exists outside the wetland.
Endangered Species Act (16 USC 1531, 50 CFR Parts 81, 225, and 402)	The Preliminary Assessment has determine that endangered and threatened species could occur on the activity. Work conducted at the activity may have to consider the habitats occupied by endangered and threaten species.
Fish and Wildlife Coordination Act (16 USC 661 Note)	The Fish and Wildlife Coordination Act requires that the U.S. Fish and Wildlife Services and other related state agencies be consulted before wetlands are modified.
Fish and Wildlife Conservation Act (16 USC 2901, 50 CFR Part 83)	The Fish and Wildlife Conservation Act requires that U.S. Fish and Wildlife Services and other related state agencies be consulted before wetlands are modified.
Fish and Wildlife Improvement Act (16 USC 742)	The Fish and Wildlife Improvement Act requires that the U.S. Fish and Wildlife Services and other related state agencies be consulted before wetlands or other habitats are modified.
Protection of Archaeological Resources (32 CFR Part 229, 229.4; 43 CFR Part 107, 171.1 - 171.500)	Any excavations on the site must address archaeological resources found during the excavation.

Navy Level D QC. Level D QC is to be used for sites that are on or about to be on the NPL. These sites are typically near populated areas and are likely to undergo litigation. Level D QC includes review and approval of the laboratory QA plan, the site work plan, and the field QA plan. The laboratory must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit, and provide MPRs on QA. These activities will be administered and evaluated by the NCR. This audit and the analysis performance sample are in addition to those related to the USEPA Superfund Program. The laboratory that performs Level D QC must have passed the performance sample furnished through the Superfund CLP and must be able to generated CLP deliverables. For a Level D site, CLP methods are used and the CLP data package generated. The Navy audit and performance sample are required in addition to any specified by the USEPA Superfund Program.

Navy Level E QC. A site requiring Level E QC will be located away from a populated area, will not be an NPL site, and will have a low probability of litigation. Level E QC includes review and approval of the laboratory QA plan and the site work plan. The laboratory must successfully analyze a performance sample, undergo an audit, correct deficiencies found during the audit, and provide MPRs on QA. For Level E, the laboratory is not required to have passed a CLP performance sample. Level E allows the use of non-CLP methods but requires that the methods be accepted USEPA methods. All methods used must be USEPA or equivalent.

Specifics regarding QA/QC, validation, and uses of each level of data are described in the Navy's *Sampling and Chemical Analysis Quality Assurance Requirements For The Navy Installation Restoration Program* (Oak Ridge Gaseous Diffusion Plant, 1988) and USEPA Office of Emergency and Remedial Response and Office of Waste Programs Environmental Enforcement Guidance, *Data Quality Objectives for Remedial Response Activities* (March 1987).

At OLF Barin the reporting requirement for legally defensible data is not necessary because the Navy is taking the necessary steps, under its IR Program, to rectify past Navy and Marine Corps waste disposal practices. Data Quality Level C is intended for sample analysis.

Table 1-4 summarizes the analytical parameters, data quality objectives, and data use for each task to be undertaken during SI activities at OLF Barin.

1.5 PROJECT LOGISTICS. This section is devoted to the logistics of onsite field work to be conducted at OLF Barin. The following sections address the logistics of communications, field operations, decontamination facilities, and disposal of wastes.

1.5.1 Communications Field personnel will use telephones while on the base to communicate with off-base parties and will have a list of emergency phone numbers available at all times. Daily communications for access needs and scheduling site operations will be coordinated with one representative from NAS Whiting Field and one representative from OLF Barin.

TABLE 1-4
DQOs FOR EACH SAMPLING TASK

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

Activity	Objectives	Data Quality Objective: Level	Data Quality Objective: Rationale
Aquifer Testing tion	Data will be used for evaluation of alternatives	II	Data necessary for transport characteriza- Feasibility Study and Risk Assessment
Groundwater Analysis	Data will be used to characterize extent of groundwater contamination	C	Data necessary for HRS Scoring, Risk Assessment, and Feasibility Study
Surface Water Sediment Analysis	Data will be used to identify environmental impact	C	Data necessary for HRS Scoring and will support Risk Assessment
Soil Analyses	Data will be used to evaluate exposure potential	C	Data necessary for HRS Scoring, Risk Assessment, and Feasibility Study
Air Survey	Monitor breathing space	I	Health and Safety

HRS - Hazard Ranking System

1.5.2 Field Operations Soil boring locations and monitoring well locations will be determined by the Contractor performing the Site Inspection. These locations will be checked and approved by representatives from NAS Whiting Field Public Works Department (Public Works) and OLF Barin's Airfield Operations.

Potable water, which is necessary for drilling and decontamination procedures, will be obtained at locations on OLF Barin specified by Public Works. Due to known contamination of groundwater in the two existing supply wells at OLF Barin, potable water will be obtained on base only if a proposed activated carbon filter unit is in place and operational. If an adequate potable water source is not available at OLF Barin, potable water will be obtained by the drilling subcontractor at a source approved by the Contractor. In either case, field blanks will be obtained and analyzed during the course of the site inspection for quality assurance purposes.

1.5.3 Decontamination Facilities The field work at the OLF Barin sites will require mobilization and field support for subcontractors, sampling crews, and survey crews. Staging and decontamination facilities will be needed to conduct these operations. Staging of the field operations will be done from vehicles used by the Contractor. These vehicles will be parked in uncontaminated areas identified at each site and will not require decontamination.

Decontamination zones for personnel and equipment used during the SI will be established at locations to be determined for each site. All contaminated materials and protective gear will either be disposed of or decontaminated in these areas before site personnel proceed into the clean zone. The specific decontamination procedures to be employed are outlined in Section 9.0 of the HASP.

A heavy equipment decontamination zone will be designated at each site. Drill rigs, casing, rods, and associated equipment will be decontaminated and steam cleaned prior to setting up at each boring or monitoring well location. In addition, the drill rig and all tools will be decontaminated prior to entering and leaving OLF Barin. Sampling tools will be decontaminated more frequently as required by the sampling protocol provided in the QAPP.

1.5.4 Disposal of Wastes All fluids generated during personnel and equipment decontamination will be containerized onsite, inside of the contamination reduction area. Contaminated items such as disposable safety and sampling equipment will be placed in doubled plastic bags that will be collected daily and stored in Department of Transportation (DOT) approved 55-gallon drums with locking ring lids. The drums will be supplied by the drilling subcontractor and left onsite for future transportation by the Department of the Navy to a suitable disposal facility. This will be coordinated with NAS Whiting Field's Public Works Department.

Drilling fluids, drill cuttings, and water resulting from monitoring well installation and development will be monitored for contamination using a portable photoionization meter. All borehole cuttings and development water will be contained in DOT 17-C open-top 55-gallon drums, permanently labeled by well number and stored in a location designated by the NAS Whiting Field's Environmental Coordinator. This requirement may be waived if approval is given in writing by the Engineer in Charge (EIC). The Navy will be responsible for disposal.

1.5.5 Sample Identification and Chain of Custody All samples collected during the field investigation will be labeled with a sample identification code that identifies the site, sample location, sample type, and series numbers for sample locations with multiple samples.

The samples at the OLF Barin sites will be labeled using the following system.

- Site. Always WHF-XXX, where "WHF" refers to NAS Whiting Field, which administers OLF Barin, and "XXX" refers to the site number, production well number, or stream sampling location.

- Sample Type.

MW - Monitoring Well	SD - Sediment
RW - Residential Well	SW - Surface Water
WP - Well Point	AR - Air (residential)
SL - Sludge	BN - Benthos
SS - Surface Soils	FB - Field Blank
SG - Soil Gas	TB - Trip Blank
	EB - Sampler Blank

- Sample Location. Sample locations will be indicated by a number that corresponds to the sample collection location and will be used in combination with the sample type. For example, sample WHF-XXX-SW-3 is a surface water sample collected at location 3 as shown on a Site Plan for Site XXX.

- Sample Number. For circumstances where multiple samples will be collected from the same location, each sample will be consecutively numbered. For example, WHF-XXX-SW-3-01 and WHF-XXX-SW-3-02 are surface water samples collected at the same location but at different times. For soil boring, the number designating the boring location will be followed by a sample depth range in parenthesis. A sample collected at WHF-XXX-SS-01 from a depth of 4 to 5 feet will be designated:

  WHF-XXX-SS-01(4-5)-1

For duplicates, a letter designation will be used for the duplicate sample. For example, the duplicate of WHF-XXX-01(4-5)-1 will be:

WHF-XXX-SS-01(4-5)A-1

If a duplicate is taken at the point again, the number would become:

WHF-XXX-SS-01(4-5)A-2

Chain of custody procedures as outlined in Section 7.0 of the QAPP will be followed during all SI activities.

2.0 PURPOSE AND SCOPE

The technical approach for the OLF Barin SI has been developed based on a review of the PA for OLF Barin, a site reconnaissance conducted on February 8, 1989, and discussions with U.S. Navy officials, which included personnel from Southern Division and NAS Whiting Field's Public Works Department.

The purpose of this SI will be to assess whether specific toxic and hazardous materials identified in the PA, and possibly other contaminants, are present in concentrations considered to be hazardous to human health and the environment. Information obtained during the SI will be used to make a general evaluation of existing site conditions in relation to the presence of contaminated soils and groundwater. Additional aspects to be evaluated include site hydrogeology, health and safety concerns, pertinent environmental regulations, and HRS documentation requirements. Upon completion of the SI, recommendations will be made as to whether or not a specific site should undergo a Remedial Investigation/Feasibility Study or be considered for no further action.

2.1 METHODS OF EXPLORATION. Soil borings, monitoring well installation, and aquifer testing will be performed as indicated in the Exploration and Sampling Program section of this Work Plan. To avoid repeating in each site specific exploration and sampling program section, this section describes the methods to be employed for each site.

2.1.1 Overburden Borings Shallow borings to be used for monitoring well installation will be advanced using hollow-stem auger. Geologic characteristics will be determined from overburden samples collected continuously from the ground surface to the water table using a split-spoon sampler. Split-spoon samples will also be collected at 5-foot intervals from the water table to completion depth. Completion depth in shallow overburden borings shall be approximately 7 feet below the water table.

To obtain information on the possible vertical extent of overburden contamination, overburden samples will be placed in 8-ounce driller's jars for field screening of total volatile organics in headspace. Field determination of total volatile organics in headspace will be done using an organic vapor analyzer (OVA) with a flame-ionization detector. Subsequent to headspace OVA measurements, overburden samples will be archived for use as reference materials.

Deep overburden borings will also be advanced using a hollow-stem auger. Geologic characteristics will be determined from split-spoon samples collected at 5-foot intervals and at all lithologic changes.

In addition to monitoring well installation, the purpose of the deep overburden borings is to identify the presence of a geologic stratum that can act as an aquitard and to locate zones of deep groundwater contamination. As with the shallow borings, headspace OVA measurements on collected split-spoon samples will be conducted. If headspace analysis indicates the presence of contamination, further hole advancement will continue until headspace OVA measurements indicate noncontaminated conditions. At this point, a monitoring well will be installed. Monitoring well screens for wells intersecting a contaminated zone will be either 5 feet or 10 feet in length. The length of the screen will be directly related to the thickness of the contaminated zone. However, no monitoring well screen shall exceed 10 feet in length.

If headspace OVA measurements do not indicate the presence of contamination, deep borings will be advanced until an aquitard is encountered or until a depth of 100 feet is attained. The maximum depth of any deep boring will be 100 feet.

2.1.2 Monitoring Well Installation Monitoring wells will be installed in the completed borings for the purpose of monitoring groundwater quality and assessing the direction and flux of groundwater flow in the surficial sand and gravel aquifer. The total depth of drilling is estimated at 410 linear feet and the depths, number of analytical samples, and quantities of materials for monitoring well installation are presented in Table 2-1. Monitoring well installation details are presented in Figure 2-1. The installation of monitoring wells will comply with Southern Division's *Specifications for Groundwater Monitoring Well Installation* (see Appendix B) and applicable Alabama Department of Environmental Management Guidance. Well screens for shallow monitoring wells will be placed to extend from approximately 3 feet above the anticipated highest water table elevation [i.e., 15-feet below land surface (BLS)] to approximately 7 feet below the highest water table elevation. Screen placement depth for deep monitoring wells will be determined at the time of drilling and based upon the criteria established in Section 2.1.1.

Due to the depth to groundwater, all monitoring wells will be 4 inches inside diameter to facilitate purging. Constructed thusly, they may serve as recovery wells in the event that groundwater remediation is determined to be necessary. All monitoring wells will be developed by pumping and/or surge block techniques to ensure a good hydraulic connection between the well and the aquifer. Specifications for well development are presented in Appendix B.

As stated in Southern Division's *Specifications for Groundwater Monitoring Well Installation* (see Appendix B), wells will be developed until sediment-free water is produced. However, it should be noted that shallow monitoring wells whose screens straddle the water table will not be developed in that part of the sand pack lying above the water table.

2.1.3 Aquifer Testing Subsequent to monitoring well installation and development, single-hole permeability tests to calculate the hydraulic conductivity will be performed on each new monitoring well. Both rising and falling head slug-tests will be performed in each individual well except for wells that are screened across the water table. In this case, only rising head tests will be performed. Data will be analyzed by either the method of Cooper et al. (1967) for confined conditions or the method of Bouwer and Rice (1976) for unconfined conditions.

Calculated values of hydraulic conductivity will be evaluated by means of a two-way analysis of variance to determine if (a) a significant difference in the hydraulic conductivity exists in the sand and gravel aquifer underlying OLF Barin and (b) a significant difference in the hydraulic conductivity exists between the upper and lower zones of the surficial aquifer. Comparisons shall be made at the 95-percent significance level. Should significant differences exist, a

TABLE 2-1
SUMMARY OF ESTIMATED QUANTITIES FOR
MONITORING WELL INSTALLATION AND SOIL BORINGS

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

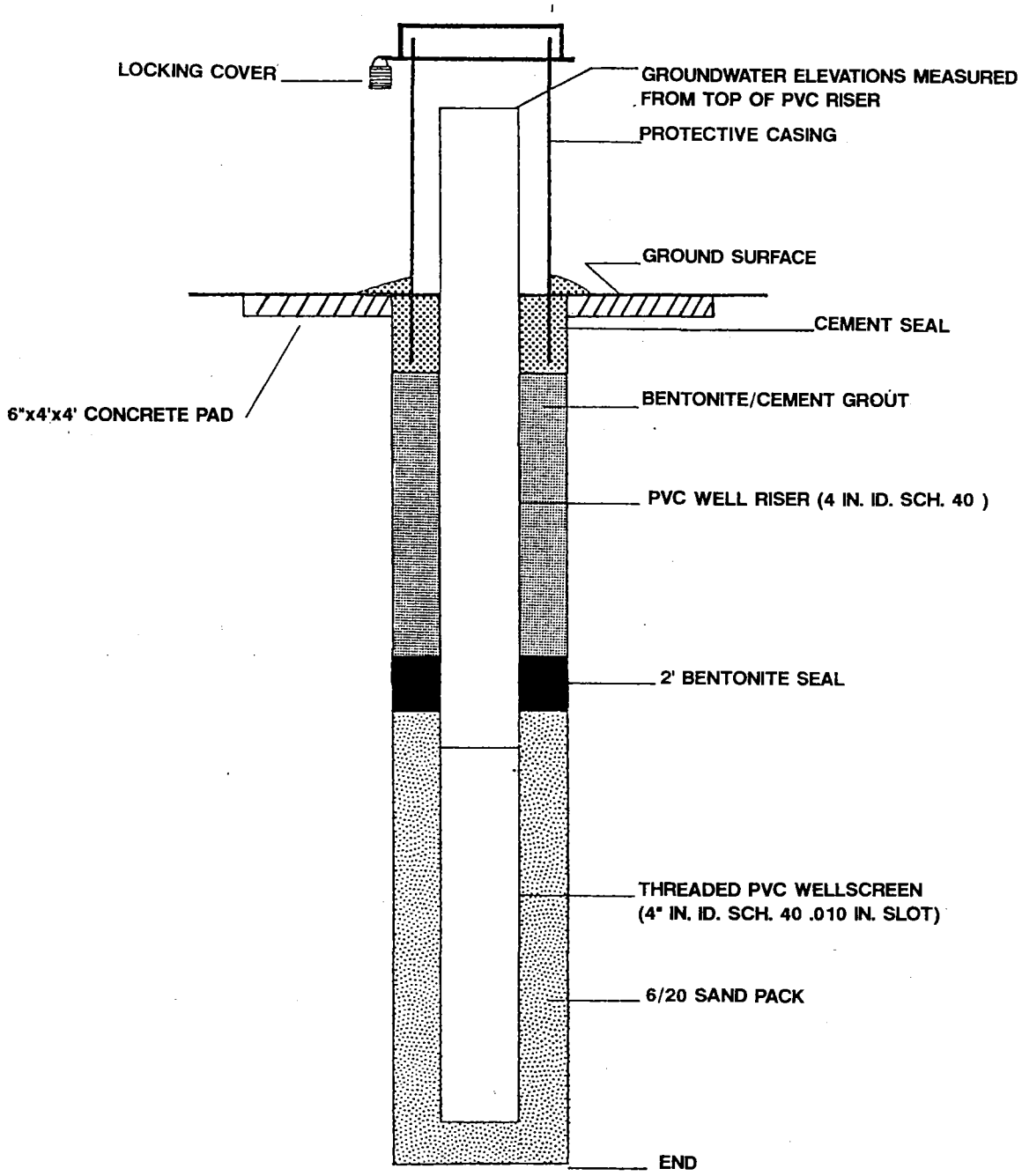
Site no.	Monitoring well	Estimated depth (ft)	Number of split-spoon samples	Well materials 4" PVC screen (ft)	4" PVC[1] riser (ft)
Site 19B	WHF-19B-1D	100	21	5 or 10	98 or 93
	WHF-19B-2D	100	21	5 or 10	98 or 93
	WHF-19B-3D	100	21	5 or 10	98 or 93
Site 20B	WHF-20B-1	22[2]	9[3]	10	15
	WHF-20B-2	22	9	10	15
	WHF-20B-3	22	9	10	15
	WHF-20B-4	22	9	10	15
	WHF-20B-5	22	9	10	15

NOTES:

[1]Length based on 3-foot riser above ground surface.

[2]Monitoring well depth based on estimated high water table depth of 15 feet below ground surface.

[3]Eight continuous split-spoon samples (0 to 16 feet BLS) plus one from 20 to 22 feet BLS.



NOT TO SCALE

FIGURE 2-1

MONITORING WELL INSTALLATION DETAIL

WORK PLAN
SITE INSPECTION

OLF BARIN
FOLEY, ALABAMA

Tukey's Test (a mean-square test) will be run to test for significant differences between individual pairs of sample means.

2.1.4 Hazard Ranking System Data Requirements To fulfill the requirements of the proposed changes of the Hazard Ranking System (i.e., HRS2), aerial photography within a 4-mile radius of OLF Barin will be reviewed with regard to land use patterns and demographics. Given the sparse population pattern in this part of Baldwin County, Alabama, aerial photography will be the easiest means of identifying potential human receptors within the 4 miles radius.

To augment information derived from the aerial photographs, records from the Baldwin County public health agency and other city, county, or state agencies that may be of interest will be reviewed to gather information on private wells and surface water use from both Sandy Creek and Wolf Creek, which are the major surface water drainages in the vicinity of OLF Barin. A private well survey will be conducted within a 0.5-mile radius of OLF Barin to supply information on groundwater use in the vicinity of OLF Barin. At this time, however, sampling of private wells is not anticipated.

A summary of the informational requirements to complete an HRS2 Scoring Package is presented in Table 2-2. This information will be gathered through records search, aerial photography interpretation, undertaking the proposed SI, and interviews with private citizens and public officials in the vicinity of OLF Barin. Preparation of the HRS2 Scoring Package will follow the proposed rule as presented in Federal Register (December 23, 1988, Vol. 53, No. 247, P. 51962-52081). If during the course of the SI the Final Rule is promulgated, the Final Rule shall govern the development of the HRS2 Scoring Package.

2.2 TASK 1 - EXPLORATION AND SAMPLING PROGRAM. The following sections describe the specific number, location, and rationale for the exploration and sampling program to be conducted at each site at OLF Barin. Background information and history of operations for each site may be found in the PA Report (NEESA Doc. 13-193) dated February 1989. A brief background summary is presented for each site.

2.2.1 Sites 19B and 20B - Maintenance Area Around the Hangars, Abandoned Underground Storage Tanks, and Fuel Pits Four aircraft maintenance hangars were located at Site 19B. Maintenance operations included the degreasing of aircraft parts and the washing of aircraft. Both operations involved the use of various solvents, including kerosene. Kerosene storage tanks, waste oil tanks, and aircraft wash racks were located at the north end of the hangars. Solvents spilled on the concrete next to the hangars would have been washed into the grass during periods of precipitation or when the concrete was washed down.

Site 20B is the location of 14 abandoned underground fuel storage tanks (of which eight of the underground tanks are now being used for water storage), 60 abandoned fuel pits, and 2.12 miles of fuel lines connecting the fueling pits to the four storage tanks. A 2,000-gallon aviation gas spill occurred in 1954 when vandals opened a valve on one of the 25,000 gallon fuel tanks. The majority of the fuel was reported to have migrated to a small unlined drainage ditch north of Guadalcanal Road (see Figure 1-2, Appendix A).

TABLE 2-2
HAZARD RANKING SYSTEM DATA NEEDS

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

I GENERAL INFORMATION

- activity's name and location
- activity's mission or purpose
- contacts
- waste types generated and disposal
- regulatory history

II ENVIRONMENTAL INFORMATION

- land use within activity boundary
- potable water system service within activity boundary
- land use within 4 miles of activity
- groundwater supplies within 4 miles of activity and surface water within 15 miles of activity
- estimated population served by groundwater within 4 miles and by surface water within 15 miles of activity
- sensitive environments on activity and within 15 miles of activity
- floodplain information
- onsite and offsite maximally exposed individuals
- climatic characterization
- drainage basin characteristics

III GEOLOGIC AND HYDROGEOLOGICAL INFORMATION

- bedrock features
- soils
- aquifer characteristics and hydraulic properties within 4 miles
- geologic formations and their characteristics within 4 miles

IV WASTE CHARACTERISTICS

- toxicity
- mobility
- quantity
- chemical and physical attributes

No information is available as to what procedures were used to abandon the underground storage tanks when the airfield was deactivated in 1959. When eight of the 25,000 gallon tanks were reactivated for water storage for fire fighting reserves, it was noted that there was fuel residue left in the tanks. Oily sheens were visible in many of the tanks during the PA visit.

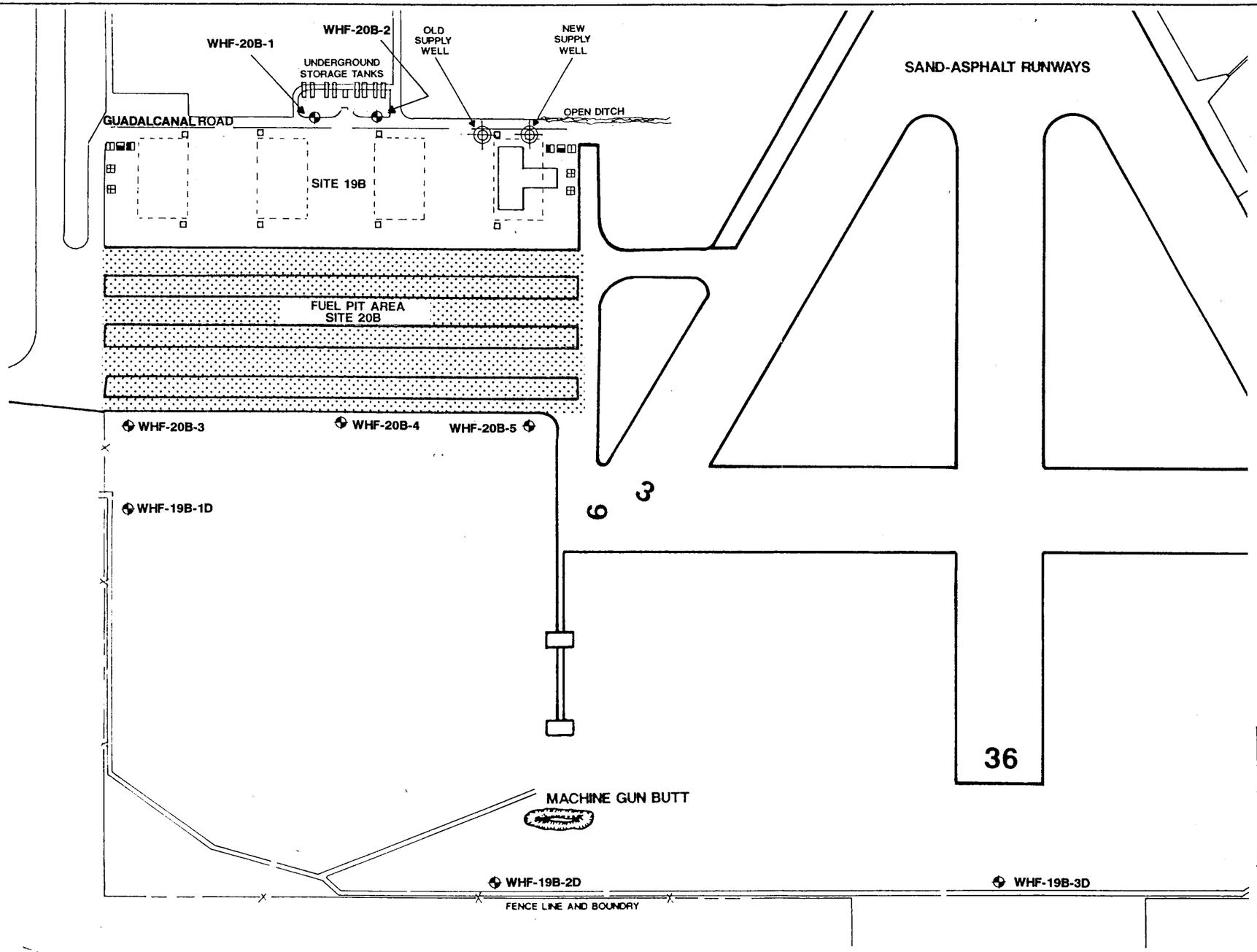
A new potable water supply well was drilled in 1988 from which chlorinated hydrocarbons were detected. Samples were also taken from the old potable water supply well (see Figure 1-2, Appendix A) and chlorinated hydrocarbons were also detected. The laboratory analysis from the sample collected from the old potable water supply well indicate that 13.2 micrograms per liter (ug/l) of trans-1,2-trichloroethylene, 6.0 ug/l of tetrachloroethylene, and 4.0 ug/l trichloroethylene, were present. The State of Alabama has permitted the well to be used for drinking water with the condition that an activated carbon filter system be installed. There is a potential that petroleum hydrocarbon contamination also exists.

Soil in this area is porous and groundwater is about 15 to 20 feet below land surface. Solvents washed down from the maintenance areas, fuel spilled during aircraft refueling activities, and a portion of the fuel spilled as a result of the 1954 vandalism incident would have most likely infiltrated into the soil. Groundwater contamination found in an onsite drinking water supply well may be evidence of such infiltration.

Because of the close proximity of Sites 19B and 20B, the exploration and sampling program of these sites are closely related. Information obtained from the groundwater sampling program will be useful in the definition of possible contaminant plumes associated with either site.

To obtain information on groundwater quality downgradient of the sites, the exploration program for Sites 19B and 20B will consist of eight soil borings with monitoring well installation at each (Figure 2-2). Five soil borings will be advanced to a depth of 7 feet below the anticipated highest water table elevation (i.e., 15 feet BLS). Shallow monitoring wells will be installed at these locations in accordance with the procedure described in Section 2.1.2 of this Work Plan. Shallow monitoring wells are located immediately downgradient of each of the two sites to ascertain groundwater quality in the upper portion of the surficial aquifer.

Monitoring wells WHF-19B-1D, WHF-19B-2D and WHF-19B-3D (see Figure 2-2) will be deep monitoring wells. Split-spoon samples will be collected from each of the borings at 5-foot intervals and at all changes in lithology. Drilling logs compiled during the drilling of the three deep monitoring wells will provide information about subsurface geologic strata. Deep monitoring wells will be installed in accordance with the procedure described in Section 2.1.2 of this Work Plan. Deep monitoring wells are situated at the facility boundary to ascertain groundwater quality in the lower part of the surficial aquifer.



LEGEND

- □ APPROX. LOCATION OF WASTE OIL TANKS
- ◧ APPROX. LOCATION OF KEROSENE TANKS
- ◫ APPROX. LOCATION OF USED OIL TANKS
- ⊞ APPROX. LOCATION OF WASH RACKS
- ⬓ APPROX. LOCATION OF LUBE OIL TANKS
- ⊕ APPROX. LOCATION OF PROPOSED MONITORING WELLS
- ----DISMANTLED HANGERS

APPROX. SCALE

0 200 400

FIGURE 2-2

SITES 19B & 20B-PROPOSED MONITORING WELL LOCATIONS

WORK PLAN
SITE INSPECTION

OLF BARIN
FOLEY, ALABAMA

The specific rationale for each boring/monitoring well location is as follows.

- WHF-19B-1D will be a deep monitoring well (approximately 100 feet BLS) located along the property line to the south/southwest of Site 19B and, based upon the regional drainage pattern, is anticipated to be downgradient of Sites 19B and 20B. In addition, soil samples taken during installation of this well will be used to identify site lithology.

- WHF-19B-2D will be a deep monitoring well (approximately 100 feet BLS) located along the property line to the south of Sites 19B and 20B and based upon the regional drainage pattern, is anticipated to be downgradient of these sites.

- WHF-19B-3D will be a deep monitoring well (approximately 100 feet BLS) located along the property line to the southeast of Sites 19B and 20B. Monitoring well WHF-19B-3D is situated so as to triangulate on groundwater flow direction and, based on the regional drainage pattern is anticipated to downgradient of Sites 19B and 20B.

- WHF-20B-1 will be a shallow monitoring well located south of the abandoned underground storage tanks (UST). This well is anticipated to be downgradient of the western end of the UST site and upgradient of the maintenance area around the hangars.

- WHF-20B-2 will be a shallow monitoring well located south of the UST site. This well is anticipated to be downgradient of the eastern end of the UST site and upgradient of the maintenance area around the hangars.

- WHF-20B-3 will be a shallow monitoring well located at the southwestern edge of the fuel pit area. This well is anticipated to be downgradient of the fuel pit area.

- WHF-20B-4 will be a shallow monitoring well located at a central position south of the fuel pit area. This well is anticipated to be downgradient of the fuel pit area.

- WHF-20B-5 will be a shallow monitoring well located at the southeastern edge of the fuel pit area. This well is anticipated to be downgradient of the fuel pit area.

Upon completion of monitoring wells WHF-20B-1, WHF-20B-3, and WHF-20B-5, field personnel will survey the elevation of the depth to water level measuring point on each of these three wells. Subsequent to this, depth to groundwater flow will be obtained and plotted to ascertain groundwater flow direction in the surficial aquifer. The remaining five monitoring well locations will be modified, if necessary, based upon groundwater flow direction.

Water level readings observed in the newly installed monitoring wells, coupled with aquifer testing, will allow an assessment of groundwater flux and flow direction.

After monitoring well installation, a water sample will be collected from the newly installed wells using a bottom filling bailer. Water samples will also be collected

from the two existing potable water supply wells. These water samples will be submitted for laboratory chemical analysis. The specific methods and parameters of analysis are discussed in Section 2.4.

2.2.2 Site 21B - Rubble Landfill The rubble landfill is located in the northeast section of OLF Barin (see Figure 1-2, Appendix A). It was reported that only demolition debris from dismantled buildings was discarded at this site. During the PA site visit, there was no visible evidence of drums or other containers that might have contained hazardous waste. The site is now overgrown with Kudzu vines therefore, site visibility is somewhat limited.

The rubble landfill lies close to Sandy Creek and surface runoff is expected to be towards the creek. In addition, the soil in this area is porous and because Sandy Creek is approximately 300 feet to the east, any leachate from the site would most likely migrate to the creek. The exploration program at the rubble landfill will consist of a detailed visual site inspection and three surficial soil borings. The approximate location of the old rubble landfill site is depicted on Figure 2-3. No trenching activities at the landfill have been reported and it is believed that all disposal activities were at the surface. Hence, three surficial soil borings will be augered at the rubble landfill site. The exact location of these borings will be determined upon completion of the visual site inspection. Surficial soil borings will be advanced by a stainless-steel hand auger to a depth of 2 feet below land surface (BLS) or to natural ground whichever is deeper. Three soil samples, from the 1 to 2 foot depth interval, will be submitted for chemical analysis. Soil samples collected for volatile organics analysis shall be collected and containerized undisturbed using brass liners. Upon extraction of the liner, the ends will be sealed with a Teflon cap, wrapped in aluminum foil, and taped closed. The analytic program for the three soil samples will consist of the analysis for constituents comprising the target compounds list (Table 2-3).

2.2.3 Site 22B - Old Fire Fighting Demonstration Area The exact location of the old fire fighting demonstration area is not known with a great degree of certainty, but all reports have it located to the west of the machine gun butt (see Figure 1-2, Appendix A). As reported in the PA, fire fighting demonstrations were conducted a few times during World War II and most likely not more than a dozen times. The fire fighting area was not used when the station re-opened during the Korean conflict.

The demonstrations reportedly consisted of station personnel extinguishing a fire on a wrecked plane. The demonstration used a damaged plane onto which combustible liquids were poured and ignited. Reportedly, waste aviation fuel, waste oils, and possibly waste solvents were burned.

The general area where the burns took place is flat with porous soils. Surface runoff from this area is minimal; therefore so any residue left over from the practice burns would likely adhere to the subsurface soils or migrate into the groundwater.

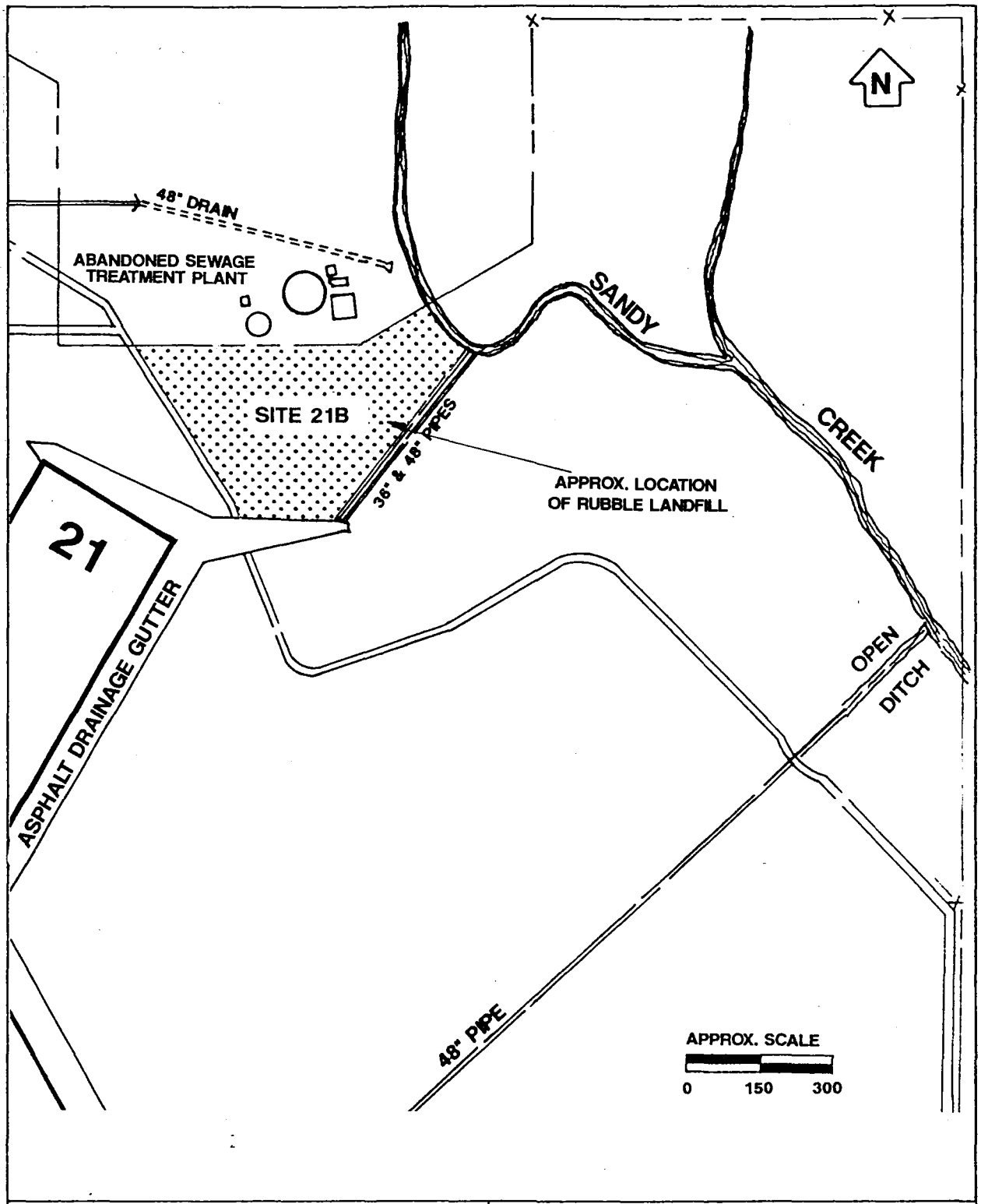


FIGURE 2-3

SITE 21B-
OLD RUBBLE LANDFILL

WORK PLAN
SITE INSPECTION

OLF BARIN
FOLEY, ALABAMA

TABLE 2-3
TARGET COMPOUND LIST

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

VOLATILE ORGANICS

Volatiles	Chemical Abstract Service Number
1. Chloromethane	74-87-3
2. Bromomethane	74-83-9
3. Vinyl Chloride	75-01-4
4. Chloroethane	75-00-3
5. Methylene Chloride	75-09-2
6. Acetone	67-64-1
7. Carbon Disulfide	75-15-0
8. 1,1-Dichloroethene	75-35-4
9. 1,1-Dichloroethane	75-34-3
10. 1,2-Dichloroethene (total)	540-59-0
11. Chloroform	67-66-3
12. 1,2-Dichloroethane	107-06-2
13. 2-Butanone	78-93-3
14. 1,1,1-Trichloroethane	71-55-6
15. Carbon Tetrachloride	56-23-5
16. Vinyl Acetate	108-05-4
17. Bromodichloromethane	75-27-4
18. 1,2-Dichloropropane	78-87-5
19. cis-1,3-Dichloropropene	10061-01-5
20. Trichloroethene	79-01-6
21. Dibromochloromethane	124-48-1
22. 1,1,2-Trichloroethane	79-00-5
23. Benzene	71-43-2
24. trans-1,3-Dichloropropene	10061-02-6
25. Bromoform	75-25-2
26. 4-Methyl-2-pentanone	108-10-1
27. 2-Hexanone	591-78-6
28. Tetrachloroethene	127-18-4
29. Toluene	108-88-3
30. 1,1,2,2-Tetrachloroethane	76-34-5
31. Chlorobenzene	108-90-7
32. Ethylbenzene	100-41-4
33. Styrene	100-42-5
34. Xylenes (total)	1330-20-7

TABLE 2-3 (Cont.)
TARGET COMPOUND LIST

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

SEMIVOLATILE ORGANICS

Semivolatiles	Chemical Abstract Service Number
35. Phenol	108-95-2
36. bis (2-Chloroethyl) ether	111-44-4
37. 2-Chlorophenol	95-57-8
38. 1,3-Dichlorobenzene	541-73-1
39. 1,4-Dichlorobenzene	106-46-7
40. Benzyl alcohol	100-51-6
41. 1,2-Dichlorobenzene	95-50-1
42. 2-Methylphenol	95-48-7
43. bis (2-Chloroisopropyl) ether	108-60-1
44. 4-Methylphenol	106-44-5
45. N-Nitroso-di-n-dipropylamine	621-64-7
46. Hexachloroethane	67-72-1
47. Nitrobenzene	98-95-3
48. Isophorone	78-59-1
49. 2-Nitrophenol	88-75-5
50. 2,4-Dimethylphenol	105-67-9
51. Benzoic acid	65-85-0
52. bis (2-Chloroethoxy) methane	111-91-1
54. 1,2,4-Trichlorobenzene	120-82-1
55. Naphthalene	91-20-3
56. 4-Chloraniline	106-47-8
57. Hexachlorobutadiene	87-68-3
58. 4-Chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7
59. 2-Methylnaphthalene	91-57-6
60. Hexachlorocyclopentadiene	77-47-4
61. 2,4,6-Trichlorophenol	88-06-2
62. 2,4,5-Trichlorophenol	95-95-4
63. 2-Chloronaphthalene	91-58-7
64. 2-Nitroaniline	88-74-4
65. Dimethylphthalate	131-11-3
66. Acenaphthylene	208-96-8
67. 2,6-Dinitrotuluene	606-20-2
68. 3-Nitroaniline	99-09-2
69. Acenaphthene	83-32-9
70. 2,4-Dinitrophenol	51-28-5
71. 4-Nitrophenol	100-02-7
72. Dibenzofuran	132-64-9
73. 2,4-Dinitrotoluene	121-14-2
74. Diethylphthalate	84-66-2
75. 4-Chlorophenyl-phenyl ether	7005-72-3
76. Fluorene	86-73-7
77. 4-Nitroaniline	100-01-6

TABLE 2-3 (Cont.)
TARGET COMPOUND LIST

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

SEMIVOLATILE ORGANICS (CONTINUED)

Semivolatiles	Chemical Abstract Service Number
78. 4,6-Dinitro-2-methylphenol	534-52-1
79. N-nitrosodiphenylamine	86-30-6
80. 4-Bromophenyl-phenylether	101-55-3
81. Hexachlorobenzene	118-74-1
82. Pentachlorophenol	87-86-5
83. Phenanthrene	85-01-8
84. Anthracene	120-12-7
85. Di-n-butylphthalate	84-74-2
86. Fluoranthene	206-44-0
87. Pyrene	129-00-0
88. Butylbenzylphthalate	85-68-7
89. 3,3'-Dichlorobenzidine	91-94-1
90. Benzo(a)anthracene	56-55-3
91. Chrysene	218-01-9
92. bis (2-Ethylhexyl)phthalate	117-81-7
93. Di-n-octylphthalate	117-84-0
94. Benzo(b)fluoranthene	205-99-2
95. Benzo(k)fluoranthene	207-08-9
96. Benzo(a)pyrene	50-32-8
97. Indeno (1,2,3-cd)pyrene	193-39-5
98. Bebenz(a,h)anthracene	53-70-3
99. Benzo(g,h,i)perylene	191-24-2

TABLE 2-3 (Cont.)
TARGET COMPOUND LIST

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

PESTICIDES/PCBs

Pesticides/PCBs	Chemical Abstract Service Number
100. alpha-BHC	319-84-6
101. beta-BHC	319-85-7
102. delta-BHC	319-86-8
103. gamma-BHC (Lindane)	58-89-9
104. Heptachlor	76-44-8
105. Aldrin	309-00-2
106. Heptachlor epoxide	1024-57-3
107. Endsulfan I	959-98-8
108. Dieldrin	60-57-1
109. 4,4'-DDE	72-55-9
110. Endrin	72-20-8
111. Endosulfan II	33213-65-9
112. 4,4'-DDD	72-54-8
113. Endosulfan sulfate	1031-07-8
114. 4,4'-DDT	50-29-3
115. Methoxychlor	72-43-5
116. Endrin ketone	53494-70-5
117. alpha-Chlordane	5103-71-9
118. gamma-Chlordane	5103-74-2
119. Toxaphene	8001-35-2
120. Aroclor-1016	12674-11-2
121. Aroclor-1221	11104-28-2
122. Aroclor-1232	11141-16-5
123. Aroclor-1242	53469-21-9
124. Aroclor-1248	12672-29-6
125. Aroclor-1254	11097-69-1
126. Aroclor-1260	11096-82-5

TABLE 2-3 (Cont.)
TARGET COMPOUND LIST

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

INORGANIC TARGET ANALYTE LIST (TAL)

Analyte
Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Vanadium
Zinc
Cyanide

Various types of combustible fluids were used during practice burns. Leaded aviation fuels were one of these fluids. More than 30 years have elapsed since the fire fighting demonstration area was active. To identify the site location more accurately it will be necessary to look for the presence of residual fuel components. Lead is such a component.

The exploration program at the old fire fighting demonstration area will consist of 54 surficial soil borings with a soil sample taken at each. Soil samples will be collected at a depth of 1 to 2 feet BLS. A sampling grid (Figure 2-4) will be established adjacent to the remnant dirt road that exists in this area, with samples taken at 100-foot intervals to a distance of approximately 300 feet from the road. Soil samples will be analyzed for total lead content. Areas with an elevated lead content will be subjected to more intensive scrutiny under a Phase II site investigation.

2.2.4 Site 23B - Drainage Ditch Leading to Sandy Creek Runoff from the hangars migrated to Sandy Creek via a small drainage ditch near Guadalcanal Road (Figure 2-5). In addition, the 2,000 gallon fuel spill in 1954 migrated to Sandy Creek via the drainage ditch. Once in the creek, fuels and oils would float down towards Wolf Bay. Heavy metals present in aviation fuel would tend to accumulate in sediment. The PA Report (NEESA, 1989) stated that Sandy Creek was reported unfishable due to kerosene contamination when operations were underway at NAAS Barin. The exact time period for this condition, however, was not specified.
The exploration program at the drainage ditch leading to Sandy Creek will consist of the collection of three soil samples from the ditch. One sample will be taken from each boring at a depth of 1 to 2 feet below land surface. Sampling will begin at the eastern end of Guadalcanal Road and samples will be taken at 100 foot intervals along the centerline of the ditch. These samples will be analyzed for total lead content and total polynuclear aromatic hydrocarbon content, both of which are residual constituents of kerosene.

Two sediment samples will be collected within Sandy Creek at the positions indicated in Figure 2-5. Surface water samples will also be taken at these locations. Water and sediment samples collected from Sandy Creek will be analyzed for target compound list volatile and semi-volatile organic compounds and target compound list metals.

2.3 TASK 2 - ELEVATION SURVEY. The location of completed monitoring wells, soil sampling points, and surface water/sediment sampling points will be identified on available site maps provided by the Navy. The elevation and horizontal location of the wells will be surveyed by a registered land surveyor to the nearest 0.01 foot and referenced to OLF Barin datum. The elevation survey is necessary to develop a piezometric map of the groundwater surface and to determine groundwater flow direction.

2.4 TASK 3 - ANALYTICAL PROGRAM. Samples of soil, sediment, surface water, and groundwater selected for analytical testing will be analyzed to identify and quantify chemical contaminants. A summary of the analytical program for the SI is presented in Tables 2-4 and 2-5. The analyses specified for each sample type were chosen based on the type of waste reported in the PA to have been disposed of at each site or, if this is unknown, the parameters comprising the target

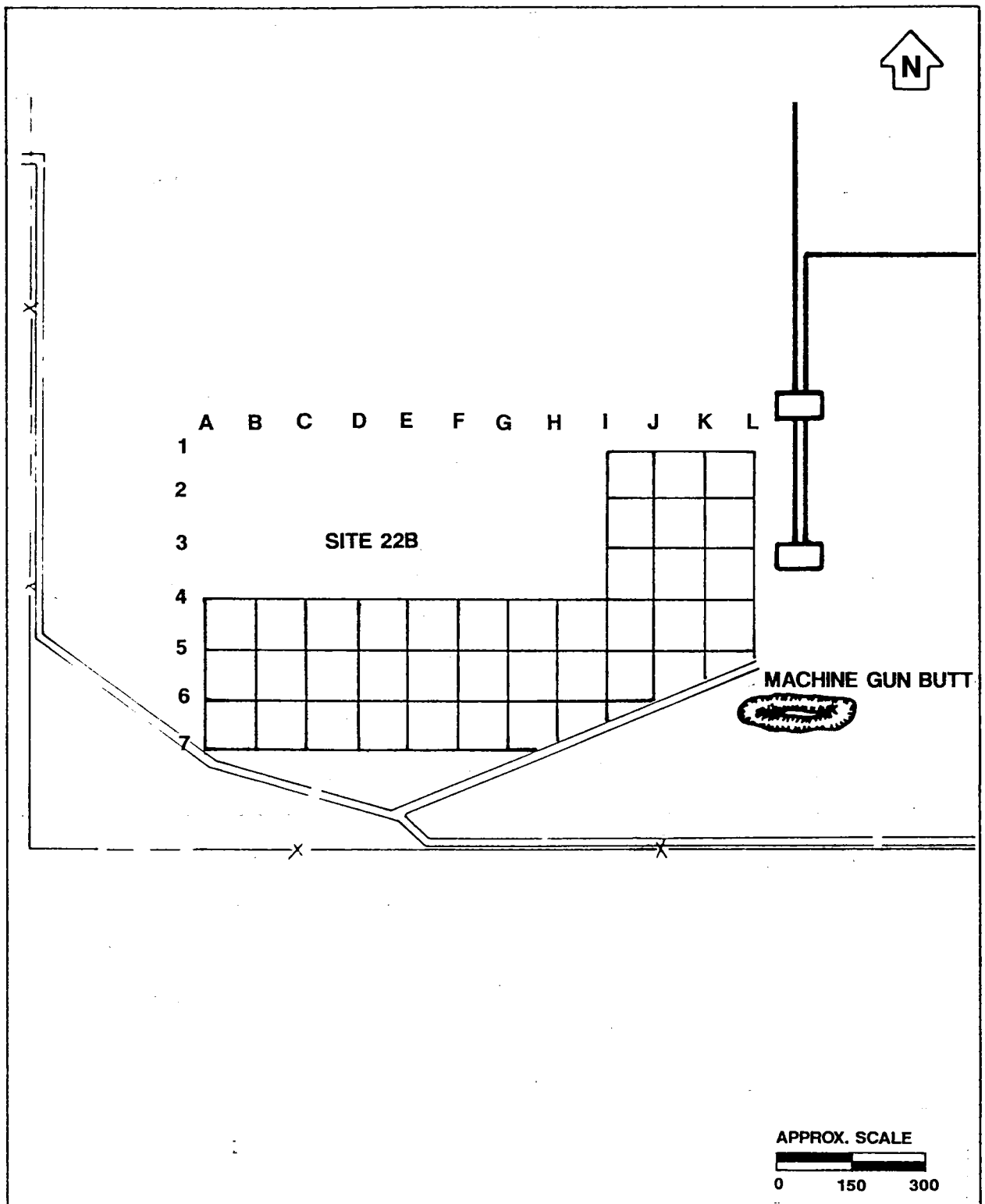


FIGURE 2-4

SITE 22B-
PROPOSED SOIL SAMPLING
LOCATION GRID

WORK PLAN
SITE INSPECTION

OLF BARIN
FOLEY, ALABAMA

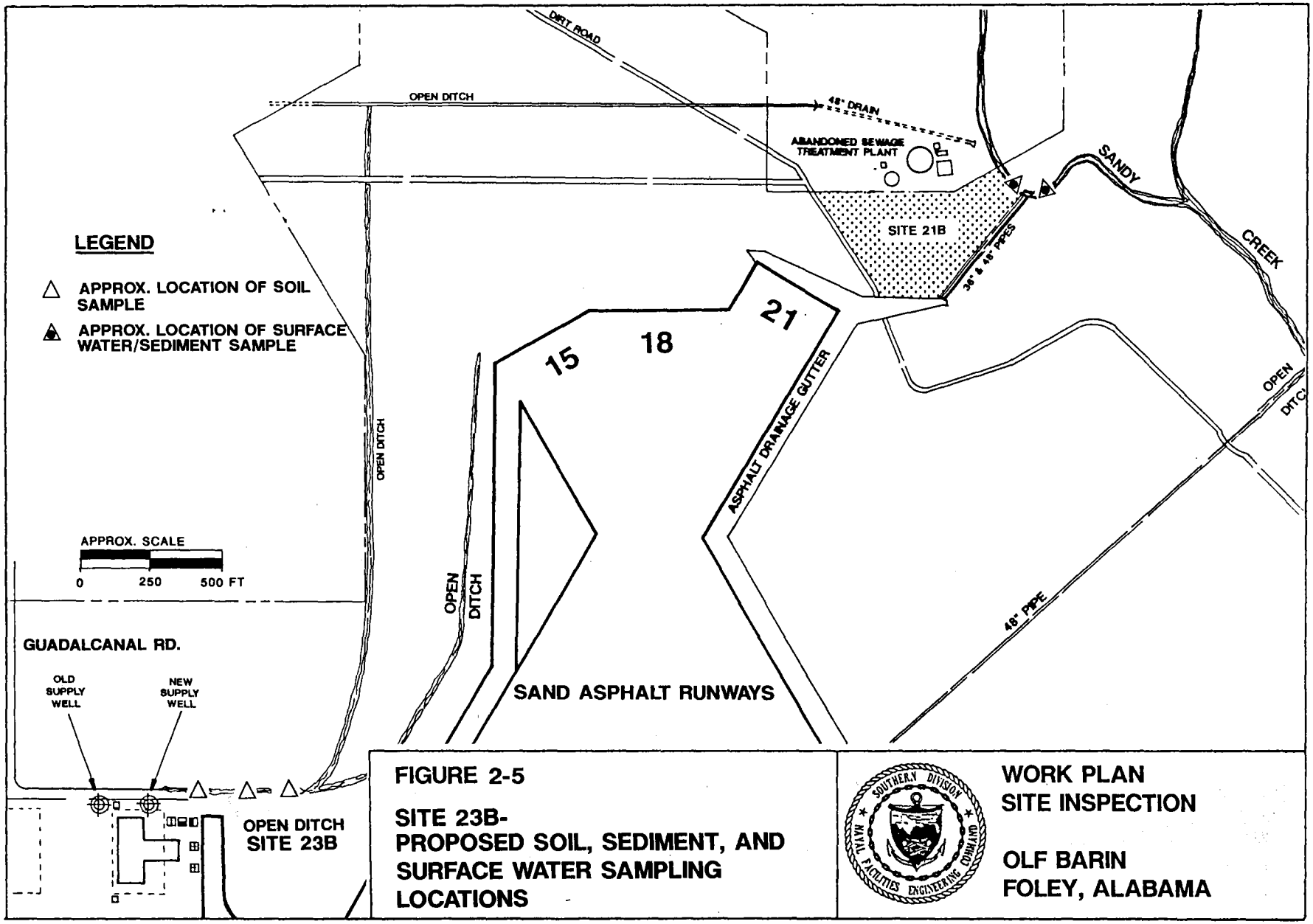


FIGURE 2-5

SITE 23B-
PROPOSED SOIL, SEDIMENT, AND SURFACE WATER SAMPLING LOCATIONS

WORK PLAN
SITE INSPECTION

OLF BARIN
FOLEY, ALABAMA

TABLE 2-4
SUMMARY OF CHEMICAL ANALYSIS

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

Site number	Media	VOAs	SEMI-VOAs	PEST/PCBs	PP Metals	Total lead	PAH
19B	Groundwater	3	3	3	3	--	
20B	Groundwater	7	7	7	7	--	
21B	Soil	3	3	3	3	--	
22B	Soil					54	
23B	Soil					3	3
	Surface Water	2	2	2	2		
	Sediment	2	2	2	2		
Subtotal	Groundwater	10	10	10	10		
	Soil	3	3	3	3	57	
	Surface Water	2	2	2	2		
	Sediment	2	2	2	2		
Duplicates	Groundwater	1	1	1	1		
	Soil	1	1	1	1	6	
	Surface Water	1	1	1	1		
	Sediment	1	1	1	1		
Field Blanks	Water	6	6	6	6	6	
Equipment Blanks[1]		10	10	10	10	1	1
Trip Blanks	Water	3					
TOTAL	Groundwater	11	11	11	11		
	Soil	4	4	4	4	63	3
	Surface Water	3	3	3	3		
	Sediment	3	3	3	3		
	Blanks	17	14	14	14	5	1

NOTE: [1] Equipment Blanks shall be collected daily. However, only samples from every other day shall be analyzed. The other samples shall be held for analyzes only if evidence of equipment blank contamination exists.

VOA - Volatile Organic Analytes
Semi-VOAs - Semivolatile Organic Analytes
Pest/PCB - Pesticides and Polychlorinated Biphyenyls
PP Metals - Priority Pollutant Metals
PAH - Polynuclear aromatic hydrocarbons

TABLE 2-5
LABORATORY ANALYTICAL PROCEDURES

SI WORK PLAN
OLF BARIN, FOLEY, ALABAMA

Media	Parameter	Method	Reference
Soils/Sediment	Total Lead	ICP	EPA Method 6010
	Volatile Organic	GC/MS	CLP-COP
	Semi-Volatile Organic	GC/MS	CLP-COP
	Polynuclear Aromatic Hydrocarbons		SW 846-8310
Surface Water/ Groundwater	Volatile Organic	GC/MS	CLP-COP
	Semivolatile Organic	GC/MS	CLP-COP
	Total Metals	AA and ICP	CLP-CIP
	pH	Potentiometric	EPA Method 150.1
	Specific Conductance		EPA Method 120.1

NOTES: ICP - Inductively Coupled Plasma
GC/MS - Gas Chromatography/Mass Spectrometry
AA - Atomic Absorption
CLP-COP - Contract Laboratory Program - Caucus Organic Pollutants
CLP-CIP - Contract Laboratory Program Caucus Inorganic Pollutants

compound list (see Table 2-3). Level C QC has been established for the analytical program during this project.

Chemical analysis will include those volatile organic compounds, semi-volatile organic compounds, and heavy metals that may have been present in solvents and fuels used at NAAS Barin. Specific compounds known to exist in groundwater under OLF Barin include tetrachloroethylene, trichloroethylene, and trans-1,2-dichloroethylene.

2.5 TASK 4 - EVALUATION AND PRELIMINARY DRAFT REPORT. To meet the objective of the SI, the data developed during this investigation and will be reviewed and an assessment of the presence and concentration of hazardous chemicals in the environment at OLF Barin will be made. Contaminants, if identified, will be compared to state and federal regulatory standards to assess whether the concentrations detected are considered hazardous and whether they pose a potential threat to human health or safety and the environment. Currently contaminants of concern, as detected in the OLF Barin production wells, include trans-1,2-dichloroethylene (13.2 ug/l), tetrachloroethylene (6.0 ug/l), and trichloroethylene (4.0 ug/l). Of these the concentration of trichloroethene is below the federal drinking water standard of 5 ug/l; the concentration of trans-1,2-dichloroethene is below both the proposed maximum contaminant level (MCL) of 100 ug/l and maximum contaminant level goal (MCLG) of 100 ug/l (40 CFR Parts 141, 142, and 143); and the concentration of tetrachloroethylene is above both the proposed MCL of 5 ug/l and proposed MCLG of 0.0 ug/l.

Further, based on the results and conclusions drawn from the evaluation described above, one of the following recommendations for each of the sites studied will be made:

- elimination from further study under the no further action alternative; or
- additional investigation activity under the RI/FS program.

Accompanying each recommendations will be a detailed rationale, with concomitant documentation, for the proposed action at a site. For sites recommended for no further action, the rationale and documentation section shall be presented as a separate appendix to the SI report.

2.6 TASK 5 - FINAL SITE INSPECTION REPORT. Subsequent to the Navy's review of the Draft SI Report, a meeting will be held at NAS Whiting Field in Milton, Florida, to discuss written comments provided by the Navy. The purpose of this meeting will be to finalize changes to the preliminary draft report. A final draft SI Report will be completed following this meeting for subsequent submittal to the Alabama Department of Environmental Management (DEM) and the U.S. Environmental Protection Agency (USEPA). Upon receipt and review of Alabama DEM and USEPA comments to the Final Draft SI Report, a meeting will be held at OLF Barin to discuss comments. Participants for this meeting will include representatives from Alabama DEM, USEPA, Southern Division, NAS Whiting Field, and the engineering contractor. Subsequent to the meeting the Final SI Report will be developed and distributed.

Following the development of the Final SI Report, a completed HRS scoring documentation package will be developed. In that it is anticipated that HRS2 will be in effect at the time of the development of the HRS scoring documentation package, existing HRS2

guidance will be followed. At the time of development of the HRS scoring documentation package for OLF Barin, the most current guidance shall be used.

2.7 TASK 6 - MEETINGS. Several meetings will be required during the course of the SI. These meetings will be held at either NAS Whiting Field or at Jordan's offices in Tallahassee. Personnel involved in these meetings may include representatives from the engineering contractor, NAS Whiting Field, and Southern Division.

2.8 PROJECT DELIVERABLES. In addition to the SI Reports, continuous written communication and reporting shall be maintained with Southern Division throughout the course of the SI for OLF Barin. Required documents to be forwarded to Southern Division's EIC shall consist of the following reports:

- monthly progress reports (MPR) from both the contractor and the analytical laboratory;
- technical memoranda discussing each data set;
- copies of field performance audits;
- copies of laboratory QC documentation;
- copies of laboratory coordinator's report; and
- final QC report

MPR will be required of both the contractor and the laboratory. Requirements for inclusion in laboratory MPRs are as follows:

1. site name and contract number;

2. numbers, types and locations, and samples collected and analyzed for Navy project only;

3. data for blanks, spikes, laboratory duplicates and controls related to Navy samples;

4. new methods used for analyses and changes in old methods;

5. copies of all control charts pertinent of Navy samples and to which results have been added over the reporting period;

6. summaries of out-of-control incidents during the reporting period, including references to documentation and corrective action reports;

7. descriptions of and justifications for significant changes in QA;

8. changes in Laboratory Quality Assurance and Control (LQAC) personnel and other key technical personnel (resumes of new personnel must be submitted) and

9. completed sample data.

Much of the information presented in an MPR is incremental in nature and relates to changes and findings since the previous MPR. These include:

1. control charts from the minimizing control charts program and any duplicates, or other QC parameters;

2. personnel changes relating to QA responsibilities;

3. method changes (e.g., a minor modification with an attached EPA variance); and

4. procedural changes in establishing control limits and/or the preparation and use of control charts.

Because the first such report for each laboratory has no precedent, more explanation and detail may be necessary; subsequent MPRs will likely not require as much detail in some areas.

MPRs from the contractor shall discuss details of the previous month's activities. Elements within the contractor's MPR will consist of project status, schedule, budget, proposed scope changes, activities undertaken and activities to be undertaken during the upcoming month, and difficulties encountered and actions taken to overcome them.

Approximately 1 month after each data set has been generated and has undergone a preliminary analysis, a technical memorandum shall be issued. The memorandum shall present a summary of the data generated from the particular activity and the preliminary analysis. Incorporated into each technical memorandum will be any necessary graphical presentation of the data and the method(s) for analysis.
A final QC Data Report shall be developed and sent to Southern Division's EIC at least 4 weeks prior to submittal of the SI Final Report. the Final QC Data Report shall contain the information specified in Table 7.6 of the Naval Energy and Environmental Support Activity Guidance Document 20.2-047B (Oak Ridge Diffusion Plant, 1988)

The report shall indicate the duration and location of storage for the data. The stored data consists of all raw data, QC charts, corrective action, logs, sample lists, chain of custody information, notebooks, work sheets, automated data processing system output, and calibration.

3.0 SCHEDULE

The schedule for this work is presented in Figure 3-1 and is contingent on notification to proceed from the Navy. Notification to proceed should include a signed contract between Jordan and the Navy. The schedule illustrated in Figure 3-1 is approximate, assumes optimum field conditions, and may be influenced by factors over which Jordan has no control. These factors would include the following:

- weather conditions during fieldwork,
- constraints on working hours due to OLF Barin operations, or
- time necessary for review of draft documents by Southern Division, NAS Whiting Field personnel, and regulatory agencies.

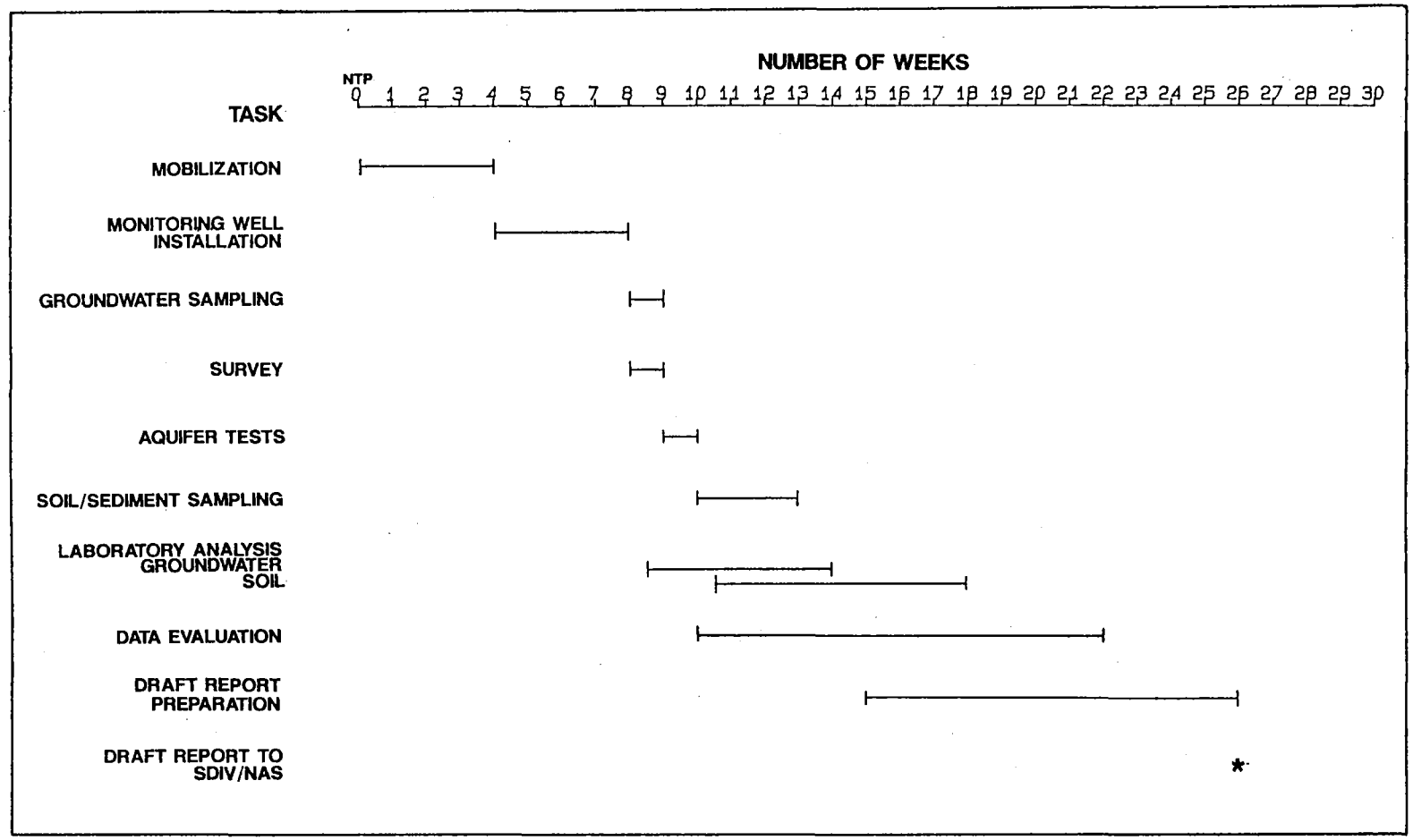


FIGURE 3-1

PROPOSED SCHEDULE

WORK PLAN
SITE INSPECTION

OLF BARIN
FOLEY, ALABAMA

REFERENCES

Bouwer, H., and Rice J. 1976. A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells. Water Resource Research 12(3): 423-428.

Cooper, H.H., Bredehoeft, J.D., and Papadopolis, I.S. 1967. Response of a finite-diameter well to an instantaneous change in water. Water Resource Research 3(1): 263-269.

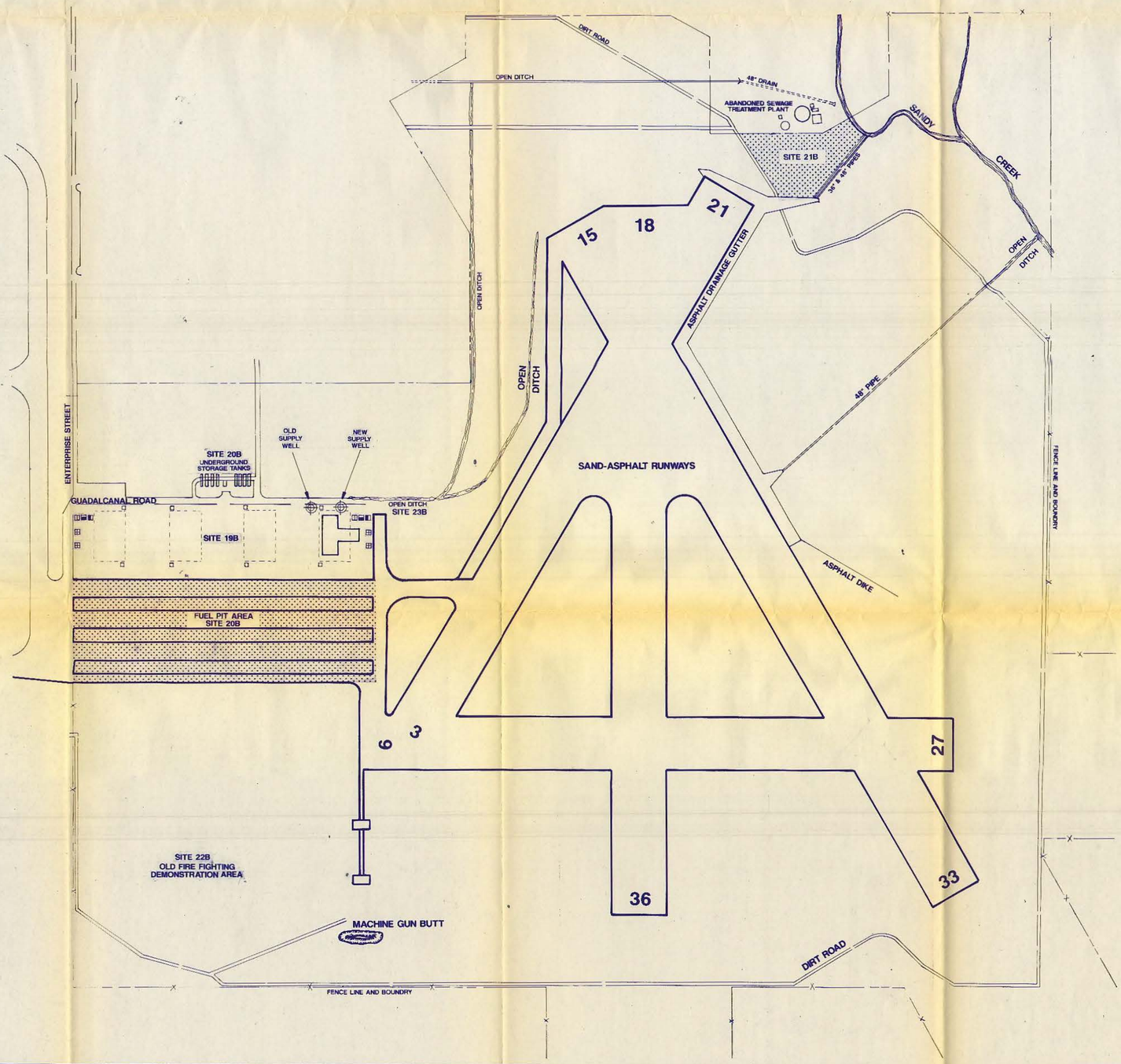
NEESA. 1989. preliminary assessment report, OLF Barin, Foley, Alabama, NEESA 13-193. 18 p plus Appendices.

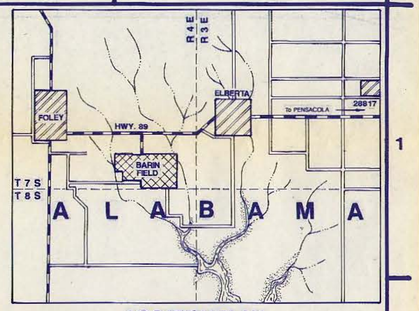
Oak Ridge Gaseous Diffusion Plant. 1988. Sampling and chemical analysis quality assurance requirements for the Navy Installation Restoration Program. NEESA 20.2-047B. 89 p.

USEPA, 1986. Superfund Public Health Evaluation Manual, Office of Emergency and Remedial Response, Washington, D.C., EPA 540/1-86/060.

APPENDIX A - OVERSIZED DRAWINGS

1-2 SITE LOCATIONS





LOCATION PLAN

SCALE: 1" = 2 MILES

LEGEND

- APPROX. LOCATION OF WASTE OIL TANKS
- APPROX. LOCATION OF KEROSENE TANKS
- APPROX. LOCATION OF USED OIL TANKS
- APPROX. LOCATION OF WASH RACKS
- APPROX. LOCATION OF LUBE OIL TANKS
- DISMANTLED HANGERS
- FENCE LINE / BOUNDARY
- PROPERTY LINE
- FENCED BOUNDARY

NAS DWG. No.	REFERENCE DRAWINGS
25007	MAP OF BARIN FIELD, NAWAL AIR BASIC TRAINING, PENSACOLA, FLORIDA; SHOWING CONDITIONS ON JUNE 30, 1950
IV-2	OLF BARIN EXISTING CONDITIONS, NAS WHITING FIELD MASTER PLAN, SEPTEMBER 1988

SURVEY BY | DATE
SURVEY FILE NO.

No.	REFERENCE DRAWINGS	FIELD BOOK No.	REV.	DATE	STATUS	MF	BY	CHKD	APPD

E.C. JORDAN CO.
ENGINEERS & SCIENTISTS

CLIENT
SOUTHERN DIVISION
NAVFACENGCOM

DESIGN		
DRAWN	W.W.	3-89
CHKD		
DEPT. HD.		
PROCESS		
PROJ. MGR.		
CLIENT		
SCALE		

TITLE
SITE LOCATIONS

OLF BARIN
FOLEY, ALABAMA

PROJ. NO. 5898-03
DWG. NO. 1-2
REV.

APPENDIX B

SITE-SPECIFIC QUALITY ASSURANCE PLAN ADDENDUM

SITE-SPECIFIC QUALITY ASSURANCE PLAN ADDENDUM

Task: OLF Barin Site Inspection

Task Objective: Ascertain presence or absence of soil or groundwater contamination

Subtasks	Standard Protocol Selected
Soil Sampling	QAP (6.6.2)
Surface Soil Sampling	QAP (6.6.4)
Drilling and Installing Monitoring Wells	See Standard Specifications for Subsurface Boring and Sampling
Groundwater Sampling	QAP (6.7.2)
Surface Water Sampling	QAP (6.7.3)
Sediment Sampling	QAP (6.6.5)

Task Organization

Name	Function
T. Allen	Project Manager
M. Nugent	Technical Director/QA Officer
E. Blomberg	Field Operations Leader
J. Burris	Field H&S Officer
H. Hooper	Field Support

Subcontractors	Function
To Be Determined	Chemical Analysis
To Be Determined	Boring and Well Installation

Local Contacts	Function
C. Black	NAS Whiting Field Point of Contact

ANALYTICAL DATA

MATRIX/PARAMETER		ANALYTICAL METHOD	NEESA QC LEVEL
Site 19B. Maintenance Area Around Hangers			
Water:	Purgeable Organics	CLP-COP	C
	Semivolatile Organics	CLP-COP	C
	Pesticides/PCBs	CLP-COP	C
	Metals	CLP-CIP	C
Site 20B. Abandoned Underground Storage Tanks and Fuel Pits			
Water:	Purgeable Organics	CLP-COP	C
	Semivolatile Organics	CLP-COP	C
	Pesticides/PCBs	CLP-COP	C
	Metals	CLP-CIP	C
Site 21B. Rubble Landfill			
Soil:	Purgeable Organics	CLP-COP	C
	Semivolatile Organics	CLP-COP	C
	Pesticides/PCBs	CLP-COP	C
	Metals	CLP-CIP	C
Site 22B. Old Fire Demonstration Area			
Soil:	Lead	EPA Method 6010	C
Site 23B. Drainage Ditch Leading to Sandy Creek			
Sediment:	Purgeable Organics	CLP-COP	C
	Semivolatile Organics	CLP-COP	C
	Pesticides/PCBs	CLP-COP	C
	Metals	CLP-CIP	C
Soil:	Lead	EPA Method 6010	C
	Polynuclear Aromatic Hydrocarbons	EPA Method 8100	C
Water:	Purgeable Organics	CLP-COP	C
	Semivolatile Organics	CLP-COP	C
	Pesticides/PCBs	CLP-COP	C
	Metals	CLP-COP	C

SAMPLE IDENTIFICATION/CROSS REFERENCE

SAMPLE ID	SAMPLE LOCATION
WHF-MW-19B-1D-1	Monitoring Well MW-19B-1D
WHF-MW-19B-1D-D-1	Monitoring Well MW-19B-1D, Duplicate
WHF-MW-19B-2D-1	Monitoring Well MW-19B-2D
WHF-MW-19B-3D-1	Monitoring Well MW-19B-3D
WHF-MW-20B-1-1	Monitoring Well MW-20B-1
WHF-MW-20B-2-1	Monitoring Well MW-20B-2
WHF-MW-20B-3-1	Monitoring Well MW-20B-3
WHF-MW-20B-4-1	Monitoring Well MW-20B-4
WHF-MW-20B-5-1	Monitoring Well MW-20B-5
WHF-SS-21B-1(1-2)-1	Site 21B
WHF-SS-21B-2(1-2)-1	Site 21B
WHF-SS-21B-3(1-2)-1	Site 21B
WHF-SS-22B-I1(1-2)-1	Site 22B, Grid Position I1
WHF-SS-22B-J1(1-2)-1	Site 22B, Grid Position J1
WHF-SS-22B-K1(1-2)-1	Site 22B, Grid Position K1
WHF-SS-22B-L1(1-2)-1	Site 22B, Grid Position L1
WHF-SS-22B-I2(1-2)-1	Site 22B, Grid Position I1
WHF-SS-21B-J2(1-2)-1	Site 22B, Grid Position J1
WHF-SS-21B-K2(1-2)-1	Site 22B, Grid Position K1
WHF-SS-21B-L2(1-2)-1	Site 22B, Grid Position L1
WHF-SS-22B-I3(1-2)-1	Site 22B, Grid Position I1
WHF-SS-22B-J3(1-2)-1	Site 22B, Grid Position J1
WHF-SS-22B-K3(1-2)-1	Site 22B, Grid Position K1
WHF-SS-22B-L3(1-2)-1	Site 22B, Grid Position L1
WHF-SS-22B-A4(1-2)-1	Site 22B, Grid Position A1
WHF-SS-22B-B4(1-2)-1	Site 22B, Grid Position B1
WHF-SS-22B-C4(1-2)-1	Site 22B, Grid Position C1
WHF-SS-22B-D4(1-2)-1	Site 22B, Grid Position D1
WHF-SS-22B-E41(1-2)-1	Site 22B, Grid Position E1
WHF-SS-22B-F41(1-2)-1	Site 22B, Grid Position F1
WHF-SS-22B-G41(1-2)-1	Site 22B, Grid Position G1
WHF-SS-22B-H41(1-2)-1	Site 22B, Grid Position H1
WHF-SS-22B-I4(1-2)-1	Site 22B, Grid Position I1
WHF-SS-22B-J4(1-2)-1	Site 22B, Grid Position J1
WHF-SS-22B-K4(1-2)-1	Site 22B, Grid Position K1
WHF-SS-22B-L4(1-2)-1	Site 22B, Grid Position L1
WHF-SS-22B-A5(1-2)-1	Site 23B, Grid Position A5
WHF-SS-22B-B5(1-2)-1	Site 23B, Grid Position B5
WHF-SS-22B-B5(1-2)-1	Site 23B, Grid Position C5
WHF-SS-22B-C5(1-2)-1	Site 23B, Grid Position D5
WHF-SS-22B-D5(1-2)-1	Site 23B, Grid Position E5
WHF-SS-22B-E5(1-2)-1	Site 22B, Grid Position E5, Duplicate
WHF-SS-22B-E5(1-2)-D-1	Site 22B, Grid Position F5
WHF-SS-22B-F5(1-2)-1	Site 22B, Grid Position G5
WHF-SS-22B-G5(1-2)-1	Site 22B, Grid Position H5
WHF-SS-22B-H5(1-2)-1	Site 22B, Grid Position I5

SAMPLE IDENTIFICATION/CROSS REFERENCE (Cont'd)

SAMPLE ID	SAMPLE LOCATION
WHF-SS-22B-I5(1-2)-1	Site 22B, Grid Position J5
WHF-SS-22B-J5(1-2)-1	Site 22B, Grid Position K5
WHF-SS-22B-K5(1-2)-1	Site 22B, Grid Position L5
WHF-SS-22B-L5(1-2)-1	Site 22B, Grid Position A6
WHF-SS-22B-A6(1-2)-1	Site 22B, Grid Position B6
WHF-SS-22B-B6(1-2)-1	Site 22B, Grid Position C6
WHF-SS-22B-C6(1-2)-1	Site 22B, Grid Position D6
WHF-SS-22B-D6(1-2)-1	Site 22B, Grid Position E6
WHF-SS-22B-E6(1-2)-1	Site 22B, Grid Position F6
WHF-SS-22B-F6(1-2)-1	Site 22B, Grid Position G6
WHF-SS-22B-G6(1-2)-1	Site 22B, Grid Position H6
WHF-SS-22B-H6(1-2)-1	Site 22B, Grid Position I6
WHF-SS-22B-I6(1-2)-1	Site 22B, Grid Position J6
WHF-SS-22B-J6(1-2)-1	Site 22B, Grid Position K6
WHF-SS-22B-K6(1-2)-D-1	Site 22B, Grid Position L6
WHF-SS-22B-L6(1-2)-1	Site 22B, Grid Position A7
WHF-SS-22B-A7(1-2)-1	Site 22B, Grid Position B7
WHF-SS-22B-B7(1-2)-1	Site 22B, Grid Position C7
WHF-SS-22B-C7(1-2)-1	Site 22B, Grid Position D7
WHF-SS-22B-D7(1-2)-1	Site 22B, Grid Position E7
WHF-SS-22B-E7(1-2)-1	Site 22B, Grid Position F7
WHF-SS-22B-F7(1-2)-1	Site 22B, Grid Position G7
WHF-SS-22B-G7(1-2)-1	Site 22B, Grid Position H7
WHF-SS-22B-H7(1-2)-1	Site 22B, Grid Position I7
WHF-SS-22B-I7(1-2)-1	Site 22B, Grid Position J7
WHF-SS-22B-J7(1-2)-1	Site 22B, Grid Position K7
WHF-SS-22B-K7(1-2)-1	Site 22B, Grid Position L7
WHF-SS-22B-L7(1-2)-1	Site 22B, Grid Position G7
WHF-SS-22B-E6(1-2)-D-1	Site 22B, Grid Position E6, Duplicate
WHF-SS-22B-F6(1-2)-D-1	Site 22B, Grid Position F6, Duplicate
WHF-SS-22B-G6(1-2)-D-1	Site 22B, Grid Position G6, Duplicate
WHF-SS-22B-F7(1-2)-D-1	Site 22B, Grid Position F6, Duplicate
WHF-SS-23B-1(1-2)-1	Site 23B, 100 Feet From Road
WHF-SS-23B-2(1-2)-1	Site 23B, 200 Feet From Road
WHF-SS-23B-3(1-2)-1	Site 23B, 300 Feet From Road
WHF-SD-23B-1-1	Sandy Creek, North Sampling Station
WHF-SD-23B-2-1	Sandy Creek, South Sampling Station
WHF-SW-23B-1-1	Sandy Creek, North Sampling Station
WHF-SW-23B-2-1	Sandy Creek, South Sampling Station

Rev.: 3
Date: 3 Nov 88
CODE 11436

SOUTHERN DIVISION NAVAL FACILITIES
ENGINEERING COMMAND

SPECIFICATIONS FOR GROUNDWATER MONITORING WELL INSTALLATION

PART 1: GENERAL

1.1 INTRODUCTION

Groundwater monitoring wells shall be located at sites approved by the Southern Division Engineer-In-Charge (EIC) and the Activity Environmental Coordinator (EC). All applicable local, state, and federal regulations concerning well installations or soil borings will be followed.

1.2 APPLICABLE PUBLICATIONS

The publications below form a part of the specification to the extent referenced. The publications are referred to in this text by designation only. The latest revision of the specifications shall be followed.

1.2.1 American Association of State Highway and Transportation Officials (AASHTO)

M 220 Epoxy Coatings Specifications

1.2.2 American Society of Tasting and Materials (ASTM)

A 120 Pipe, Steel, Black and Hot-dipped, Zinc coated, welded, and seamless

A 312 Seamless and Welded Austenitic Stainless Steel Pipe

B 209 Aluminum and Aluminum-alloy Sheet and Plate

C 150 Portland Cement

C 778 Standard Sand

D 1457 Polytetrafluoroethylene (PTFE) Molding and Extrusion

D 1785 Standard Specification of Polyvinyl Chloride Pipe (PVC pipe, Schedules 40, 80, 120)

D 1586 Method for Penetration Test and Split Barrel Sampling of Soils

D 1587 Practice for Thin Wall Tube Sampling of Soils

D 2113 Diamond Core Drilling for Site Investigation

F 480 Thermoplastic Water Well Casing, Pipe and Couplings made in Standard Dimension Ratios (SDR)

F 883 Padlock

1.2.3 American Petroleum Institute (API)

13-A Oil Well Drilling Fluid Specifications

1.3 SUBMITTALS

1.3.1 A completed "Southern Division Naval Facilities Engineering Command Groundwater Monitoring Well Installation Report" will be submitted for each well installation.

1.3.2 Certificates of Conformance

a) Casing
b) Screen
c) Grout
d) Drilling Mud
e) Gravel Pack
f) Caps and Plugs
g) Centralizers
h) Surface Casing
i) Well Protective Cover
j) Flush Mount Protective Cover
k) Padlock
l) Protective Post
m) Well Designation Sign
o) Epoxy Paint

1.4 DELIVERY AND STORAGE

All materials shall be delivered in undamaged condition, stored off the ground, and protected from the weather in an area designated by the EC. All defective or damaged material will be replaced with new material.

PART 2. PRODUCTS

2.1 All materials shall conform to the respective specifications and other requirements as specified herein.

2.1.1 Well Casing (threads compatible with well screen below)

Material type will be approved by the EIC. The material provided will have adequate strength to resist external forces both during and after installation. Markings, writing, or paint strips are not allowable on any of the materials.

a. PVC, flush threaded joints (schedule 40) ASTM F480 and ASTM D1785

All PVC flush threaded joints will meet or exceed the water pressure ratings (at 73 degrees Fahrenheit) for the size and schedule of PVC pipe used in the project, as listed in ASTM D1758: Table XI.2.

b. Polytetrafluoroethylene (PTEF), flush threaded joints, slotted, ASTM D1457

Virgin materials shall be used to meet the ASTM specification. Certification of compliance and joint evaluation are required. Shall be shipped in closed containers. PTFE "O" rings will be used to seal all joints.

c. 316 stainless steel, flush threaded joints, ASTM A312
d. 304 stainless steel, flush threaded joints, ASTM A312

End fittings shall be double entry flush screw threads. The casing shall be cleaned in the following manner: 5-minute immersion in static bath of acid, pressure wash with detergent and cool water, rinse with warm water, and allow to air dry.

2.1.2 Well Screen

Material type will be approved by the EIC. The material provided will have adequate strength to resist external forces both during and after installation. Water velocity through the screen openings shall not exceed 0.1 foot per second. The opening size will be determined from an analysis of the material in geologic formation to be screened and/or the size of the filter pack material. Markings, writing, or paint strips are not allowable on any of the materials.

a. PVC, flush threaded joints (schedule 40), slotted, ASTM F480 and ASTM D1785

Two inch I.D. screens will have three rows of slots with a spacing of 1/8 inch between slots. Four-inch I.D. screens will have six rows of slots with a spacing of 1/8 inch between slots. All PVC flush threaded joints will meet or exceed the water pressure ratings (at 73 degrees Fahrenheit) for the size and schedule of PVC pipes as listed in ASTM D1785, Table XI.2.

b. polytetrafluoroethylene (PTFE), flush threaded joints, slotted, ASTM D1457

Virgin materials shall be used to meet the ASTM specification. Certification of compliance and joint evaluation are required. Shall be shipped in closed containers. PTFE "O" rings will be used to seal all joints.

c. 316 stainless steel, wire wrapped, flush threaded joints, ASTM A312
d. 304 stainless steel, wired wrapped, flush threaded joints, ASTM A312

The screen shall be continuous slot, wire wound design. It shall be fabricated by circumferentially wrapping a triangularly shaped wire around a circular array of internal rods. The configuration must produce sharp outer edges, widening inward. PTFE "O" rings will be used to seal all joints. End fittings will be welded to the screen body.

2.1.3 End Plugs, flush threaded joints compatible with casing and screen above)

The end plug shall match the type of material selected for the screen or casing above. All ASTM specifications that apply to the above materials shall apply to the end plugs. Markings, writing, or paint strips are not allowable on any of the above materials.

2.1.4 Well Caps, flush threaded joints (Compatible with casing above)

The well cap shall match the type of material selected for the casing above. All ASTM specifications that apply to the above materials shall apply to the well caps. Markings, writer, or paint strips are not allowable on any of the above materials.

2.1.5 Adjustable centralizers

The centralizer shall be capable of keeping casing and screen straight and plumb in the borehole during well installation. The material type shall be compatible with above casing and screen. No solvents or glues will be used.

2.1.6 Annular space fill materials

a. Filter pack (98% pure silica, cleaned with potable water, uniformity coefficient of 1-3, specific gravity 2.6 - 2.7). Shall meet ASTM C 775 standard sand specifications.

b. 1/4-inch bentonite pellets (90% montmorillonite clay, bulk dry density 80 lbs/cu ft., specific gravity 1.2, pH of 8.5-10.5)

c. Granular bentonite (API std 13-A for bentonite)

d. Portland Cement (ASTM C 150 Type I)

2.1.7 Surface casing (steel) ASTM A 120

a. 24-inch diameter 0.25-inch wall thickness
b. 20-inch diameter 0.25-inch wall thickness
c. 16-inch diameter 0.25-inch wall thickness
d. 10.75-inch diameter 0.25-inch wall thickness
e. 24-inch diameter 0.50-inch wall thickness
f. 20-inch diameter 0.50-inch wall thickness
g. 16-inch diameter 0.50-inch wall thickness
h. 10.75-inch diameter 0.365-inch wall thickness

2.1.8 Surface Completion

a. Locking 16-gauge steel protective well cover, round or square and 5-ft. in length

b. Flush mount 22-gauge steel, water resistant welded box with 3.8-inch steel lid, locking device, and padlock guard

c. Concrete pad at ground surface (3' x 4' x 6")

d. Padlock (brass, corrosion resistant, keyed alike)

e. Steel protective post (4-inch diameter, 6-ft. length, 1/4-inch thickness, concrete filled) ASTM A 120.

f. Well designation sign, sheet aluminum, ASTM B 209, 1.8 inch by 18 inch by 6 inch, anchors and fasteners compatible with sign, designation to be provided by EIC pressure sensitive precision cut 4-inch vinyl letters, fastened to well cover.

g. High visibility yellow epoxy paint

PART 3: EXECUTION

3.1 DRILLING METHOD

The proposed drilling method must be approved by the EIC. Hollow-stem auger methods will be given first preference, rotary methods second, and any other methods normally require detailed evaluation.

3.2 WELL INSTALLATION

Well depths, length of screen and sump will be determined on a site-specific basis with approval of the EIC. Screen lengths will be limited to 10 feet unless specifically approved in writing by the EIC. Two-inch well diameters will be specified for shallow well installations. Deeper installations or anticipated conversion to recovery wells may require 4-inch wells. Recovery well specifications will be approved by the EIC.

Well installation shall follow commonly accepted professional drilling procedures. The borehole will be logged as drilling proceeds by a qualified geologist/hydrogeologist (shall meet minimum qualifications for Geologist-in-Training as described in Article 1, Chapter 23, Title 1, Code of Laws of South Carolina: Rules of the South Carolina State Board of Registration for Geologists). Soil samples shall be collected according to one of the following methods: ASTM D 1586-Method for Penetration Test and Split Barrel Sampling of Soils or ASTM D 1587-Practice for Thin Wall Tube Sampling of Soils. Consolidated Rock will be sampled according to ASTM D2113 Diamond Core Drilling for Site Investigation. Gravel pack, seals, and grout will be installed using tremie methods. Bentonite seals shall be allowed to hydrate the time period specified by the manufacturer. Measurements to the top of the gravel pack and seals shall be made accurately with a weighted steel tape and adjusted to reflect the top of casing. If water is used in the drilling process, a sample shall be collected from the source and analyzed for the parameter specified in the investigation.

3.3 WELL DEVELOPMENT

Well development shall take place no sooner than 24 hours after placement of the grout. The development method shall be approved by the EIC. The selected method shall be capable of removing all drilling fluids and cuttings from inside the well, within the gravel pack, and within the formation. The method shall prevent the introduction of any type of contamination into the aquifer from the development process. Introduction of outside water to the well shall be minimized. Any water introduced into the well shall be recovered to the maximum extent possible. A written report will be required describing why any introduced water could not be recovered.

The development process should result in wells that are sediment free. A well that produces turbid water (as defined by the Safe Drinking Water Act PL 93-523) may be rejected by the EIC.

3.4 MATERIAL DISPOSAL

All borehole cuttings and development water will be contained in DOT 17-C Open-top 55-gallon drums, permanently labeled by well number and stored in a location designated by the EC. The requirement may be waived if approval is given in writing by the EIC. The Navy will be responsible for disposal.

3.5 DECONTAMINATION

All down hole drilling equipment, the drill rig, tools, etc., will be decontaminated according to the approved Quality Control Plan prior to beginning work, between each well location, and after the last well is completed. The drill rig will be placed on 10-mil polyethylene sheeting at each drilling site to prevent any spillage or leaking of hydraulic fluid or fuel from reaching the ground surface. All of the decontamination waste will be handled according to section 3.4 above.

3.6 WELL PROTECTION

A steel, hinged, locking protective casing will be installed within a 3-ft. by 4-ft by 6-inch thick concrete pad. The pad will be set level and 4-inch below grade. The pad shall be installed so that surface runoff does not pond around the well casing and protective cover. If designated by the EIC, four steel protective post will be installed at the four corners of the pad but not set within the pad. The post will be 6-ft in length, 4-inch in diameter and have a wall thickness of 0.25-inch. The post will be filled with concrete and set three feet below grade in a 10-inch diameter hole with concrete backfill. The protective casing and any protective post installed shall be painted with two coats of high visibility yellow epoxy paint that meets the specifications of AASHTO M 200. The protective casing will be locked with a Type P01 (Key Operated), Option E (Corrosion Resistant) padlock that conforms to ASTM F 883. If more than one padlock is required, the padlocks shall be keyed alike. Two keys, for the locks installed, shall be delivered to the EIC and two to the EC.

3.7 WELL DESIGNATION

A permanent sign will be attached to the protective casing. The well designation number will be taken from the attached list of "IRP Well Numbering System".

4.0 INSTALLATION RESTORATION PROGRAM WELL NUMBERING SYSTEM

The system will locate a particular well on an activity, key it consistent with the Initial Assessment Study (IAS) of the Activity, and sequentially number them at each site. The EIC will provide designations for sites not included in the IAS.

Example:	CEF-1-1	Cecil Field, Site 1, Well 1
	KYW-5-8	Key West, Site 5, Well Number 8

FLORIDA

Cecil Field	CEF
Ft. Lauderdale	FLD
Key West	KYW
NavHosp Key West	KWH
Homestead	HST
Jacksonville	JAX
Mayport	MPT
Panama City	PCY
Whiting FIeld	WHF
Andros Island	AIS
Pensacola	PEN
Saufley	SFY
Correy Station	CRY
Orlando	OLD

GEORGIA

Albany	ALB
Atlanta	ATL
Kings Bay	KBA
Athens	ATH

SOUTH CAROLINA

Parris Island	PAI
Beaufort	BFT
NavHosp Beaufort	BFH
NWS Charleston	NWS
NS Charleston	CSY

LOUISIANA

NAS New Orleans	NOS
NSA New Orleans	NOS

MISSISSIPPI

Gulfport	GPT
NavHome Gulfport	GPH
Meridian	MRD

TENNESSEE

Memphis	MPH
Bristol	BRT

TEXAS

Corpus Christi	CCT
Chase Field	CAF
Kingsville	KVE
NAS Dallas	DNA
NWIRP Dallas	DWP
McGregor	MGR

TITLE: Procedures for the development of groundwater monitoring wells.

Author: K.L. Busen Principal Hydrogeologist

Reviewed By: R.M. Nugent Principal Hydrologist

Approved By: _____

_____

PURPOSE: Development of groundwater monitoring wells are performed to remove all the drilling fluids from the borehole and the mud cake from the wall of the borehole and to create a graded zone of sediment (filter pack) around the screen. Proper well development is necessary to achieve ambient groundwater quality in the well and infiltration sand-free water at the approximate specific capacity of the natural formation.

SCOPE: The procedures outlined in this document should be followed in developing a monitoring well after well drilling and installation or in the re-development of a well prior to collecting groundwater samples or conducting aquifer testing.

REQUIREMENTS:

The monitoring well should be properly installed. If grout was used in the installation of the well and the grout extends below the potentiometric surface of the groundwater a period of not less than 12 hours is required for the grout to cure before developing the well. For wells where the grout does not extend to the water table (eg. gas station monitoring wells where the screen is placed above the water table) then well development can take place immediately after the installation of the well providing the grout at land surface is protected from the purged groundwater.

EQUIPMENT: Proper equipment should be selected based on the monitoring well conditions. This section will discuss the equipment that should be used for various field conditions and the procedures that are necessary to operate the equipment and to develop the well under various conditions.

Monitoring Wells. Development of monitoring wells where no unusual conditions exist generally requires fitting the pumping equipment to the diameter of the well and the amount of lift required.

Lift. Suction pumps such as centrifugal and peristaltic pumps are restricted to 1 atmosphere of lifting capacity (33.9 feet of water at 4 degrees C), however, because of frictional head loss, the maximum lifting capacity of these pumps is approximately 20 to 22 feet of head. Push pumps such as submersible pumps, bladder pumps, and most manual pumps have a much greater lifting capacity. Other pumping techniques that are not restricted by depth include air lifting and bailing.

Well Diameter. Any of the currently available pumping equipment can be used for bailing a 4-inch or greater diameter well. Restrictions that will apply to monitoring wells

with a diameter less than 4-inches is the diameter of the pumping equipment (particularly submersible pumps). Considerations for choosing the proper pump should be the well diameter, the pumping rate, and the volume of water that will be required to develop the well. A list of the pumping equipment that can be used for developing wells includes:

- o submersible pumps (various diameters),
- o centrifugal and trash pumps (high groundwater),
- o peristaltic pumps (high groundwater),
- o pneumatic pump (air source generally required),
- o bladder pump,
- o air lifting equipment (hoses, eductor casing, air compressor),
- o manual pumps (B-K pump, WaTerra pumps), and
- o bailers.

Contaminated Monitoring Wells. A heavily contaminated monitoring well requires unusual precautions. In some situations pumping equipment must be used to develop these wells with the understanding that the equipment can never be used in other monitoring wells. This scenario must be discussed and approved by the Project Manager before sacrificing equipment.

For contaminated wells, it is best to use equipment that can be decontaminated easily or is disposable. Pumping equipment that meets this criteria are:

- o bailers,
- o air lifting equipment (hoses, eductor casing),
- o centrifugal pumps, and
- o manual hand pumps (B-K pump, WaTerra pumps).

Restrictions on the pumping equipment are that centrifugal pumps can only be used in wells where the potentiometric surface of the groundwater is less than 20 feet. Bailers, air lift technique, and manual pumps can be used in most wells.

Submersible pumps should not be used for developing heavily contaminated wells.

Note: Special procedures will be necessary for the handling, treating, and disposal of the contaminated groundwater that is purged from the well during well development.

Wells Containing Large Amounts of Sand and Silt. Wells that contain a large amount of fines (sand and silt) require pumping equipment that can pump this material. Submersible pumps and "Keck" pumps should not be used for developing wells that will produce a significant amount of sands and silts.

For these wells, it is best to use equipment that can be easily dismantled or are unaffected by sand and silt. Pumping equipment that meets this criteria are:

- bailers,
- air lifting equipment,
- centrifugal pumps and trash pumps,
- pneumatic pumps, and
- manual hand pumps (B-K pump, WaTerra pumps).

Restrictions on the pumping equipment are that centrifugal pumps and trash pumps can only be used in wells where the potentiometric surface of the groundwater is less than 20 feet. Bailers, air lift technique, pneumatic pumps, and manual pumps can be used in most wells. Other restrictions include the physical effort necessary to use the equipment (eg. air lifting equipment requires a two-person crew).

PROCEDURES:

Overpumping. The simplest method of well development is by overpumping, that is, pumping at a higher rate than the well can recharge. Overpumping, by itself, seldom produces full stabilization of the aquifer and filter pack. Overpumping may compact finer sediments around the borehole and thereby restrict flow into the screen. It is, therefore, recommended that some form of agitation be performed along with overpumping. Agitation or backwashing cause reversals of flow through the screen openings that will agitate the sediment, remove the finer fraction, and then rearrange the remaining formation particles. Backwashing also breaks down bridging in the filter pack. Agitation can be accomplished through surging of the well by turning the pump on and lifting a column of water to the top of the well, then shutting the pump off and letting the water fall back into the well (used with pumps that do not have check valves). By overpumping and periodically surging the well, the filter pack is developed to allow a minimal amount of sands into the well and the drilling fluids and mud pack is broken up and removed from the borehole and surrounding formation. Air lift pumping should be allowed to continue with periodic surging of the well until the well is sufficiently developed. The overpumping and surging technique are performed with submersible, centrifugal and pneumatic pumps.

Manual pumps and bailers can be used to overpump wells with smaller recharge; however, adequate surging may not be accomplished. Surging of low yield monitoring wells can be performed by adding clean water into the well to backwash the screen and filter pack. Factors must be considered, however, whenever adding something to a well (including clean water) to ensure that the added substance will not affect the water quality or jeopardize the purpose of the well. A general rule whenever water is added to a well is to remove at least 150 percent of the volume of added water from the well.

Well Development by Air. Pumping and surging of a monitoring well by air is another method of well development. This practice has increased with the increase of air compressors on drilling rigs. In this method, air is injected into the well to lift the water to the surface. Surging of the well is accomplished by shutting the air supply off when the water reaches the top of the well. The aerated water column falls back into the well causing backwash of the screen, filter pack, and surrounding formation. This is the best method for surging a well. It is also the best method for removing large amounts of sand and silt from wells. Air lift pumping should be allowed to continue with periodic surging of the well until the well is sufficiently developed.

Factors to consider when using this method are as follows.

1. Compressed air in most air compressors is generally derived through the use of an oil bath. Many of these air compressors (particularly old compressors) release a significant amount of oil with the compressed air. This oil could contaminate the monitoring well. Filters are available to remove over 99 percent of this oil and on new compressors, the amount of released oil is a small amount. Most air compressors do not have this filter (particularly rental companies that have older compressors that release a large amount of oil).

2. The use of compressed air will aerate the water in the well and if the air is released in the screened zone, will push air into the surrounding formation. The aerated water and air in the surrounding formation could cause changes to the ambient groundwater quality.

A method to avoid the release of air into the screened zone is to use an eductor casing. An eductor casing is a casing that is of smaller outside diameter than the inside diameter of the well casing. The eductor casing is placed inside the well to just above well bottom. The air line is placed inside the eductor casing so the end of the line is approximately 5 feet above the bottom of the eductor casing. The air supply is slowly turned on to lift the water inside the eductor casing and create a suction at the bottom of the eductor casing. Water will be discharged through the eductor casing. The sudden release of air is to be avoided. If the air supply is turned on too quickly, air will blow out the bottom of the eductor casing and water will be discharged between the well casing and the eductor casing.

Surging and backwashing are accomplished by shutting the air supply off when the water reaches the top of the eductor casing. The water column falls back into the well causing backwash of the screen, filter pack, and surrounding formation. Air lift pumping should be allowed to continue with periodic surging of the well until the well is sufficiently developed.

Well Development Criteria. A well is considered developed when the purged water is as clear and sediment free as the formation will allow and when the field supervisor determines that the discharge rate of the well is representative of the aquifer characteristics.

REFERENCES

F.G. Driscoll, *Groundwater and Wells*, 2nd edition, Johnson Division, 1986.

APPENDIX C

QUALITY ASSURANCE PLAN
FIELD PROGRAM

1.0

QUALITY ASSURANCE PLAN - FIELD PROGRAM

UNITED STATES DEPARTMENT OF THE NAVY

INSTALLATION RESTORATION PROGRAM

APPROVED FOR:

E.C. JORDAN CO.

Program Manager Raymond A. Allen, III, CPSS	Date
QA Officer R. Michael Nugent, Ph.D.	Date

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APPENDIX A - QUALITY ASSURANCE PROJECT PLAN ADDENDUM FORMAT

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3.0 PROGRAM DESCRIPTION

3.1 PURPOSE

The purpose of this generalized Quality Assurance Program Plan (QAPP) is to indicate prime responsibilities and prescribe requirements for assuring that the specific site investigations undertaken by E.C. Jordan Co. (Jordan) for the Installation Restoration Program (IRP) are planned and executed in a manner consistent with quality assurance objectives. This QAPP provides guidance and specifications to assure that:

- field determinations and analytical results are valid through preventive maintenance, calibration and analytical protocols;
- samples are identified and controlled through sample tracking systems and chain-of-custody (COC) protocols;
- records are retained as documentary evidence of the quality of samples, applied processes, equipment, and results;
- generated data are validated and their use in calculations is documented;
- calculations and evaluations are accurate, appropriate and consistent throughout the projects; and
- safety is maintained by requiring inclusion of the Health and Safety staff function in the project organization.

3.2 SCOPE

The requirements of this QAPP apply to all Jordan and subcontractor activities as appropriate for each specific project undertaken.

The prime responsibilities indicated in Section 4.0 extend to all quality-related controls and activities. The quality control (QC) and quality assurance (QA) elements described in each section are aimed at preventing isolated sub-standard or erroneous actions from occurring in essential areas.

The content and format of the QAPP is based on "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans - QAMS-005/80" prepared by U.S. Environmental Protection Agency's (USEPA) Office of Research and Development.

This QAPP establishes, among other things, the procedures to be followed for conducting site investigations. Since each site investigation will require data gathering efforts and likely will require field measurements, an addendum to this QAPP will be prepared for each phase of the site investigation. The site-specific QAPP addendum will be included for each phase of the Work Plan.

3.3 PROGRAM SUMMARY

The Department of Defense (DOD) has initiated the Installation Restoration Program (IRP) as a component of compliance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) as modified by the Superfund Amendments and Reauthorization Act (SARA). The IRP will be performed in accordance with USN management guidance and in compliance with the requirements of the National Contingency Plan (NCP), the Resource Conservation and Recovery Act (RCRA) and other applicable or appropriate and relevant requirements. The IRP was established by the DOD to identify the locations and contents of past disposal sites at their installations and to eliminate the hazards to public health (both real and potential) in an environmentally responsible manner. The IRP is implemented in the following four phases.

Phase I - Records Search. Phase I consists of an installation-wide records search and personnel interviews to collect and evaluate evidence regarding the potential for contamination at the installation.

Phase II - Confirmation/Quantification. Phase II consists of on-site investigations, including physical and chemical analyses to ascertain and quantify the existence and extent of contamination, and to identify necessary corrective measures if contamination is present. Phase II may consist of one or more stages of investigation to gather data necessary for either eliminating the site from the IRP or implementing Phase IV.

Phase III - Technical Development. Phase III consists of the implementation of research requirements and the development of technology for objective assessment of environmental effects. A Phase III requirement can be identified at any time during the program.

Phase IV - Remedial Actions. The objective of Phase IV is to select and implement control measures that will comply with DOD, USN, USEPA, and state regulatory agency policies regarding past hazardous waste disposal sites. This is usually accomplished in two steps: Phase IV-A, design of remedial actions; and Phase IV-B, implementation of remedial actions.

To facilitate the conduct of the IRP program under the guidelines of the SARA of 1986 and Executive Order 12580, the Phase II/IV-A program will generally be conducted as a Remedial Investigation/Feasibility Study (RI/FS). Phase II activities will generally be referred to as the Remedial Investigation (RI). Remedial Action Planning (Phase IV-A) will generally be referred to as the Feasibility Study (FS).

3.4 MAJOR TASK SUMMARY

The IRP activities to be undertaken at DOD sites by Jordan will consist of scientific and engineering investigations and studies which include multiple tasks and subtasks within each Phase. Each task will be described in the site-specific Work Plan.

3.4.1 Sampling and Analytical Program

Field activities associated with the site investigations will include geophysical explorations and sampling of soil, sediment, surface water, groundwater and air, as appropriate for each site. The specific sampling plan for each site will be described in the task Work Plan and QAPP addendum.

The analytical program is described in Section 9. Analyses will be performed by two laboratories. One laboratory will analyze duplicate samples to provide an external measure of analytical quality. Methodologies may include those utilized by USEPA under the Safe Drinking Water Act (SDWA), CERCLA, SARA, RCRA, and the Clean Water Act (CWA).

3.4.2 Deliverables

Technical progress and financial management reports will be submitted each month. Major reports will be submitted at the completion of each phase. Additional outputs include this QAPP, Work Plans, the site-specific QA addenda, and site-specific Health and Safety Plans (HASP). A specific list of deliverables is to be included in each Work Plan.

3.4.3 Schedule

The Work Plans will include a schedule of activities for each site.

4.0 PROGRAM ORGANIZATION AND RESPONSIBILITIES

4.1 ORGANIZATION

Jordan operates under a matrix system in which personnel belong to functional departments and, at the same time, are assigned to projects. Functional departments are responsible for developing and maintaining Jordan's engineering and scientific disciplines. They provide for personnel training and the establishment of engineering and scientific standards. Each project's organization is responsible for complying with program guidelines and achieving project objectives.

This portion of the QAPP addresses the program organization. Those who are assigned to a project within the program organization are responsible for properly utilizing functional organization resources. In this way, the entire resources of Jordan are made available to each project, but responsibility for initiating services and for ensuring acceptable results remains within the program organization. This responsibility carries with it the authority to initiate, modify, and, if necessary, stop activities, as appropriate for the assurance of project quality. It is the Quality Assurance Coordinator's (QAC) role to assist the Task Order Managers (TOM) in meeting project goals while providing an independent evaluation of product quality.

4.2 SPECIFIC RESPONSIBILITIES

Figure 4-1 shows a typical program organization and its principal lines of communication. The responsibilities of the Jordan program positions and support organizations are summarized below.

Regional Officer. The Regional Officer (RO) is James R. Wallace, P.E., Southeast Division Manager. He is responsible for establishing a contract for the services to be performed and for committing the corporate resources necessary to conduct the program work activities; for supplying corporate-level input for problem resolution; and for assisting the Program Manager and Technical Director as needed in project implementation.

Program Manager. The Program Manager (PM), Raymond A. Allen, III CPSS, is responsible for the overall program. Some specific responsibilities of his role include:

- overall technical responsibility for the program;
- establishing and overseeing all subcontracts for support services;
- initiating program activities;

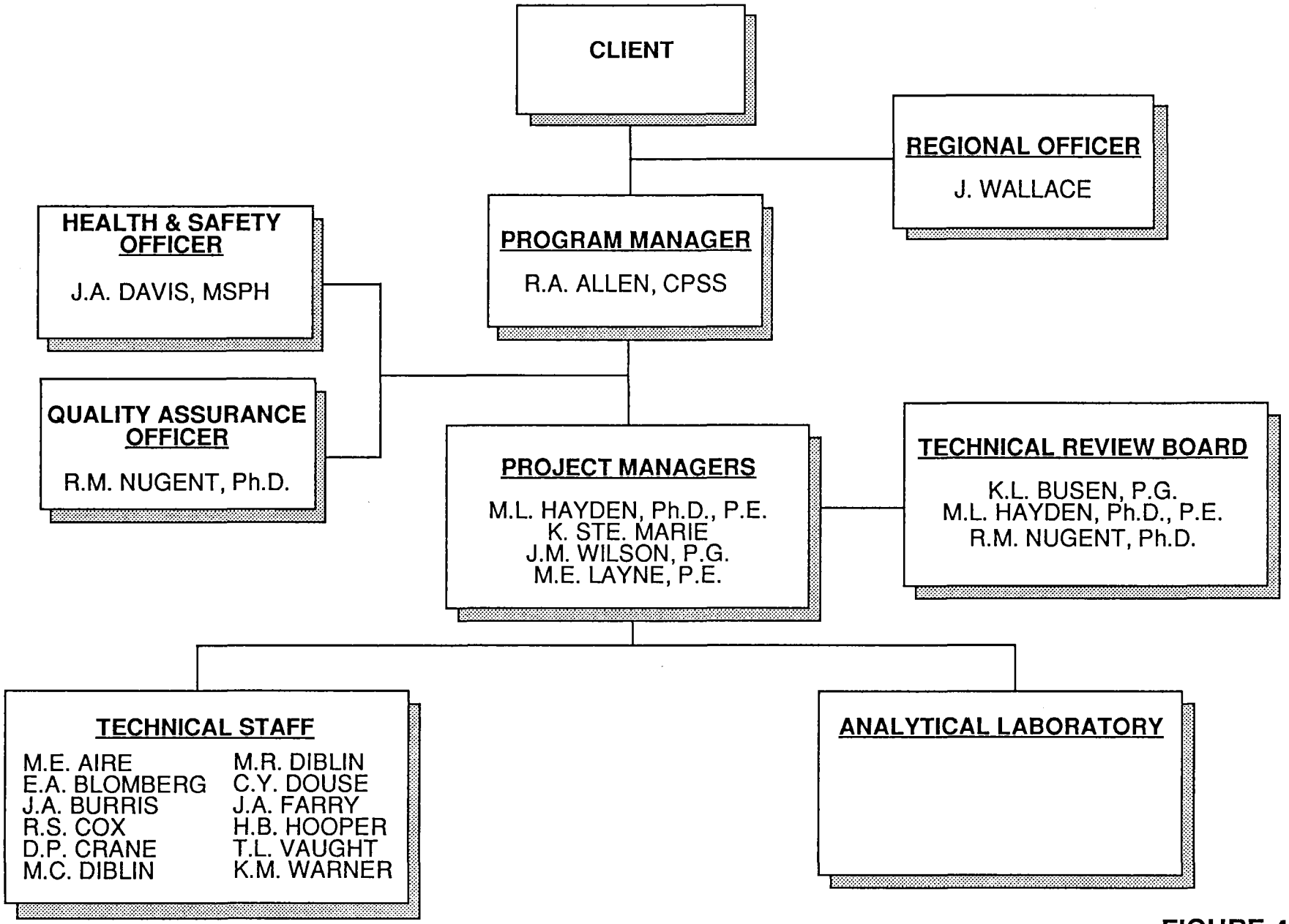

FIGURE 4-1
TYPICAL PROGRAM ORGANIZATION

- implementing the subcontracting plan to significantly involve small and/or disadvantaged business in the program;
- participating in the work plan preparation and staff assignments;
- identifying and fulfilling equipment and other resource requirements;
- monitoring task activities to ensure compliance with established budgets, schedules, and the scope of work;
- regularly interacting with the IRP Management Team, the CO and others, as appropriate, on the status of the project;
- preparing monthly technical/management/cost progress reports; and
- ensuring that appropriate financial record and reporting requirements are met.

Project Manager. Mr. Allen will also hold the positions of Project Manager (PrM). This senior-level position is established because of the importance of day-to-day scope, schedule and budget monitoring both within Jordan and between Jordan and the IRP Management Team. It is expected that program decisions will be occurring frequently, therefore it is necessary to anticipate and immediately implement the administrative actions (initiate internal work orders, follow-up on support needs, amend subcontracts, track cost-charges) to carry out the program plans.

Technical Director. Each site investigated under the IRP will be assigned a Technical Director (TD). Mr. R. Michael Nugent, Ph.D., has been assigned the TD for this project.

The TD is responsible for the following:

- the appropriateness and adequacy of the technical or engineering services provided;
- developing the technical approach and level of effort required to address each of the tasks/subtasks;
- the day-to-day conduct of the work, including the integration of the input of supporting disciplines and subcontractors, (i.e., drilling and laboratory subcontractors);
- ongoing quality control during performance of the work; and
- the technical integrity as well as the clarity and usefulness of all project work products.

Technical Review Board. A Technical Review Board (TRB), made up of senior technical staff from the Jordan team, will assist the PrM and TD by providing review of the technical aspects of the project to assure that the services reflect the accumulated experience of the firms; that they are produced in

accordance with the corporate policy; and meet the intended needs of the IRP Management Team. The primary function of this board is to assure the application of technically sound methodologies and the development of litigatively defensible data, interpretations and conclusions. Members of the TRB will be identified in each Work Plan.

Quality Assurance/Health and Safety Coordinators. The TD is supported by a Quality Assurance Officer (QAO) and a Health and Safety Officer (HSO). These staff-level positions will report to the PM. The QAO will assure that appropriate IRP and USEPA protocols are followed and will be responsible for the development of the task-specific quality assurance addendum. The QAO works with the PM/TD to insure that established quality control procedures are implemented. The HSO is responsible for insuring that the project team complies with Jordan's Health and Safety Program. She is also responsible for seeing that a health and safety plan is developed for each site activity.

Other key line positions are the technical activity leaders, i.e., the senior and/or most-experienced individual in each technical area of the project. These technical activity leaders are identified on the Project Organization Chart in each Work Plan.

5.0 QUALITY ASSURANCE OBJECTIVES

5.1 GENERAL

The quality of measurements made during this study will be determined by the following characteristics: accuracy; precision; representativeness; completeness; and comparability. Specific objectives for each characteristic are established to develop sampling protocols, and identify applicable documentation, sample handling procedures and measurement system procedures. These objectives are established based on site conditions, objective of the project, and knowledge of available measurement systems. The subsequent use of these measurements in calculations and evaluations is also subjected to aspects of this QAPP as described in the following sections.

5.2 REPRESENTATIVENESS

Measurements will be made so that results are as representative of the media (e.g., air, soil, water) and conditions being measured, as possible. Sampling protocols will be developed to assure that samples collected are representative of the media. Sample handling protocols (e.g., storage, transportation) are selected to protect the representativeness of the collected sample. Proper documentation will establish that protocols have been followed and sample identification and integrity assured.

Sample collection and field handling will be in accordance with the standard procedures contained in this QAPP.

5.3 PRECISION AND ACCURACY

Precision, the ability to replicate a value, and accuracy, the ability to obtain a true value, are addressed for all data generated. Data quality objectives for precision and accuracy are established for each major parameter to be measured at the site. These objectives are based on prior knowledge of the capabilities of the measurement system to be employed, selected in accordance with the requirements of the project. The precision and accuracy requirements vary, depending on their intended use. For example, a screening tool to identify the general extent of chemical distribution will not require the same precision and accuracy required to define the exact nature and amount of chemicals present at specific locations. Section 9.2 contains information regarding analytical procedures.

Calculations performed with the data generated are also checked for accuracy by the TD or their designees, and precision, i.e. comparability of calculation efforts between tasks, is assured by the QAO.

5.4 COMPLETENESS

The characteristic of completeness is a measure of the amount of valid data obtained compared to the amount that was expected to be obtained under normal

conditions. The amount of valid data expected is established based on the measurements required to accomplish project objectives. The number of groundwater, surface water, sediment, and air samples to be obtained is specified for each site in the QAP Addendum. Because sampling and waste characterization activities often rely on a field protocol, the QAP Addendum would provide an upper limit on the number of samples to be collected. For example, multiple depth soil sample collection may be specified, but rock outcroppings may be encountered prior to reaching the specified depth. In that case, it would not be possible to obtain a predetermined number of soil samples. The extent of completeness must therefore be reviewed on a relative basis for sample collection activities. Completeness of data handling systems is described in Sections 10.0, 12.0 and 14.0.

5.5 COMPARABILITY

The characteristic of comparability reflects both internal consistency of measurements made at the site and expression of results in units consistent with other organizations reporting similar data. Each value reported for a given measurement should be similar to other values within the same data set and within other related data sets. Comparability of data and measuring procedures must also be addressed. This characteristic implies operating within the calibrated range of an instrument and utilizing analytical methodologies which produce comparable results (e.g., data obtained for total recoverable phenolics via wet chemistry is not necessarily comparable to data obtained for phenol via Gas Chromatography/Mass Spectrometry (GC/MS)).

Measurements compared to similar measurements which appear as "outliers" will be reassessed. Units of measurement will be externally comparable by utilizing the appropriate standard units for each measurement system.

5.6 QUALITY ASSURANCE OBJECTIVES

For Jordan's efforts under the IRP, the quality assurance objectives are:

- to collect sufficient background information and current chemical characterization data to assess each site and recommend action alternatives;
- to collect sufficient field, sampler and trip blank samples and field duplicates to allow an assessment of sample representativeness and sample collection protocol precision;
- to analyze sufficient internal duplicates, blanks, reference standards and matrix spike samples to allow an assessment of analytical precision and accuracy. Sufficiency of analytical QC procedures is specified by the referenced methods (see Section 9.2); and
- to produce documented, consistent and technically defensible reports.

6.0 SAMPLING PROCEDURES

6.1 GENERAL

The quality of sample collection techniques is assured by keying the sampling technique used to both the media/matrix to be sampled and the analytes of interest. For example, samples intended for semi-volatile organic analyte (SVOA) analyses are collected in glass bottles; samples for volatile organic analyte (VOA) analyses are collected in Teflon-septum-capped glass vials with "zero" headspace to minimize diffusive and evaporative losses; and most samples for inorganic analyses are collected in linear polyethylene bottles. Sample containers provided by Jordan are prepared in a manner consistent with USEPA protocol, as noted in the following section.

Acquisition of environmental samples also requires specialized collection techniques to preserve their integrity and ensure that a representative portion of the source is collected. Media-specific sample collection techniques are specified in the following sections.

Further, unless the proper sample bottle preparation and sample preservation measures are taken in the field, sample composition can be altered by contamination, degradation, biological transformation, chemical interactions, and other factors during the time between sample collection and analysis. Typical sample bottle preparation protocols are presented in Section 6.2. Steps taken to maintain the in-situ characteristics required for analysis may include refrigeration of samples at 4°C, freezing, pH adjustment, and chemical fixation. Samples are preserved according to the protocol established for the specific analytical method selected to obtain the desired data. Tables 6-1 and 6-2 provide more specific information.

Sample Labels and Records

Sample labels will be prepared prior to initiation of work, generally using the computerized label system. Each sample will require several containers dependent on the intended analysis to be performed. The pH and specific conductance of each aqueous sample will be determined in the field. At the time the sample is obtained, a sample record will be completed. In addition to the sample record, documentation will include:

- a plan of the site;
- sample label numbers;
- a description of the sample site;
- other physical descriptors of the sample site (e.g., stream width, groundwater depth, etc.);

TABLE 6-1

SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS
CERCLA/RCRA SAMPLES

	Concentration	Container	Sample Size	Preservation	Holding Time
WATER					
Organics GC & GC/MS	VOA	glass	2 x 40 mℓ	Cool to 4°C	7 days
	Extractables				
	Low	amber glass	2 x 80 oz. or 4 x 1 ℓ	Cool to 4°C	5 days to extraction 40 days after extraction
	Medium	wide-mouth glass	4 x 32 oz.	None	Same as above
Inorganics	Metals				
	Low	polyethylene	1 ℓ	HNO_3 to pH ≤ 2	6 months (Hg-30 days)
	Medium	wide-mouth glass	16 oz.	None	6 months
	Cyanide				
	Low	polyethylene	1 ℓ	NaOH to pH >12	14 days
	Medium	wide-mouth glass	16 oz.	Cool to 4°C	
Organic/Inorganic	High Hazard	8-oz. wide-mouth glass	6 oz.	None	14 days
COD	--	polyethylene	0.5 ℓ	H_2SO_4 to pH <2	28 days
TOC	--	polyethylene	0.5 ℓ	HCl to pH <2	28 days
Oil & Grease	--	glass	1.0 ℓ	H_2SO_4 to pH <2	28 days
Phenols	--	polyethylene	1.0 ℓ	H_2SO_4 to pH <2	28 days
General Chemistry	--	polyethylene	1.0 ℓ	None	--
SOIL					
Organics GC & GC/MS	VOA	2 oz. wide-mouth glass	2 oz.	Cool to 4°C	10 days
	Extractables				
	Low/Medium	4 oz. wide-mouth glass	4 oz.	Cool to 4°C	10 days to extraction 40 days after extraction
Inorganics	Low/Medium	4 oz. wide-mouth glass	4 oz.	Cool to 4°C	NA
Organic/Inorganic	High Hazard	8 oz. wide-mouth glass	6 oz.	None	NA
Dioxin	All	4 oz. wide-mouth glass	4 oz.	None	NA
EP Toxicity	All	250 mℓ polyethylene	200 grams	None	NA
AIR					
Volatile Organics	Low Medium	Charcoal or Tenax Tube 7 cm long, 6mm OD, 4mm ID	100 ℓ air	Cool to 4°C	NA

TABLE 6-2
REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
CWA SAMPLES

Parameter Name	Container[1] Type	Container[1] Size	Preservation[2]	Maximum Holding Time[3]
Bacterial Tests				
Coliform, fecal and total	P,G	250 mℓ	Cool, 4°C, 0.008% $Na_2S_2O_3$	6 hours
Fecal streptococci	P,G	250 mℓ	Same as above	6 hours
Inorganic Tests				
Acidity	P,G	100 mℓ	Cool, 4°C	14 days
Alkalinity	P,G	100 mℓ	Cool, 4°C	14 days
Ammonia	P,G	1000 mℓ	Cool, 4°C, H_2SO_4 to pH <2	28 days
Biochemical oxygen demand	P,G	200 mℓ	Cool, 4°C	48 hours
Bromide	P,G	100 mℓ	None required	28 days
Biochemical oxygen demand, carbonaceous	P,G	100 mℓ	Cool, 4°C	48 hours
Chemical oxygen demand	P,G	100 mℓ	Cool, 4°C, H_2SO_4 to pH <2	28 days
Chloride	P,G	100 mℓ	None required	28 days
Chlorine, total residual	P,G	in field	None required	Analyze immediately
Color	P,G	50 mℓ	Cool, 4°C	48 hours
Cyanide, total and amenable to chlorination	P,G	1 ℓ	Cool, 4°C, NaOH to pH >12, 0.6g ascorbic acid	14 days
Fluoride	P	100 mℓ	None required	28 days
Hardness	P,G	100 mℓ	HNO_3 to pH <2, H_2SO_4 to pH <2	6 months
Hydrogen ion (pH)	P,G	25 mℓ	None required	Analyze immediately
Kjeldahl and organic nitrogen	P,G	1 ℓ	Cool, 4°C, H_2SO_4 to pH <2	28 days
Metals				
Chromium VI	P,G	100 mℓ	Cool, 4°C	24 hours
Mercury	P,G	150 mℓ	HNO_3 to pH <2	28 days
Metals, except chromium VI and mercury	P,G	1-5 parameters-100mℓ 6-10 parameters-125mℓ >10 parameters-150mℓ	Same as above	6 months
Nonconventional Pollutants				
Nitrate	P,G	100 mℓ	Cool, 4°C	48 hours
Nitrate-nitrite	P,G	50 mℓ	Cool, 4°C, H_2SO_4 to pH <2	28 days
Nitrite	P,G	100 mℓ	Cool, 4°C	48 hours
Oil and grease	G	1 ℓ	Cool, 4°C, H_2SO_4 to pH <2	28 days
Organic carbon	P,G	10 mℓ	Cool, 4°C, HCl or H_2SO_4 to pH <2	28 days
Orthophosphate	P,G	50 mℓ	Filter immediately, cool, 4°C	48 hours
Oxygen, dissolved probe	G bottle and top	in field	None required	Analyze immediately
Winkler	Same as above	200 mℓ	Fix on site and store in dark	8 hours
Phenols	G	1 ℓ	Cool, 4°C, H_2SO_4 to pH <2	28 days
Phosphorus (elemental)	G	100 mℓ	Cool, 4°C	48 hours
Phosphorus, total	P,G	150 mℓ	Cool, 4°C, H_2SO_4 to pH <2	28 days
Residue, total	P,G	200 mℓ	Cool, 4°C	7 days
Residue, filterable	P,G	200 mℓ	Cool, 4°C	48 hours
Residue, nonfilterable (TSS)	P,G	200 mℓ	Cool, 4°C	7 days
Residue, settleable	P,G	1 ℓ	Cool, 4°C	48 hours
Residue, volatile	P,G	200 mℓ	Cool, 4°C	7 days
Silica	P	see metals	Cool, 4°C	28 days
Specific conductance	P,G	25 mℓ	Cool, 4°C	28 days
Sulfate	P,G	250 mℓ	Cool, 4°C	28 days

TABLE 6-2(CONT.)

REQUIRED CONTAINERS, PRESERVATION TECHNIQUES, AND HOLDING TIMES
CWA SAMPLES

Parameter Name	Container[1] Type	Container[1] Size	Preservation[2]	Maximum Holding Time[3]
Sulfide	P,G	200 mℓ	Cool, 4°C, add zinc acetate plus sodium hydroxide to pH >9	7 days
Sulfite	P,G	100 mℓ	None required	Analyze immediately
Surfactants	P,G	400 mℓ	Cool, 4°C	48 hours
Temperature	P,G	in field	None required	Analyze
Turbidity	P,G	40 mℓ	Cool, 4°C	48 hours
Organic Tests				
Purgeable halocarbons	G, Teflon-lined septum	40 mℓ	Cool, 4°C, 0.008% $Na_2S_2O_3$[4]	14 days[5]
Purgeable aromatic hydrocarbons	Same as above	40 mℓ	Cool, 4°C, 0.008% $Na_2S_2O_3$[4], HCl to pH 2	14 days[5]
Acrolein and acrylonitrile	Same as above	40 mℓ	Cool, 4°C, 0.008% $Na_2S_2O_3$[4], Adjust pH to 4-5	14 days[5]
Phenols	G, Teflon-lined cap	1 ℓ	Cool, 4°C, 0.008% $Na_2S_2O_3$[4]	7 days until extraction, 40 days after extraction
Benzidines	Same as above	1 ℓ	Same as above	7 days until extraction
Phthalate esters	Same as above	1 ℓ	Cool, 4°C	7 days until extraction, 40 days after extraction
Nitrosamines	Same as above	1 ℓ	Cool, 4°C, store in dark, 0.008% $Na_2S_2O_3$	Same as above
PCBs, acrylonitrile	Same as above	1 ℓ	Cool, 4°C	Same as above
Nitroaromatics and isophorone	Same as above	1 ℓ	Cool, 4°C, 0.008% $Na_2S_2O_3$[4], store in dark	Same as above
Polynuclear aromatic hydrocarbons	Same as above	1 ℓ	Same as above	Same as above
Haloethers	Same as above	1 ℓ	Cool, 4°C, 0.008% $Na_2S_2O_3$[4]	Same as above
Chlorinated hydrocarbons	Same as above	1 ℓ	Cool, 4°C	Same as above
TCDD	Same as above	1 ℓ	Cool, 4°C, 0.008% $Na_2S_2O_3$[4]	Same as above
Volatile Organics	G, Teflon-lined septum	40 mℓ	Cool, 4°C	14 days[5]
Semi-Volatiles	G, Teflon-lined cap	1ℓ	Cool, 4°C	7 days until extraction, 40 days after extraction
Pesticides Tests				
Pesticides	Same as above	1 ℓ	Cool, 4°C, pH 5-9	Same as above
Radiological Tests				
Alpha, beta and radium	P	1 ℓ	HNO_3 to pH <2	6 months

[1] Appropriate sample containers: P = polyethylene, G = glass.
[2] Sample preservation should be performed immediately upon sample collection. For composite chemical samples, each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting is completed.
[3] Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples (preserved, as required) may be held before analyses and still be considered valid. Some samples may not be stable for the maximum time period given in the table. A permitter or monitoring laboratory is obligated to hold the sample for a shorter time if knowledge exists to show that this is necessary to maintain sample stability.
[4] Use $Na_2S_2O_3$ (sodium thiosulfate) only if chlorine is present.
[5] 7 days if unpreserved.

- photographs of the sample site may be taken showing the sampling equipment and/or unusual conditions (orientation of photograph must be shown on sketch map); and

- chain-of-custody documentation (see Section 7).

Sample Shipment

Preparation of samples for shipment is performed in the following manner:

1. Label bottles with sample number and sample type (e.g. influent to treatment, effluent from treatment). Each sample set will have a unique sample number. Labels will be secured with tape.

2. Check Department of Transportation (DOT) regulations to insure that samples are packaged correctly for transportation. Should any problems or questions arise with preparation of samples for shipment, contact the task leader.

3. Package samples in the approved shipping container. Laboratory paperwork is to be included with the samples. Ensure samples are cooled to recommended temperature prior to sealing shipping container.

4. Ship samples immediately to the appropriate laboratory via an overnight carrier. Laboratory name and address should be clearly marked on the shipping container.

5. Inform the Laboratory Services Coordinator (LSC) that the samples have been shipped.

6.2 PREPARATION OF SAMPLE CONTAINERS

In order to maintain comparability with data to be generated through USEPA's National Contract Laboratory Program (CLP), Jordan has chosen to acquire precleaned sample containers through either I-CHEM RESEARCH INC., the supplier to USEPA-CLP, or through an approved laboratory which utilizes the same procedures. The procedures used by I-CHEM are detailed below.

6.2.1 Semivolatile Organic Analyte Containers (1-liter amber glass bottles and 4oz. clear glass jars)

1. Wash containers, closures, and Teflon liners in hot tap water with laboratory grade non-phosphate detergent.

2. Rinse three times with tap water.

3. Rinse with 1:1 nitric acid.

4. Rinse three times with ASTM Type 1 deionized water.

5. Rinse with pesticide grade methylene chloride.

6. Oven dry.

7. Remove containers, closures, and Teflon liners from oven.

8. Place Teflon liners in closures and place closures on containers. Attendant to wear gloves and containers not to be removed from preparation room until sealed.

6.2.2 Elemental Parameter, Cyanide and Miscellaneous Parameter Containers (1-liter 500, 250, 125 and 60ml clear and 1-liter amber polyethylene bottles)

1. Wash bottles, closures, and Teflon liners with hot tap water with laboratory grade non-phosphate detergent.

2. Rinse three times with tap water.

3. Rinse with 1:1 nitric acid.

4. Rinse three times with ASTM Type 1 deionized water.

5. Air dry in contaminant-free environment.

6. Place liners in closures and place closures on bottles. Attendant to wear gloves and bottles not to be removed from preparation room until sealed.

6.2.3 Volatile Organic Analyte Containers (40ml glass vials and 2-oz glass jars)

1. Wash vials, septa, and closures in hot tap water with laboratory grade non-phosphate detergent.

2. Rinse three times with tap water.

3. Rinse three times with ASTM Type 1 deionized water.

4. Oven dry vials, septa, and closures.

5. Remove vials, septa, and closures from oven.

6. Place septa in closures, Teflon side down, and place on vials. Attendant to wear gloves and vials not to be removed from preparation room until sealed.

6.2.4 Preparation of Pump Tubing

Adequate lengths of 3/8 inch ID Teflon tubing and 3/8 inch ID silicon tubing will be prepared by Jordan if pump tubing is specified for the sampling episode. The tubing preparation procedure is:

1. Pump detergent solution through system for 2 minutes.

2. Pump clean hot water through system for 2 minutes or until clear, whichever is longer.

3. Pump blank water through system for 2 minutes.

4. Pump decontamination fluid specified in the site specific QAPP through system for 2 minutes.

5. Pump blank water through system for 2 minutes.

6. Seal tubing ends, wrap and label with date of cleaning.

6.2.5 Automatic Composite Sample Containers

The Jordan procedure for cleaning the 5-gallon, 3-gallon, or 2½-gallon glass bottles is:

1. Wash bottles and Teflon-lined caps thoroughly with hot detergent water.

2. Rinse bottles and Teflon-lined caps with hot tap water.

3. Rinse bottles and Teflon-lined caps with blank water.

4. Allow bottles to completely dry.

5. In a well ventilated area (e.g., a laboratory hood), rinse the bottles with dichloromethane or acetone. Inhalation of dichloromethane is avoided. Rinse the bottles making sure that every part of the bottle comes in contact with the dichloromethane or acetone. Three hundred mℓ can be used to clean up to 16 bottles at one cleaning.

6. Allow bottles to dry in a well-ventilated area for at least 24 hours.

7. Heat Teflon-lined caps at 250°F for one hour or replace Teflon-lined caps with new properly cleaned Teflon.

8. After bottles have dried, cap the bottles using a pair of surgical gloves.

6.3 DECONTAMINATION PROCEDURES

Equipment to be decontaminated during the project may include: (1) drill rig; (2) tools; (3) monitoring equipment; (4) respirators; (5) sample containers; (6) truck or trailer and (7) laboratory equipment.

All decontamination will be done by personnel in protective gear appropriate for the level of decontamination, determined by the Site Safety Officer. The decontamination work tasks will be split or rotated among support and work crews. Decontamination procedures within the trailer (if used) should take place only

after other personnel have cleared the "hot area", moved to the clean area and the door between the two closed.

Miscellaneous tools and samplers will be dropped into a plastic pail, tub or other container. They will be brushed off and rinsed (outside, if possible) and transferred into a second pail to be carried to further decontamination stations. They will be washed with a non-phosphate detergent solution, rinsed with pesticide grade ethanol:methanol 90:10 v/v (if required), rinsed with a detergent solution and finally rinsed with deionized water. Well screen and riser pipe shall be cleaned in a manner similar to that for drill rigs.

6.3.1 Drilling Rig/Backhoe and Tools

It is anticipated that the drill rigs, backhoes, downhole tools, and well riser pipe and screen will be contaminated during test pit/borehole activities. They will be cleaned with high pressure water or portable high pressure steam followed by soap and water wash and rinse. Other solvents may be used if necessary. Loose material will be removed by brush. The person performing this activity will usually be at Level D protection plus splash protection.

6.3.2 Sample Containers

Exterior surfaces of sample bottles will be decontaminated prior to packing for transportation to the analytical laboratory. Sample containers will be wiped clean at the sample site, but it will be difficult to keep the sample containers completely clean. The samples will be taken to the decontamination area. Here they will be further cleaned as necessary and transferred to a clean carrier and the sample identities noted and checked off against the chain-of-custody record. The samples, now in a clean carrier, will be stored in a secure area prior to shipment.

6.3.3 Monitoring Equipment

Monitoring equipment will be protected as much as possible from contamination by draping, masking or otherwise covering as much of the instruments as possible with plastic without hindering the operation of the unit. The HNU meter, for example, can be placed in a clear plastic bag which allows reading of the scale and operation of the knobs. The HNU sensor can be partially wrapped, keeping the sensor tip and discharge port clear.

The contaminated equipment will be taken from the drop area and the protective coverings removed and disposed of in the appropriate containers. Any direct or obvious contamination will be brushed or wiped with a disposable paper wipe. The units can then be taken inside in a clean plastic tub, wiped off with damp disposable wipes and dried. The units will be checked, standardized and recharged as necessary for the next day's operation. They will then be prepared with new protective coverings.

6.3.4 Respirators

Respirators will be decontaminated daily. Taken from the drop area, the masks will be disassembled, the cartridges set aside and the rest placed in a cleansing solution. (Parts will be precoded, e.g., #1 on all parts of mask #1.) After

an appropriate time within the solution, the parts will be removed and rinsed off with tap water. The old cartridges will be marked so as to indicate length of usage (if means to evaluate the cartridges' remaining utility are available) or will be discarded into the contaminated trash container for disposal. In the morning the masks will be re-assembled and new cartridges installed if appropriate. Personnel will inspect their own masks to be sure of proper readjustment of straps for proper fit.

6.3.5 Decontamination Trailer or Truck and Staging Area

The decontamination trailer or truck, if used, will be cleaned daily. This will include vacuuming with a vacuum having a water filter to capture dust particles. The area will be wet mopped with cleanser and again with clean water. Work bench areas will be wiped down. Wash buckets and the cleaning area will be decontaminated and made ready for the next day's use.

6.3.6 Laboratory Equipment

Sample handling areas and equipment will be cleaned/wiped down daily. Disposable wipes will be used and discarded into a plastic bag. These will subsequently be taken to and placed in the disposal drum for final disposition. For final cleanup, all equipment will be disassembled and decontaminated. Any equipment which cannot be satisfactorily decontaminated will be disposed of (e.g., glassware, covers for surfaces) as previously indicated.

6.4 SAMPLING SITE LOCATION

The rationale for each sampling site location is identified in the site work plan. To permit proper evaluation of the sample analysis results it is important that the actual location of the samples be properly documented. If possible, sampling sites will be marked in the field with stakes or flagging. All sampling site locations will be accurately referenced on a base map. Photographs of sampling sites are taken as necessary to document site conditions.

6.5 AIR SAMPLING

Short-term sampling is most often utilized when real-time monitoring is desired. Equipment for real-time monitoring must be calibrated according to manufacturer's instructions prior to use. Typical equipment includes:

- oxygen deficiency meter;
- combustible gas monitor (explosimeter);
- chemically reactive indicating tubes (e.g., Drager) for specific compounds (HCN, H_2S etc.);
- photoionization (PI) survey meter (total volatile organics); and

- organic vapor analyzer (OVA) (total or specific volatile organics).

All real-time monitoring results are recorded on the appropriate field data sheets (Figure 6-1).

6.6 SOIL SAMPLING

6.6.1 General

Soil sampling programs are undertaken to define the location, nature and concentration of contaminants in a site subsurface. The location and distribution of contaminants at a given site are governed by many factors, including:

- site operation or waste disposal practices;
- site design;
- site closure;
- waste characteristics;
- site topography and surface drainage;
- climate; and
- site geology.

Development of a soil sampling plan that will effectively reveal the distribution and magnitude of contamination at a specific site requires at a minimum:

- an assessment of the factors listed above;
- evaluation of the methodology and results of any previous sampling and analysis programs which may have been completed at the site; and
- definition of the scope and objectives of the project.

A number of techniques have been developed to obtain samples from various depths below the ground surface. The techniques described herein are those normally employed by Jordan. They have been selected to provide practical, efficient means of obtaining samples in a manner consistent with safety protocol and QA/QC requirements. Additionally, they employ equipment that is normally available for use.

AIR QUALITY MONITORING RECORD

SITE _____

SAMPLE STATION _____

DATE _____

ON-SITE TIME - START _____ END _____

INSTRUMENT _____

AMBIENT WEATHER DATA

TEMP. - °F _____

HUMIDITY _____

BAROMETRIC PRESSURE _____

CONDITIONS (i.e., FOG, RAIN) _____

_____

WIND SPEED/DIRECTION _____

TIME	VALUE	TIME	VALUE	TIME	VALUE	TIME	VALUE

NOTES _____

_____

_____

_____

_____

_____
SIGNATURE

FIGURE 6-1

EC JORDAN CO

The selection of sampling techniques to be employed at a given site is based upon the depth from which samples must be obtained and the nature of the soils to be sampled. The sampling techniques are categorized by the depths at which each is applicable:

- shallow samples are from depths of less than about 5 feet, usually less than 2 feet;
- intermediate samples are from depths up to about 15 feet; and
- deep samples are generally from depths greater than 15 feet.

Maintaining proper records is a significant aspect of sample taking. At the time samples are obtained, the following must be recorded by the sampler:

- sample site location (e.g., grid coordinates baseline station and offset, or the location plotted on a map or aerial photograph);
- sample type and depth;
- date and time of sampling;
- project and sample designations;
- sampler identification; and
- analyses requested.

Additionally, the sampler must initiate chain-of-custody (COC) procedures and describe the sample site in adequate detail to allow the analytical results to be properly interpreted and, if necessary, to allow collection of additional samples from the same sample site. Jordan uses preprinted labels, standardized record forms and photographs to expedite this process and ensure uniformity of records. The sampling protocols and recordkeeping requirements for the types of samples described in the following pages vary according to the sampling techniques. Additional requirements may also be established on a site-specific basis. The entire soil sampling process is designed and conducted in a manner that provides samples suitable for the intended analyses and that are properly documented.

6.6.2 Deep Samples

Objective

To obtain deep soil samples suitable for chemical analysis.

Approach

For soil sampling from depths greater than about 15 feet, borings are usually employed.[1] Borings are normally completed as either cased or augered holes.

Boring Methods

The boring methods employed at a given site are selected on the basis of the site's subsurface conditions. Jordan will prepare detailed drilling specifications that govern the drilling subcontractor's efforts upon awarding of the drilling subcontract which is based on competitive bid. These specifications are modified on a site specific basis to reflect the needs of each project. Principal boring methods are described in the following section.

Cased Borings. Casing is used to support the boring as it is advanced. The casing is driven or drilled to the sample elevation and soil remaining in the interior of the casing is washed out with drilling fluid. Potable water or air is normally used to wash out the casing. The samples are retrieved from undisturbed soils below the bottom of the casing. The advantages of this drilling technique are:

- relative simplicity of procedure;
- relatively low risk of personnel exposure;
- can be used to obtain soil samples from a wide range of subsurface conditions;
- can be used to obtain samples from depths greater than 100 feet; and
- good availability of equipment.

The disadvantages of cased borings arise from the need to use a drilling fluid. When sampling pervious soils, such fluids can permeate ahead of the casing. This can result in contamination of the underlying pervious soils if drilling fluids are recirculated. To prevent contamination, drilling fluids may be used only once. Further, the drilling fluids and cuttings removed from the hole may require collection, containerization, and transportation to a suitable disposal site. When drilling fluids are recirculated, as may be done when drilling through relatively low permeability soils, each borehole will generate relatively small quantities of spoils. However, when new fluid must be continually introduced into the hole, management of drilling fluids and spoils can result in significantly increased cost over auger borings. Management of drilling fluids is further complicated under freezing conditions.

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[1]Backhoes can excavate test pits considerably deeper than 15 feet, however, such deep pits are very difficult to sample at discrete depths. Further, deep test pits can pose significant safety risks. Thus, Jordan does not normally use such pits.

Auger Borings. With this technique, hollow stem augers are advanced into the soil. Drill cuttings are compressed laterally and carried upwards on the auger flights. The bottom of the auger is blocked with a plug while the auger is advanced. When the desired sampling depth is reached, the plug is withdrawn and a sample is obtained from below the bottom of the augers. The advantages of the hollow stem auger technique include:

- relative simplicity of procedure;
- relatively low risk of personnel exposure;
- can be used to obtain soil samples from a wide range of subsurface conditions;
- drilling fluids are generally not required; and
- good availability of equipment.

The disadvantages of the hollow stem auger technique include:

- difficulty in penetrating excessively cobbley or bouldery soils; and
- difficulty in sampling granular soils below the water table since without drill fluids there is no practical means to maintain hydrostatic equilibrium in the borehole. When the plug is withdrawn, water and sediment from outside the augers may enter the borehole, potentially causing contamination and difficulty in sampling undisturbed soil below the bottom of the augers.

Other Methods. Other methods (casing advancer systems, cable tool, mud rotary, and bucket auger) are available. These methods, however, are either similar to those already discussed or not readily applicable to work at contaminated sites. They may, however, be considered for use on a site-specific basis.

Sampling of Test Borings

Types of Samplers. Test boring samples are normally taken from undisturbed soil below the depth of the casing or auger with either a thin wall tube or split spoon sampler.

Thin Wall Tube Sampler - Thin wall tube samplers are used in fine-grained or cohesive soils. Because the tube only causes minor disturbance of the soil being collected, the tubes are typically used to obtain soil specimens for geotechnical laboratory testing. The sampler is lowered to the bottom of the borehole and pushed into undisturbed soil. When the sampler is withdrawn, it contains a cylinder of soil. A thin wall tube consists of thin steel with a sharpened edge, usually about 30 inches long. Typical tubes range from about two inches to four inches in diameter. The tube is attached to a sampler head, containing a check valve which is in turn coupled to the drill rods. After the thin wall sampler has been withdrawn from the boring, it is removed from the drill rod and placed in a frame. The tube is then taken to a laboratory and the cylinder of soil is forced from the tube with a hydraulic jack.

Split Spoon Sampler - A split spoon sampler may be used to sample all types of soil. This sampler consists of a split steel tube or sample barrel threaded at both ends. A sharpened drive shoe secures the bottom of the barrel and an adaptor secures the top. The adaptor is threaded to connect directly to the drill rods and contains a check valve (see Figure 6-2). The split spoon is driven into undisturbed soil below the casing or hollow stem auger (see Figure 6-3). After the sampler has been driven, it is withdrawn from the borehole and the sampler is opened by removing the drive shoe and adaptor.

Sample Collection. The drilling monitor will take charge of the sampling device as soon as it is withdrawn from the borehole and opened. The sample will be collected and documented, employing the procedures as outlined below.

1. Scan the soil with a PI detector and record measurements.

2. Photograph any portions selected for chemical analysis, showing an appropriate visual scale (optional).

3. Remove the portion(s) of the sample selected for chemical analysis and place it into appropriate containers using a clean spatula. Soil intended for VOA analysis should be placed in 2-oz. wide-mouth glass jar and capped as quickly as possible. The 2-oz. containers should be filled as near to capacity as practicable to minimize volatilization of the sample into the container headspace. Soil intended for other types of analyses should be placed in appropriate containers and capped.

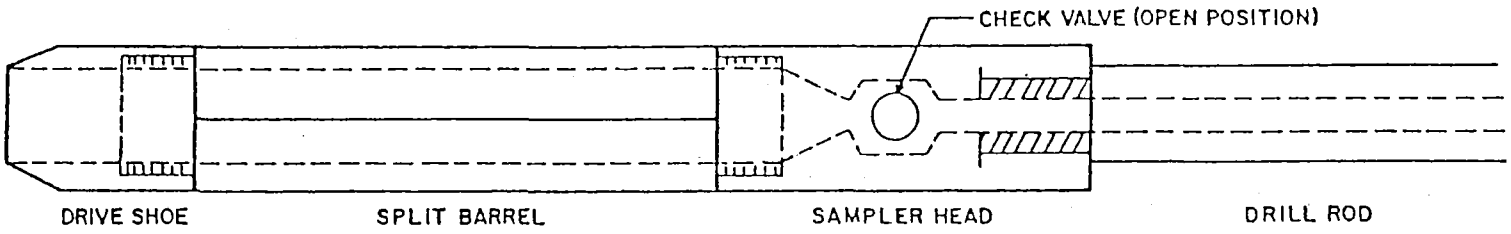
4. Visually examine the sample and record its characteristics (e.g., texture, color, consistency, moisture content, layering and other pertinent data), and classify using the Unified Soil Classification System.

5. Place the remainder of the sample in a 16-ounce "soil jar". This sample portion will be used for headspace PI measurement and for any physical materials testing that is required.

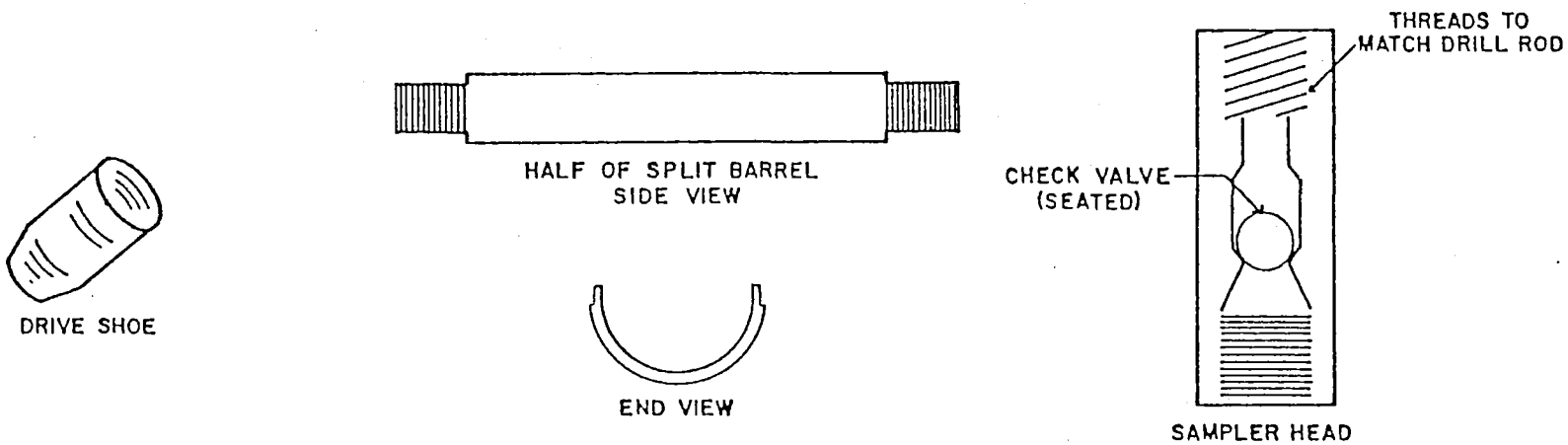
6. Discard any excessively disturbed or loose material found in the sampler which may not be representative of the interval sampled. This material will be discarded with boring spoils at each boring location.

7. Decontaminate the sampling device in accordance with the procedure specified in Section 6.3.

SPLIT SPOON SAMPLER



SPLIT SPOON SAMPLER DISASSEMBLED



NOTE: NOT TO SCALE

FIGURE 6-2
SPLIT SPOON SAMPLER

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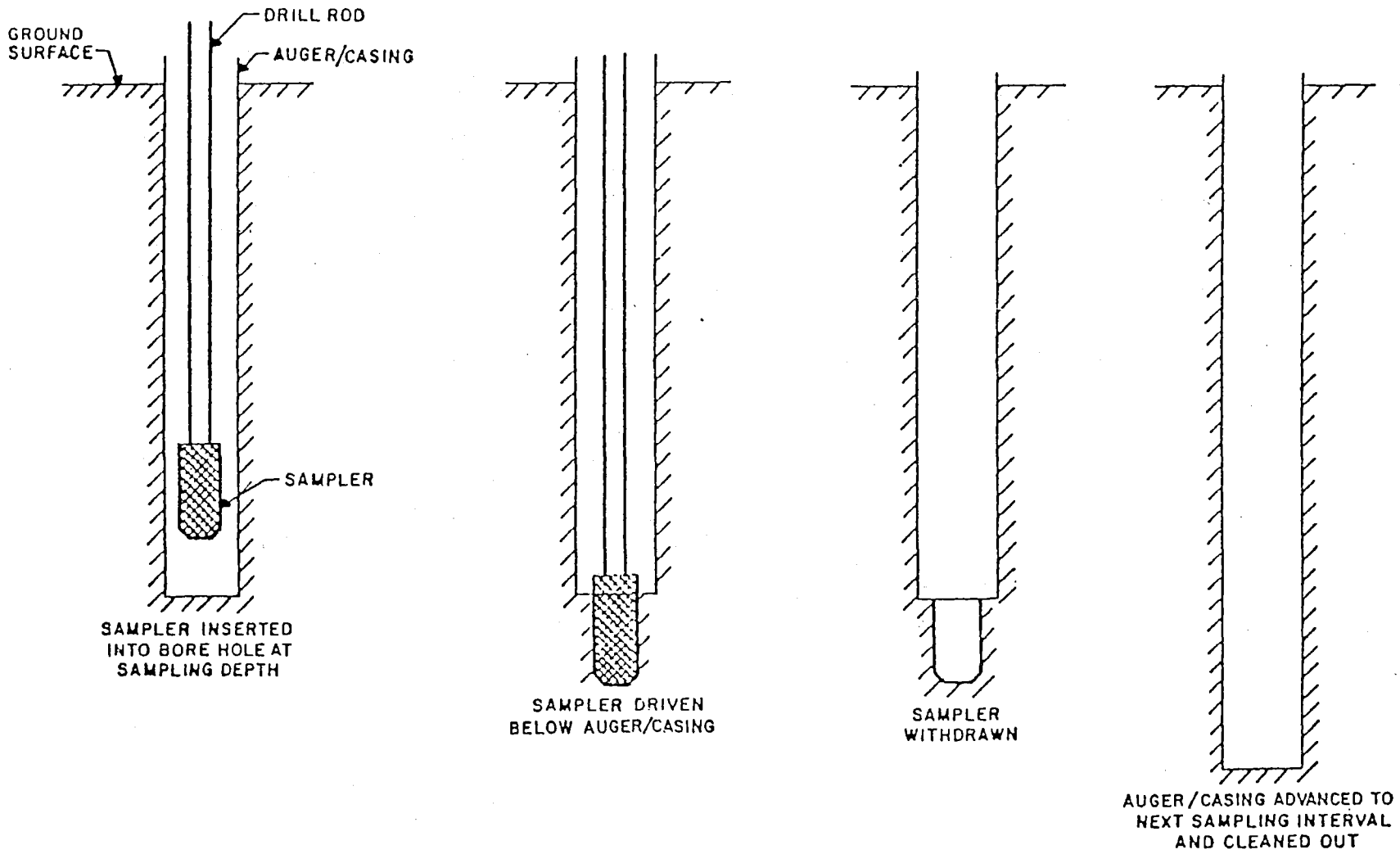

FIGURE 6-3

STEPS IN SAMPLING A TEST BORING

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In some instances, none of the samples from a given boring will be prepared for chemical analysis. In these instances, steps 2 and 3 of the procedure listed above are omitted and the sample is placed in one or more "soil jars." Immediately after the samples are collected, all labeled vials and jars are checked for completeness of the sampling objective and chain-of-custody procedures are initiated. The boring log is also updated at this time by the drilling monitor. Boring logs may be completed by the driller, but for purposes of completeness and documentation a separate boring log is also compiled by the drilling monitor. The boring logs will include interpretations of subsurface materials and conditions encountered, sample locations, and other notes pertinent to how the boring was conducted. The drilling monitor's boring log can be completed in a site field book or on a boring log form (see Figure 6-4).

The sampler must exercise considerable care while collecting samples for analysis. Some methods to assure that high quality samples are collected are described below.

1. Make sure that the sample is obtained from undisturbed soil below the casing or auger. This is accomplished by monitoring or checking the drill crew's measurements, observing the sampling process and examining the sample once it is retrieved.

2. Carefully remove and discard portions of the sample that may have become contaminated by contacting the casing, auger, or drilling fluids.

3. Conserve sample volume since under certain soil conditions it may be difficult or impossible to achieve good sample recovery with either split spoons or thin wall tubes.

Procedures employed to prevent cross-contamination during test boring sampling operations include the following:

- Samples are taken immediately after the boring is advanced to the desired sampling elevation.

- The sampling tools are decontaminated prior to taking each sample.

- The drilling contractor is not permitted to use oil, grease or other petroleum based lubricants on the drill rods, casing or sampling tools.

- The drilling technique and procedures to be utilized, particularly the use of drilling fluids, are carefully evaluated for each site.

BORING NO. _____

SOIL BORING LOG

PAGE ___ OF ___

PROJECT NO. _____

DRILLING CONTRACTOR _____ DESCRIBED BY _____

RIG NO. _____ CHECKED BY _____

DRILLER _____ DATE STARTED _____

DATE FINISHED _____

GROUND ELEV. _____ BIT SIZE _____ CASING SIZE _____

DEPTH TO WATER (DATE) _____ CORE SIZE _____ INCLINATION _____

DEPTH: SOIL _____ ROCK _____ TOTAL _____

SAMPLE NO.	DEPTH FT.	NO. BLOWS PER 6 IN.	REC. IN.	P.I. ppm	DESCRIPTION

FIGURE 6-4

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6.6.3 Intermediate Depth Samples

Objective

To obtain soil samples from depths of up to 15 feet for chemical analysis.

Approach

Although test borings can be employed to obtain samples from any depth (as described in Section 6.6.2), backhoe excavated test pits are often more practical and cost effective at intermediate depths.

The major advantages of test pit sampling programs are:

- Samples of any size can be obtained.
- The subsurface is exposed in the test pit revealing the sample site geology and facilitating sample collection and recovery.
- Availability of equipment is good.

There are three factors that must be considered when designing a test pit sampling program:

- the depth at which samples can be effectively obtained;
- site-specific safety issues, including contamination potential and test pit stability; and
- impact on groundwater.

Sampling Procedures

To expedite the sampling and recordkeeping efforts and to minimize periods of potential exposure during the excavation of test pits, the sampling crew will have sufficient tools and equipment to sample each pit prior to requiring decontamination. The backhoe and tools will be decontaminated between each test pit. The backhoe bucket and boom will be decontaminated as required during excavation of each test pit.

The actual layout of each test pit, temporary staging area and spoils pile will be predicated on site conditions and wind direction at the time the test pit is made. During excavation, sampling and logging of each test pit, the backhoe operator and all site personnel will remain upwind or crosswind of the test pit and spoils pile. Wind direction will be monitored by means of a wind sock or other banner located in a prominent position visible to all personnel. Preselection and the use of hand and horn signals is important during completion of test pits due to noise levels around the machine. The sampling crew and backhoe operator will rehearse appropriate signals ahead of time and be thoroughly familiar with their meaning. All personnel should be equipped with air blast horn devices, especially when wearing respiratory safety gear which hinders communication.

Sampling of unopened buried drums is excluded from this test pitting protocol. Jordan undertakes such work on a site-specific basis and utilizes appropriate safety and sampling protocols for each instance.

Test pits are logged as they are excavated. Records of each test pit will be made on prepared forms or in a field book. If the log is made in a field book it will be transcribed to prepared forms. These records include plan and profile sketches of the test pit showing all materials encountered, their depth and distribution in the test pit and sample locations. These records will also include safety and sample screening information. An example test pit record form is shown as Figures 6-5 and 6-5A. Jordan has found this format useful since it provides all necessary sampling, monitoring and subsurface records for each test pit in a concise and uniform manner. This format also provides a cross-check with chain-of-custody records and sample label counts.

The actual depth and type of samples obtained from each test pit will be selected at the time the test pit is excavated. Sufficient samples are usually obtained and analyzed to quantify contaminant distribution as a function of depth for each test pit. Additional samples of each waste phase and any fluids encountered in each test pit may be collected.

Test pits are excavated and sampled in the following manner:

1. The sampler and backhoe operator will plan the excavation.

2. The backhoe operator will excavate the test pit in several depth increments.

3. After each increment, the operator will wait while the sampler inspects the test pit to decide if conditions are appropriate for sampling. Practical depth increments range from 2 to 4 feet.

4. The backhoe operator, who will have the best view of the test pit, will immediately cease digging if:

   - any fluid phase or groundwater seepage is encountered in the test pit,

   - any drums or other potential waste containers are encountered, or

   - distinct changes of material are encountered.

   This action is necessary to permit proper sampling of the test pit and to prevent a breach of safety protocol.

   For instance, should any fluids or seepage be encountered, they could, after suitable screening and monitoring, be sampled. Waste and sludge deposits could likewise be sampled before proceeding. Should uncollapsed drums be encountered, the test pit would be terminated, backfilled and redug at an adjacent location.

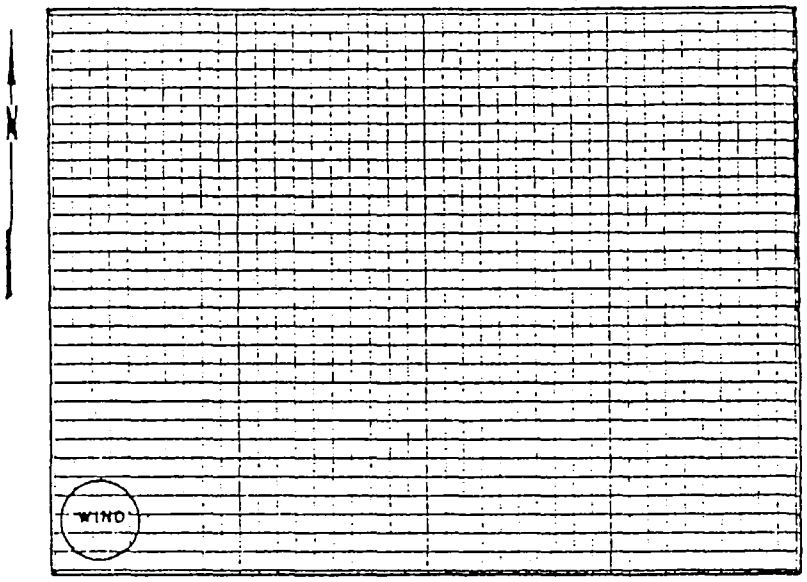
TEST PIT RECORD

SITE _____

TEST PIT _____ DATE _____ TIME ST. _____ END _____

COORDINATES _____ GRID ELEMENT _____

SKETCH MAP OF TEST PIT SITE
(SHOW SURFACE MONITORING RESULTS)



SCALE 1" = ____ FT

CREW MEMBERS

1.

2.

3.

4.

5.

6.

MONITOR EQUIPMENT

P I METER	Y	N
EXPLOSIVE GAS	Y	N
AVAIL. OXYGEN	Y	N
OVA	Y	N

OTHER _____

_____

PHOTOGRAPHS, ROLL _____

EXPOSURE _____

NOTES _____

FIGURE 6-5

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TEST PIT RECORD
PROFILE ALONG TEST PIT-____

SITE_____

DEPTH (FT) SCALE 1" = _____ FT

NOTES:

SAMPLES OBTAINED

NO.	DEPTH (FT)	INIT. SER. NO.	HD. SP. VOA PPM
S-1			
S-2			
S-3			
S-4			
S-5			
S-6			
S-7			
S-8			

REFERENCE: FIELD BOOK, PG. _____
ATTACHMENTS _____

_____
SIGNATURE

FIGURE 6-5A (CONT)

5. The test pit is sampled as described in the following sections.

Sampling from Ground Surface. To sample the pit from the ground surface, two methods have been used. The method is selected in the field at the time the test pit is sampled.

a. Samples can be obtained from the backhoe bucket. The sampler or crew chief will direct the backhoe operator to remove material from the selected depth or location within the test pit. The bucket will be brought to the surface and moved away from the pit. The sampler will approach the bucket and monitor its contents with the PI meter. If granular or loose soils and/or uniform materials are encountered, the sample will be obtained directly from the bucket. The sample is collected from the center of the bucket and placed in sample jars using a clean trowel or spatula.

   If a composite sample is desired, several depths or locations within the pit are selected and a bucket is filled from each area. A sample bottle is filled from each bucket and then emptied into a mixing surface (e.g., butcher paper or plastic sheet) and thoroughly stirred prior to being placed into the sample jars. The disposable mixing surfaces are discarded into the test pit when it is backfilled.

   If cohesive soils or multiphase conditions are encountered (e.g., the bucket contains a mixture of soil and sludge) the sampler will proceed as above if practical; if not, he will direct the backhoe operator to empty the bucket onto the ground. He will then obtain the sample from the interior of soil clods or lumps of sludge using a clean trowel or spatula.

b. Samples can be obtained directly from the test pit. This is necessary when soil conditions preclude obtaining suitable samples from the backhoe bucket (e.g., caving or excessive mixing of soils or wastes within the test pit) or when samples from relatively small discrete zones within the test pit are required. This approach is also required to sample seepage occurring at discrete levels or zones in the test pit. In these circumstances, samples will be obtained by means of extendable handled tools: scrapers, trowels, spoons or cups. The face of the test pit is scraped to remove the smeared zone that has contacted the backhoe bucket. The material to be sampled, if a solid, is then removed from the test pit wall by means of long handled scoops or trowels. The sample is then thoroughly stirred on a clean disposable mixing surface and placed in sample jars. If fluids are removed from the pit they are placed in a mixing jar as obtained. They are then decanted into sample jars.

In-Pit Sampling Safety. While samples can be obtained directly from the test pit, as noted above, it is Jordan policy that personnel will sample and log pits from the ground surface except as provided for by the following criteria:

- The project will benefit significantly from the improved quality of the test pit logging and sampling data obtained if personnel enter a test pit rather than conduct such operations from the ground surface.

- There is no practical alternative means of obtaining such data.

- The site safety officer determines that such action can be accomplished without breaching site safety protocol. This determination will be based on actual monitoring of the test pit after it is dug (including, at a minimum, measurements of volatile organics, explosive gases and available oxygen).

- An experienced geotechnical professional determines that the test pit is stable or is made stable prior to entrance of any personnel in accordance with 29 CFR 1926.652 (Special Trenching Requirements).

If all of these conditions are satisfied, one person will enter the test pit. On potentially hazardous waste sites, this individual will be dressed in safety gear as required by the conditions in the pit. This person will be affixed to a safety rope and continuously monitored while in the pit. A second individual will be fully dressed in appropriate protective gear and on stand-by during all pit entry operations. The individual entering the pit will remain therein for as brief a period as practical commensurate with performance of his work. After removing the smeared zone, samples are obtained with a trowel or spoon.

Sampling in the Vicinity of Drums. Should collapsed or highly-corroded drums be encountered which are obviously empty and pose no unusual threat, the test pit could be continued after appropriate monitoring. If possible, the test pit is sampled from the ground surface by means of long-handled scoops or trowels. As described above, the face of the test pit must be first scraped to remove the smeared zone that has contacted the backhoe bucket. Attempts to sample drums or containers also could be made from the ground surface, with appropriate safety procedures. After sampling, the test pit would be backfilled.

6.6.4 Shallow Samples

Objective

To obtain samples of surface and near surface soils suitable for chemical analysis.

Approach

Shallow soils samples are usually obtained by using one of the following devices:

- split-spoon sampler;
- hand auger or corer;
- trowel or spoon; and
- spade.

The split-spoon sampler was described in Section 6.6.2. Two distinct types of hand augers are available: a cup-type auger and a screw-type auger. Use of either device is generally limited to the upper portion of the soil profile (less

than five feet). These augers are best suited for obtaining composite samples from relatively shallow depths and in relatively loose soils. Use of trowels or spades is straightforward but usually limited to sampling very shallow depths (less than 18 inches).

Soil samples can be either grab or composite, depending on the objective of the sampling program. In grab sampling, the soil jar can be filled directly which is usually desirable for VOA samples. In composite sampling, several methods are available:

- Samples can be composited over depth at a single spot.
- Samples can be composited laterally, in which one sample is comprised of several (usually three or four) soil specimens in the vicinity of the sampling site.

Composite samples are mixed in the same manner as composite test pit samples (see Section 6.6.3). Samples for volatile organic constituent analysis should not be composited.

Immediately after taking a sample, the sampler fills the containers required for the requested analyses, attaches the labels, initiates COC procedures and completes the field sample data record.

6.6.5 Sediment Samples

Objective

To obtain samples of the sediment found in streams, ponds or other water bodies for chemical analysis.

Approach

Sediment samples are usually taken in conjunction with surface water samples to help define the partitioning of the contaminants between the soil and water. The exact location of each sampling station will be established in the field at the time of sampling. The sample station will be noted on a site plan or aerial photograph and marked in the field with flagging and a four-foot long wooden stake. The stake will be labeled with the sample station number and remain in place until completion of the entire project.

If both water and sediment samples are to be collected at a given sampling site, the water samples will be collected prior to the sediment sample. The sediment samples will be collected in the following manner:

1. The sampler will select the sample site, locate it on a site map or aerial photograph and set the wooden stake.
2. Where sediments are to be obtained in wetlands, a grab sample will be obtained in the immediate vicinity of any associated surface water sample. Unless otherwise specified, grab or composited samples will be obtained from the surface of the sediment.

3. The sampler will photograph the sample site (if specified for the project), complete the required records and initiate COC procedures.

Sediment sampling information is recorded on the surface water/sediment field data record form (presented later as Figure 6-8) or may be recorded in a field book.

The recommended sediment collection devices are Teflon or glass coring tubes for shallow wadeable water, and gravity corers in deeper waters. Scoops and drag buckets are not recommended because they cause a great degree of disturbance to the sediment. However, in special applications in deeper water, dredges such as the Eckman and Ponar can be used if precautions are taken to minimize the sediment disturbance.

In shallow, wadeable waters, the direct use of a core liner or tube (five-inch) is recommended. The tube is pushed into the substrate until approximately 1 inch (2.5 centimeters) or less of the tube is above the sediment-water interface. When hard or coarse substrates are sampled, a gentle rotation of the tube while it is pushed will facilitate greater penetration and reduce core compaction. The tube is then capped with a Teflon plug or a sheet of Teflon held in place by a rubber stopper or cork. After capping, the tube is slowly extracted, the negative pressure and adherence of the sediment keeping the sample in the tube. Before the bottom part of the core is pulled above the water surface, it too is capped. Caution should be exercised not to disturb the area to be sampled. The sampler should always stand downstream from the sample location when wading in shallow water.

To help prevent contamination from direct contact between the sampler's hands that the upper part of the tube, a collar-type device is constructed of wood and should have a circular recess to accept the top of the tube. The recess will have a hole in it to allow water to pass through when the tube is pushed in, and will be lined with sheet Teflon. Handles will be attached to the sides of the collar. After the tube is driven in, a wide circular motion will be used to help loosen the core for easy removal; take off the collar device; cap the top of the tube (as described above); pull it up out of the sediment layer; and cap the bottom of the tube before removing it from the water.

Another method of obtaining recently deposited sediments in shallow, wadeable waters with a core tube, is to use the tube as a horizontal scoop. The tube is placed on its side on the sediment surface and carefully inserted into the sediment so that the top inside surface is just at the sediment/water interface. It is important to disturb the fines as little as possible. After the tube is filled, both ends will be capped with a Teflon plug, as described above, before the tube is removed from the sediment. If this method is used with a tube having an outer diameter of 2 inches and wall thickness of 1/8-inch, only the top 2 inches of sediment will be sampled (allowing a 1-millimeter clearance between the sediment surface and top inside of the tube).

A minimum of 500 grams of sediment is collected at each site. Therefore, one tube with a 4-inch-long core, outer diameter of 2 inches, and wall thickness of 1/8 inch is adequate for one sample (the volume of each core would be approximately 750 mℓ). For other tube sizes and core lengths, the number of tubes necessary can be calculated by using the formula for the volume of a cylinder

($\pi r^2 L$). Additional material may be required if duplicate analyses are performed on individual samples.

When the sediment material is difficult to penetrate with a Teflon or glass tube, a commercially available hand coring device can be used. These devices are equipped with a metal barrel, a handle, and a core liner. The liner is inserted and then held in place by a screw-on core cutter, usually manufactured of stainless steel. The core cutter, along with the handle attached to the core barrel, increases the efficiency of sediment penetration. After the sample has been obtained, the cutting head is removed and the liner is carefully withdrawn and immediately capped, as previously described. When coarse grain deposits such as sand are sampled, the use of a core retainer will increase the efficiency of sample retention. Only retainers manufactured of stainless steel should be used in order to minimize the risk of trace metal contamination and eliminate corrosion. When several samples are to be obtained, it is advisable to carry extra core liners to the sample site. This eliminates the need for time-consuming extrusions and permits the use of the core liners as sample containers for shipment to the laboratory.

Substantially different procedures are required to sample sediments in larger streams, lakes or other deep water bodies. Such work is normally accomplished from a raft or boat. If significant thicknesses of sediment must be sampled, test boring techniques will likely be employed.

In deep waters and hard substrates, a gravity corer or thin-wall tube sampler may be required to collect sediment samples. These samplers rely on the weight and gravity to penetrate the bottom.

A gravity corer is easily operated by a two-person crew from a boat or any structure extending over the water surface. The equipment, fastened to a flexible line of rope or wire, is lowered to within 2 or 3 meters of the bottom. Terminal velocity is generally achieved within this distance (Bouma, 1969), and better accuracy and corer orientation is obtained than with a free fall from the surface. The corer is retrieved to the surface, cutting head unscrewed, and liner with sediment removed. Caution must be exercised at this point not to lose the sample, particularly if it is coarse grained. Only those corers that have some water in the core tubes above the sediment should be retained. This ensures that the sediment surface is intact and provides a reference point for determining the sample depth below the sediment/water interface. After the core liner has been removed from the barrel, the bottom and top of the liner should be capped and stored upright in an ice-filled cooler for delivery to the lab. The operation is repeated with a new liner until sufficient samples for sample analysis are obtained.

If both water and sediment samples are to be collected at a given sampling site, the water samples will be collected prior to the sediment sample.

6.7 WATER SAMPLING

6.7.1 General

Water sampling programs are undertaken to define the location, nature and concentration of contaminants in site groundwater, surface water, and/or wastewater. The location and distribution of contaminants at a given site are governed by many factors, including:

- site operation or waste disposal practices;
- site design;
- site closure;
- waste characteristics;
- site topography and surface drainage;
- climate; and
- site hydrogeology.

Development of a water sampling plan that will effectively reveal the distribution and magnitude of contamination at a specific site requires:

- an assessment of the factors listed above;
- evaluation of the methodology and results of any previous sampling and analysis programs which have been completed at the site; and
- definition of the scope and objectives of the project.

Many of the sampling procedures are consistent for all types of water sampling. General considerations are presented here and are discussed in more detail in the following sections.

Sample Collection

Water sample containers are generally filled directly from the source, sampler or pump discharge without special considerations. A major exception is the collection of VOA samples. Volatile Organic Analyte samples must be collected as specified below. Each sample is taken in duplicate.

1. Uncap the sample bottle, taking care not to touch the Teflon-faced septa. If the septa is contaminated in any way, it should be replaced.

2. If a chlorine residual is potentially present, check for chlorine content with KI paper or a chlorine residual comparator. If a residual chlorine content is detected, add three drops of ten (10) percent sodium thiosulfate to the sample container prior to filling the bottle.

3. Fill the sample vial slowly from bailer or pump discharge, minimizing air entrainment, until the vial overflows.

4. Place the Teflon-faced silicon rubber septa on the convex meniscus, Teflon side (shiny side) down and screw cap on.

5. Invert the bottle, tap lightly, and check for air bubbles.

6. If air bubbles are present, open the bottle, add sample to eliminate air bubbles, and reseal. Repeat this procedure until the bottle is filled and no air bubbles are detected.

Sample Preservation

The following preservation procedures are examples of typical preservation protocols specific to the indicated analyses. More detail is provided in Tables 6-1 and 6-2.

Volatile Organic Analytes - Fill the sample bottle as previously described. If chlorine is detected, ten (10) percent sodium thiosulfate should be added (three drops) to the sample container prior to filling the container. Place samples on ice until shipment. Also note that if hold times are anticipated to exceed 7 days, the sample should be preserved with HCl to less than pH 2.*

Semi-volatile Organic Analytes - Fill the sample bottle, seal with a Teflon-lined cap, and place on ice for shipment.

Elements - Following any required filtration, fill the sample bottle, preserve the sample to less than pH 2* with nitric acid, seal container, and place sample on ice for shipment.

Biochemical Oxygen Demand/Residue - Fill sample bottle, seal, and place on ice for shipment.

Chemical Oxygen Demand/Total Organic Carbon/Ammonia - Fill sample bottle as described above, add sulfuric acid until less than pH 2*, cap bottle, and place sample on ice for shipment.

Total Recoverable Phenolics - Fill sample bottle and, if chlorine is present, add one mℓ of ten percent sodium thiosulfate. Add sulfuric acid until pH is less than 2.* Cap sample and place on ice for shipment.

Cyanide - Fill the sample bottle, and if chlorine is present, add one mℓ of ten percent ascorbic acid. Add 10 N sodium hydroxide to a pH greater than 12, cap bottle, and place sample on ice for shipment.

Oil and Grease - Fill sample bottle, add sulfuric acid until pH is less than 2.* Cap bottle, and place sample on ice for shipment.

Disposable pipettes should be used to introduce chemicals into the samples. Chemicals used for preserving should be poured into a 150 mℓ beaker. They should not be drawn directly from the preservative bottles because the bottle may become contaminated. Measurements for pH and temperature should not be taken from the sample containers. When preserving samples, pH paper should be used. The sample should be poured across the pH paper. Never place pH paper directly into sample.

Note: * Shipping regulations limit the amount of preservative which can be added to approximately 1.5 mℓ/1ℓ sample.

6.7.2 Groundwater/Domestic Well Sampling

Objective

To obtain samples of groundwater from new and existing wells suitable for chemical analysis.

Approach

The groundwater sampling locations are selected to delineate the distribution of chemicals and to quantify, to the extent possible, the contaminated groundwater plume in the aquifers underlying the site. The actual sampling points are then selected following review of the locations of the existing groundwater wells (monitoring and domestic) in the vicinity of the site. New monitoring wells may be installed to supplement the existing array. The rationale for their location is normally described in the site work plan.

The sampling locations will be indicated on a site map. Preprinted labels will be prepared for all groundwater samples (using the computerized label system). These samples will consist of various containers for each location and will be analyzed for the parameters selected for the project. A sample splitting flow chart is illustrated in Figure 6-6. The pH and specific conductance of each sample will be determined in the field. Selection of either glass or plastic containers is dependent on the types of analyses that are to be performed. Appropriate containers are specified in Tables 6-1 and 6-2.

6.7.2.1 Monitoring of Groundwater Wells Monitoring of groundwater wells will proceed from the upgradient or background wells to the downgradient or contaminated wells as best as can be determined. The monitoring procedure is as follows:

1. Check the well for proper identification and location.

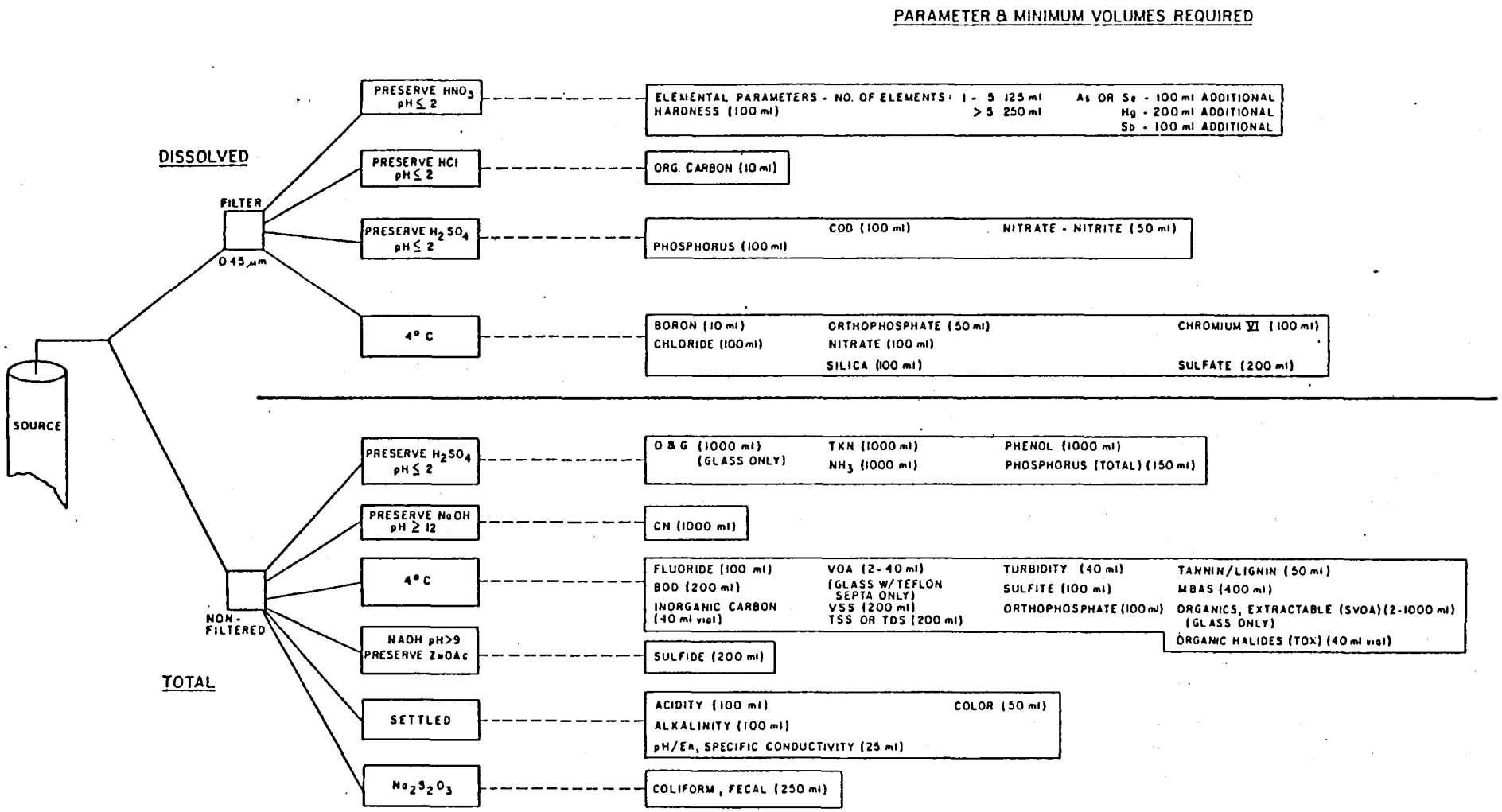
2. Measure and record the height of protective casing.

3. After unlocking the well and removing any well caps, measure and record the ambient and well-mouth organic vapor levels using the photoionization meter. If the ambient air quality at breathing level reaches 5 ppm, the sampler shall utilize the appropriate safety equipment as described in the HASP.

4. Measure and record the distance between the top of the well and the top of the protective casing.

5. Using the electronic water level meter, measure and record the static water level in the well and the depth to the well bottom to the nearest 0.01 foot. Upon removing the water level wire, rinse it with pesticide grade ethanol:methanol 90:10 v/v and then either potable or deionized (DI) water (as specified for the site).

SAMPLE SPLITTING FLOW CHART–GROUNDWATER/SURFACE WATER MONITORING



NOTE: ALL SAMPLES SHOULD BE KEPT AT 4°C REGARDLESS OF PRESERVATIVE

FIGURE 6-6

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6. Calculate the volume of stagnant water in the well. Volume in liters equals 0.154 times the square of the inside diameter of the well (in inches) times the depth of water (in feet).

6.7.2.2 Sampling of Groundwater Monitoring Wells Following the measurements and calculations described above, sampling will commence in the sequence below, utilizing the appropriate purging technique (1a through 1d):

1. Lower the submersible pump or peristaltic pump intake into the well. For shallow groundwater situations, the intake of the suction tubing or of the submersible pump will be lowered to the top of the well screen and the well purged of the required volumes. Available alternatives to this procedure may be utilized in certain situations:

   a. If the well screen is very large, making pumping from the top impractical, the suction line or submersible pump should be lowered to the approximate mid-point of the screened portion of the well.

   b. If the well is situated in tight formations such as tills, clays or rock, the purging of the well should be performed from near the top of the well screen. Pumping or purging at this level until 1 to 3 volumes have been purged will facilitate removal of standing well water without creating a large artificial gradient in the well.

   c. Upon client request, and when conditions permit, the pump intake may be placed just below the water surface and purging initiated. As the water surface lowers, the pump intake is lowered to remain below the water surface.

   d. When using a submersible pump in conjunction with an inflatable packer system, the packer should be placed just above the top of the well screen and inflated according to the packer manufacturer's instructions. The volume of stagnant water to be purged should be recalculated based on the depth below the packer. The packer is not deflated until sampling is complete.

2. Connect the instrumentation header to the pump discharge and begin flushing the well. Monitor the in-situ parameters (pH, Eh, temperature, and specific conductivity) and measure the volume of groundwater being pumped. Alternately, in-situ parameters may be monitored in a beaker filled from the pump discharge. Purging of the standing well water is considered complete when the following is achieved:

   - a minimum of three well volumes has been purged, and in situ parameters have stabilized; or
   - five well volumes have been purged; or
   - the well has been pumped dry.

3. Record the in situ parameters.

4. After purging, lower the bailer to the middle of the screened interval or mid-point of the static water level. If the analysis to be performed is for lighter-than-water chemical species, then the bailer should be lowered to the top of the water column for sample collection.

5. Collect the sample(s).

   Volatile and semivolatile samples are filled directly from a bailer with as little agitation as possible.

   Other samples will be placed directly into the appropriate container from the bailer or pump discharge.

   Where filtration is required, an inline filter should be used if possible. Vacuum and pressure filtration are acceptable alternatives to an in-line device. Filtration procedures are described in Table 6-3. Note that all groundwater samples scheduled for analysis of elemental parameters will be filtered, unless specifically prohibited in the task-specific QAPP.

6. Remove the pump or bailer from the well and decontaminate the pump, tubing or bailer by flushing with decontamination fluid specified in Section 6.3. Up to one gallon of the solvent is used as needed. Rinse the bailer with one gallon of potable or DI water. Rinse again with potable or DI water.

7. Complete sample data record (Figure 6-7) after each well is sampled.

8. Secure the well cap and lock.

Domestic Wells. Domestic water supply wells will be sampled in a similar manner, with the exception of using the in-place pumping equipment. The sampling point will be determined at the time of sampling, and will be as close to the pump as practical at each location. Domestic supply samples will not be taken from taps delivering aerated, softened or filtered water. Faucet aerators will be removed if possible before sampling. The water tap will be turned on and run for at least 5 minutes before the sample is taken to flush stagnant water from the system. All sample containers will be filled with water directly from the tap and the samples processed as described for monitoring well samples except that samples collected for elemental parameters will <u>not</u> be filtered so that the sample will represent actual ingestion. Components of the plumbing system will be noted to assist in data interpretation.

6.7.3 Surface Water

Objective

To obtain surface water samples, commonly referred to as ambient water samples, to characterize the physical and/or chemical status relative to a pristine condition, and to establish the degree and extent of contamination.

TABLE 6-3

STANDARD FIELD FILTRATION PROCEDURES

A. IN-LINE FILTRATION

EQUIPMENT

1. A portable 102-mm acrylic backflushing filter unit
2. 102-mm diameter filter papers. 0.45 μm membrane filters
3. DI rinse water
4. 20% v/v nitric acid rinse solution

PROCEDURES

1. Attach in-line filter assembly, after assembling filter paper into filter holder to discharge line of sampling pump. Open by-pass valve completely.

2. Turn sampling pump on slowly, turn by-pass valve closed allowing flow into the filter. Remove trapped air through the filter bleed valve, if necessary.

3. Discard the initial 100 mℓ ± of filtrate. Collect subsequent filtrate into sample bottle.

4. Rinse barrel and filter holder assembly between samples with three rinses of reagent water. The rinse sequence when elemental parameters will be analyzed is: DI water - 20% v/v nitric acid - DI water.

TABLE 6-3 (Continued)

STANDARD FIELD FILTRATION PROCEDURES

B. VACUUM FILTRATION

EQUIPMENT

1. Two sets of either glass funnel type of self-contained polysulfone filters with sintered glass discs or polysulfone filter plates

2. 47-mm diameter filter papers, 0.45 μm membrane filters

3. Vacuum pump or ISCO peristaltic pump with silicone tubing

4. DI rinse water

5. 20% v/v nitric acid rinse solution

PROCEDURES

1. Thoroughly rinse sintered glass disc, filter funnel, and stem or polysulfone filter units with DI water.

2. On the basis of visual clarity of sample, prefiltering with larger pore filters may be required. If sample has a heavy clay content, organics, or suspended matter, prefiltration through a 3.0 or 5.0-μm membrane filter may be necessary.

3. Place membrane filter on filter holder with minimum handling.

4. Attach filter holder with filter to filter funnel and receiver.

5. Swirl and slowly pour sample bottle into filter funnel.

6. Attach suction tubing to filter flask and vacuum pump (or ISCO pump). Pump is tuned on in the vacuum mode.

7. Filter a small portion of the sample and discard filtrate after rinsing flask with sample filtrate.

8. If prefiltering was required, pass sample through a 0.45-μm membrane filter using another filtering apparatus.

9. Transfer filter sample to appropriate bottles.

10. Rinse filtration equipment between samples with at least three rinses of DI water. The rinse sequence, when elemental parameters are to be analyzed, is: DI water - 20% v/v nitric acid - DI water.

TABLE 6-3 (Continued)

STANDARD FIELD FILTRATION PROCEDURES

C. PRESSURE FILTRATION

EQUIPMENT

1. Pressure filter apparatus consisting of 1 liter barrel filter, filter holder, and pressure hose connectors.

2. Source of pressurized gas, i.e., tank of nitrogen, argon, etc.

3. 147 mm filter papers, 0.45-μm membrane filter.

4. Place filter holder and filter onto barrel assembly, making sure to align O-ring for a positive seal.

5. Attach swing-away bolts and tighten hand-tight.

6. Turn over filter assembly and attach pressure hose assembly.

7. Slowly turn on pressurized gas and increase pressure regulator to a maximum of 20 psi.

8. Collect filtrate from bottom of barrel assembly.

9. Rinse barrel and filter holder assembly between samples with three rinses of DI water. The rinse sequence when elemental parameters will be determined is: DI water - 20% v/v nitric acid - DI water.

PAGE _____ OF _____

GROUNDWATER FIELD SAMPLE DATA RECORD

PROJECT _____ **JOB NO.** _____

STATION NO./LOCATION _____ **DATE** _____

SKETCH ON BACK [ ] YES [ ] NO PHOTOGRAPHS [ ] YES [ ] NO ROLL NO./EXPOSURE NO. _____

FIELD DATA

TIME: START _____ AIR TEMP _____

END _____ WEATHER _____

WATER DEPTH _____ [ ] TOP WELL WELL DEPTH _____ WELL MATERIAL _____

[ ] TOP CASING WELL DIAMETER _____

WELL STICK-UP _____ WELL/CASING _____

SAMPLING EQUIPMENT USED _____ VOLUME PURGED _____

FIELD DATA COLLECTION [ ] IN SITU VOA LEVEL (ppm) AMBIENT _____

[ ] IN BOTTLE SAMPLE LOCATION _____

HEADSPACE _____

SAMPLE PURGE DATA

@ _____ GAL	@ _____ GAL	@ _____ GAL	@ _____ GAL
TEMP _____ °C	TEMP _____ °C	TEMP _____ °C	TEMP _____ °C
SP. COND _____ @25°C	SP. COND _____ @25°C	SP. COND _____ @25°C	SP. COND _____ @25°C
pH _____	pH _____	pH _____	pH _____
Eh _____	Eh _____	Eh _____	Eh _____

BOTTLE I.D.	LAB I.D.	VOL	MATERIAL	FILTERED	PRES./VOL	ANALYSIS REQUESTED

REMARKS/OBSERVATIONS _____

SAMPLER _____

FIGURE 6-7

Approach

The technique for surface water sampling must be selected after addressing such items as:

- depth of water body;
- flow rate;
- stratification;
- specific gravity/solubility of anticipated analytical parameters;
- seasonal variations; and
- analytical parameters of interest.

The sample will be taken in the following manner:

1. Collect the sample from the surface water body by immersing a clean beaker or the sample bottle. If a stream is being sampled, collect the sample upstream of the sampler with the opening of the sampling device oriented upstream but avoiding floating debris.

2. Directly fill the appropriate sample containers from the sampling device if needed.

3. Measure the following parameters, if possible, by direct immersion of instrument probes into the water body:

   - photoionization meter reading;
   - temperature measurement;
   - pH measurement;
   - specific conductance measurement; and
   - any other site-specific field measurements required.

   If direct measurement is not possible, measure these parameters from water remaining in the sampling device or another sample bottle. This information will be recorded on the sample data record, sample labels will be completed and chain-of-custody procedures will be initiated.

4. Complete the sample data record (Figure 6-8).

Surface water samples may also be composited over time, as described in Section 6.7.4.

6.7.4 Wastewater

Objective

The objective of wastewater discharge sampling, commonly referred to as source sampling, is to characterize a treated, untreated or partially treated waste stream in terms of flow rate, volume, chemical constituents and physical properties. Source sampling is employed in treatability studies, regulated effluent compliance determination, process control and identification of potential contributors to a contamination incident. It often requires 24-hour composite sample collection, continuously for multiple 24-hour periods.

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PAGE _____ OF _____

SURFACE WATER /SEDIMENT FIELD SAMPLE DATA RECORD

PROJECT _____ JOB NO _____

STATION NO/LOCATION _____ DATE _____

SKETCH ON BACK YES ☐ NO ☐ PHOTOGRAPHS YES ☐ NO ☐ ROLL NO/EXPOSURE NO _____

FIELD DATA

TIME: START _____ AIR TEMP. _____

END _____ WEATHER _____

WATER DEPTH @ SAMPLE LOCATION _____ WIDTH OF STREAM _____

TYPE OF STREAM SAMPLE _____ SAMPLE METHOD _____

STREAM VELOCITY MEASUREMENTS ☐ YES ☐ NO

FIELD DATA COLLECTED ☐ IN SITU TEMP _____ °C

☐ IN BOTTLE SP. COND _____ @ 25°C pH _____

DISSOLVED OXYGEN _____ PPM ☐ METER VOA LEVEL(PPM) AMBIENT _____

☐ WINKLER SAMPLE LOCATION _____

HEADSPACE _____

TYPE/DESCRIPTION OF SEDIMENT _____

DEPTH OF SEDIMENT SAMPLE _____ EQUIPMENT USED _____

BOTTLE ID	LAB ID	VOL	MATERIAL	FILTERED	PRES./VOL.	ANALYSIS REQUESTED

REMARKS/OBSERVATIONS _____

SAMPLER _____

FIGURE 6-8

Approach

Based on existing data, or during initial site reconnaissance, sampling locations will be selected in accordance with project goals, i.e. to procure a sample which appropriately represents the properties being investigated. Special emphasis is required prior to sampling to accurately define the goals of sampling and assess the impact of sampling methodologies on analytical requirements and the intended use of analytical results. The need to measure the flow rate of the stream and the accuracy required must also be assessed in light of project goals. In many cases, very accurate flow monitors may exist, or must be installed by the sampling crews. However, in certain instances, only knowledge of total volume is required. In any case, this aspect of source sampling must be integral to the selection of sampling technique.

Sampling Location. Sampling locations will be chosen to provide the most representative sample (e.g. if two outfalls are present, sample in the stream just below where the water is mixed). Samples will be taken in the center of the channel where the flow and mixing is greatest, and never near the end of a dead end piping line. The techniques (e.g., depth of sampling, method of sampling) will be uniform among the samples procured within a given facility or area to the extent possible.

Sampling Procedures

Automatic Composites. Conditions permitting, automatic composite samplers (ISCO 1580 super-speed) will be set up at each sample location. Constant time - constant volume samples will normally be collected. The following is the procedure for the composite sampler set-up:

1. Transport the composite samplers to the sampling points.

2. Place sampler such that suction line is as short as possible. Use AC power whenever possible.

3. Place silicon tubing in sampler and cut Teflon suction line to desired length. Insert Teflon tubing into silicon tubing and secure with hose clamps.

4. Collect sampler blank according to blank procedures.

5. Secure the sampler tubing to obtain a representative sample. Rigid conduit or stainless steel weights should be used to secure the tubing so that it is facing into the waste stream. The intake line should be situated at a turbulent location and at a depth between 1/3 and 1/2 the channel depth. The Teflon tubing must extend beyond the rigid conduit.

6. Calibrate the composite samplers with a graduated beaker. Aliquot volumes for a 24-hour composite with a 20-minute interval between samples are as follows:

   130 mℓ/20 minutes for a 2.5 gallon composite
   160 mℓ/20 minutes for a 3.0 gallon composite
   260 mℓ/20 minutes for a 5.0 gallon composite

   (See ISCO manual for sampler instructions.)

7. Place appropriate sampler jug in the base of the sampler. Pack ice around sampler container.

8. Remove cap and Teflon liner from sample jar and place in a secure place.

9. Secure ISCO control unit to the sampler base (a cylindrical sampler extension neck will be necessary when a five-gallon jug is used).

10. Monitor the first sample aliquot to ensure proper operation.

11. Check the composite sampler at least every four hours to ensure that it is operating properly and adequately iced. Spent desiccant should be replaced with dry desiccant when necessary.

12. If improper volumes of sample are noted, take necessary steps to correct sampler malfunction. If the sampler is pulling too little sample, increase the sample aliquot volume or decrease the time between sample intervals. If the sampler is pulling too much sample, stir the composite, discharge the excess and recalibrate the ISCO to draw the appropriate volume.

13. Allow composite sampler to run for 24 hours.

14. Replace composite container with a clean jug at the end of each 24-hour period.

15. Replace the silicon and Teflon tubing with new tubing at the completion of each 72-hour period. Sampler blanks must be run every time the tubing is changed.

Manual Composites. In certain instances, manual compositing will be required. Sludge locations with a high solids content, pressurized discharge lines, and inaccessible sample locations are a few examples that require manual compositing. The following procedures should be used:

1. Determine the desired volume and frequency of sample aliquots.

2. Procure sample. If a discharge line is used, be sure to clear line of any debris, etc. so that a fresh, uniform sample is obtained. If aliquots are drawn from a wet well, manhole, or other location by means of an intermediate container, be sure to thoroughly rinse the container prior to drawing sample.

3. Repeat Step 2 at the appropriate intervals until the desired volumes have been collected and composited in the appropriate container. The composite container should be iced at all times.

Grab Samples. In situ measurements for pH and temperature will be taken concurrent with grab samples. Grab samples will be taken according to the following procedure:

1. Determine the time interval at which samples will be collected.

2. Identify any sample locations at which a chlorine residual is present.

3. Collect the appropriate samples. The preferred method for grab sampling is immersion of the sample bottle or appropriate beaker in the waste stream. The container should be thoroughly rinsed with sample and then filled. Samples should be taken from a turbulent section of the waste stream at a depth of one-third to one-half the stream depth to ensure a well-mixed, representative sample. If the physical characteristics of the sample point prevent this, samples may be collected through the ISCO pump unit. Before doing this, purge the suction line (switch to reverse) then run (switch to forward) until the pump discharge is uniform. Bottles may be filled directly from the pump discharge. In the event that neither procedure is appropriate, samples may be collected by means of a stainless steel bucket. Should this be necessary, the bucket must be thoroughly rinsed with the wastewater prior to sample collection.

Sample Handling

The procedures for handling the listed sample fractions are described in the following sections:

Composite Samples. Samples for SVOA, Inorganics, Biochemical Oxygen Demand (BOD)/Residue, and Chemical Oxygen Demand (COD)/Total Organic Carbon (TOC)/ammonia analyses are all taken from the sample composite container. The composite sample must be blended to provide a homogeneous mixture, including a representative suspension of any solids in the container. No specific method is required; hand stirring with clean glass rods or mechanical stirring with paddles that are Teflon-coated is acceptable. Metal mixing devices may not be used.

General steps for splitting a composite sample are:

1. Line up all appropriate bottles into which the sample must be poured (COD/TOC/ammonia, BOD/Residue, SVOA and elements.

2. Blend the sample and sequentially fill each sample bottle one-third full.

3. Gently swirl the composite, return to the first bottle, fill an additional one-third of each bottle.

4. Repeat the same pattern and fill the last one-third of each.

5. Leave some head space so that any preservative chemicals required may be added. Preservation requirements are described in Section 6.7.1 and Tables 6-1 and 6-2.

6. If appropriate, record data on the Field Sample Data Sheet (Figure 6-9).

Grab Samples. VOA, cyanide, oil and grease, and total recoverable phenolics samples are taken as grab samples in the field. These samples may be composited in the lab. The waste streams must be tested for the presence of chlorine. Potassium iodide starch paper can be used to detect a chlorine residual. If plant personnel suspect a chlorine residual and the KI test is negative, it should be assumed that chlorine is present. Preserve the grab samples as described in Section 6.7.1.

6.8 SOIL GAS

Soil gas samples are collected from the vadose zone to assist in contaminant source location. Jordan may subcontract both sampling and analysis for this task on a site-specific basis. Organizational details will appear in each site's Work Plan. Jordan's procedure is described below. Subcontractor procedures will be included in site QAPP Addenda.

6.8.1 General Soil Gas Procedures

Soil gas surveys are used to help identify and characterize the extent of subsurface contamination. Soil gas just below the surface is analyzed for volatile organic compounds (VOCs) present in the soil or migrating upward from deeper contamination. The main advantage of this method is that large areas can be investigated at a lower cost than drilling or test pitting.

The soil gas sample can be obtained using a variety of methods. A probe is driven into the ground to a depth determined by site-specific hydrogeologic conditions. This probe can be a modified split spoon apparatus, a slide bar, or a hollow probe inserted after augering. Once the probe is in place, Teflon tubing is connected to a pump drawing 100-150 mℓ/min. An air tight syringe pierces the Teflon tubing to remove the gas sample. The sample is then injected into the field gas chromatograph (Photovac 10 series or equivalent) to determine the absence or presence of target VOCs. Cross-contamination in the sampling procedure is avoided by changing the Teflon tubing and thorough decontamination of the probes between samples.

FIELD SAMPLE DATA SHEET

PLANT ______________________

CREW ______________________ CHIEF

SAMPLE TYPE															SAMPLE NUMBER	PRESERVATIVE		DATE			COMPOSITE ENDING DATE			TEMP °C	pH @ POINT OF SAMPLING	RCDR'S INITIALS	SAMPLING POINT DESCRIPTION	NOTES:
OIL & GREASE	CHLORIDES	SULFIDES	TOTAL SOLIDS/TVS	TOTAL PHENOL	SAMPLE BL	VOL ORG BL	VOL ORG	MERCURY	CYANIDE	BOD/TSS	NON-VOL ORG	METALS (TOTAL)	ASBESTOS	COD/TOC/TKN/NH3/P		I°	CHEMICAL	MONTH	DAY	TIME	MONTH	DAY	TIME					

FIGURE 6-9

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A number of gas chromatographs can be used that meet the portability and sensitivity requirements. E.C. Jordan will use a Photovac 10S50 equipped with a photoionization detector (PID) unless otherwise noted. A Teflon column and precolumn packed with 5% SE-30 is used for separation. The column length will be left to the analyst's discretion. Target compounds usually include benzene, toluene, trans-1,2-dichloroethane (t-1,2-DCE), trichloroethylene (TCE), and perchloroethylene (PCE). A three-point calibration curve will be run for target compounds. Quality control will consist of method blanks, syringe blanks, and duplicates.

6.9 HYDROCARBON SCREEN FOR SOIL/SEDIMENT AND WATER SAMPLES

6.9.1 Scope and Application

This is a heated headspace capillary GC-PID/FID (in series) method applicable to the determination of hydrocarbons (i.e. gasoline, fuel oil) in soil/sediment and water samples.

The estimated method detection limit (MDL) for each parameter in water is as follows:

	µg/ℓ
gasoline	10
fuel oil	50
hexane	10
benzene	10
toluene	10
xylenes	10
methy t-butyl ether (MTBE)	20

The MDL for soil/sediment samples may differ from those listed, depending upon the nature of chemical interferences in the sample matrix.

6.9.2 Summary of Method

An inert gas (helium) is bubbled through a 5 ml water sample or 5 g soil sample (in 5 ml of water) contained in a specially designed purging chamber at 65°C. The compounds of interest are transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent trap where the compounds are trapped. After purging is completed, the trap is heated and back flushed with the inert gas to desorb the compounds on to a gas chromatographic column (DB-5). The gas chromatograph is temperature programmed to separate the compounds which are detected with a photoionization detector and a flame ionization detector in series.

7.0 SAMPLE CUSTODY

7.1 GENERAL

Jordan has established a program of sample chain-of-custody (COC) that is followed during sample handling activities in both field and laboratory operations. This program is designed to assure that each sample is accounted for at all times. To maintain this level of sample monitoring, computer-generated sample container labels and shipping manifests are normally employed. Field data sheets, COC records, and analytical request forms (ARF) must also be completed by the appropriate sampling and laboratory personnel for each sample.

The objective of the Jordan sample custody identification and control system is to assure, to the extent practicable, that:

- all samples scheduled for collection, as appropriate for the data required, are uniquely identified;
- the correct samples are analyzed and are traceable to their records;
- important sample characteristics are preserved;
- samples are protected from loss or damage;
- any alteration of samples (e.g., filtration, preservation) is documented;
- a forensic record of sample integrity is established; and
- client confidentiality is maintained.

The advantages of a computer-based COC system over field marking systems are:

- all required samples are indicated on pre-prepared labels and shipping manifests; and
- once the computer-generated label is affixed to the bottle and covered with clear plastic tape, sample identification is virtually unalterable without evidence.

The COC protocol followed by the sampling crews involves:

- Documenting procedures and amounts of reagents or supplies (e.g., filters) which become an integral part of the sample from sample preparation and preservation.
- Recording sampling locations, sample bottle identification, and specific sample acquisition measures on the appropriate forms.
- Using pre-prepared sample labels to document all information necessary for effective sample tracking.

- Completing standard field data record forms to establish sample custody in the field before sample shipment (see Section 6).

Pre-prepared labels are normally developed for each sample to be collected. Each label is numbered to correspond with the appropriate sample(s) to be collected. A summary of the labels prepared, with space for sample tracking and notations, is also printed. This sample manifest assists sample control in the field and is eventually retained as part of the project file. Examples of pre-prepared labels and sample manifests are shown in Figures 7-1 and 7-2.

The COC record is used to:

- document sample handling procedures including sample location, sample number and number of containers corresponding to each sample number;
- document the sample; and
- document the COC process.

The COC description section requires:

- the sample number and sample bottle identification number, where applicable;
- the names of the sampler(s) and the person shipping the samples;
- the date and time that the samples were delivered for shipping; and
- the names of those responsible for receiving the samples at the laboratory.

A COC record is shown in Figure 7-3.

The COC record is completed in quadruplicate. Two copies accompany the samples to the laboratory, another is kept by the sample crew chief and transferred to the Laboratory Services Coordinator (LSC) and the last copy is maintained in the project file. Additional copies can be provided if needed for the project.

7.2 SAMPLE SHIPMENTS

Packing

Sample containers are generally packed in picnic coolers for shipment. Bottles are to be packed tightly so that no motion is possible. Styrofoam, vermiculite, and "bubble pack" are suitable for most instances. (High-hazard samples require different packing.) Ice is placed in double "Ziploc" bags and added to the cooler along with all paperwork in a separate "Ziploc" bag. The cooler top is then taped shut. Custody seals and taping of bottle caps may be required for certain samples, particularly those analyzed through the USEPA Contract Laboratory Program.

```
E.C. JORDAN CO.      1300-82
DATE          TIME
MW-101
VOA-624
40ML  NO FILT  4 DEG.C
      100

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-101
EXT ORG-625
1-LITER  NO FILT  4 DEG.C
      103

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-102
VOA-624
40ML  NO FILT  4 DEG.C
      106

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-102
EXT ORG-625
1-LITER  NO FILT  4 DEG.C
      109

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-103
VOA-624
40ML  NO FILT  4 DEG.C
      112

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-103
EXT ORG-625
1-LITER  NO FILT  4 DEG.C
      115

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-104
VOA-624
40ML  NO FILT  4 DEG.C
      118

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-104
EXT ORG-625
1-LITER  NO FILT  4 DEG.C
      121
```

```
E.C. JORDAN CO.      1300-82
DATE          TIME
MW-101
VOA-624
40ML  NO FILT  4 DEG.C
      101

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-101
DISSOLVED ORG. CARBON
60ML  FILTERED  HCL
      104

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-102
VOA-624
40ML  NO FILT  4 DEG.C
      107

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-102
DISSOLVED ORG. CARBON
60ML  FILTERED  HCL
      110

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-103
VOA-624
40ML  NO FILT  4 DEG.C
      113

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-103
DISSOLVED ORG. CARBON
60ML  FILTERED  HCL
      116

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-104
VOA-624
40ML  NO FILT  4 DEG.C
      119

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-104
DISSOLVED ORG. CARBON
60ML  FILTERED  HCL
      122
```

```
E.C. JORDAN CO.      1300-82
DATE          TIME
MW-101
EXT ORG-625
1-LITER  NO FILT  4 DEG.C
      102

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-101
DISS:FE/CU/CD/MN
250ML  FILTERED  HNO3
      105

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-102
EXT ORG-625
1-LITER  NO FILT  4 DEG.C
      108

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-102
DISS:FE/CU/CD/MN
250ML  FILTERED  HNO3
      111

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-103
EXT ORG-625
1-LITER  NO FILT  4 DEG.C
      114

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-103
DISS:FE/CU/CD/MN
250ML  FILTERED  HNO3
      117

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-104
EXT ORG-625
1-LITER  NO FILT  4 DEG.C
      120

E.C. JORDAN CO.      1300-82
DATE          TIME
MW-104
DISS:FE/CU/CD/MN
250ML  FILTERED  HNO3
      123
```

FIGURE 7-1
EXAMPLE COMPUTERIZED LABELS

DATE: TIME:

SAMPLE ID	CLIENT ID	NOTES	PARAMETER		CONTAINER	PRESERVED	ECJ SERIAL DATE SAMPLED
MW-101	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	100
MW-101	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	101
MW-101	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	102
MW-101	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	103
MW-101	E.C.JORDAN CO.		DISSOLVED ORG. CARBON	FILT	60 ML	HCL	104
MW-101	E.C.JORDAN CO.		DIS. FE/CU/CD/MN	FILT	250 ML.	HNO3	105
MW-102	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	106
MW-102	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	107
MW-102	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	108
MW-102	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	109
MW-102	E.C.JORDAN CO.		DISSOLVED ORG. CARBON	FILT	60 ML	HCL	110
MW-102	E.C.JORDAN CO.		DIS. FE/CU/CD/MN	FILT	250 ML.	HNO3	111
MW-103	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	112
MW-103	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	113
MW-103	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	114
MW-103	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	115
MW-103	E.C.JORDAN CO.		DISSOLVED ORG. CARBON	FILT	60 ML	HCL	116
MW-103	E.C.JORDAN CO.		DIS. FE/CU/CD/MN	FILT	250 ML.	HNO3	117
MW-104	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	118
MW-104	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	119
MW-104	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	120
MW-104	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	121
MW-104	E.C.JORDAN CO.		DISSOLVED ORG. CARBON	FILT	60 ML	HCL	122
MW-104	E.C.JORDAN CO.		DIS. FE/CU/CD/MN	FILT	250 ML.	HNO3	123
MW-105	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	124
MW-105	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	125
MW-105	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	126
MW-105	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	127
MW-105	E.C.JORDAN CO.		DISSOLVED ORG. CARBON	FILT	60 ML	HCL	128
MW-105	E.C.JORDAN CO.		DIS. FE/CU/CD/MN	FILT	250 ML.	HNO3	129
SW-4	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	130
SW-4	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	131
SW-4	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	132
SW-4	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	133
SW-4	E.C.JORDAN CO.		DISSOLVED ORG. CARBON	FILT	60 ML	HCL	134
SW-4	E.C.JORDAN CO.		DIS. FE/CU/CD/MN	FILT	250 ML.	HNO3	135
SW-5	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	136
SW-5	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	137
SW-5	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	138
SW-5	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	139
SW-5	E.C.JORDAN CO.		DISSOLVED ORG. CARBON	FILT	60 ML	HCL	140
SW-5	E.C.JORDAN CO.		DIS. FE/CU/CD/MN	FILT	250 ML.	HNO3	141
SW-6	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	142
SW-6	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	143
SW-6	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	144
SW-6	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	145
SW-6	E.C.JORDAN CO.		DISSOLVED ORG. CARBON	FILT	60 ML	HCL	146
SW-6	E.C.JORDAN CO.		DIS. FE/CU/CD/MN	FILT	250 ML.	HNO3	147
DUPLICATE-1	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	148
DUPLICATE-1	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	149
DUPLICATE-1	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	150
DUPLICATE-1	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	151
DUPLICATE-1	E.C.JORDAN CO.		DISSOLVED ORG. CARBON	FILT	60 ML	HCL	152
DUPLICATE-1	E.C.JORDAN CO.		DIS. FE/CU/CD/MN	FILT	250 ML.	HNO3	153
DUPLICATE-2	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	154
DUPLICATE-2	E.C.JORDAN CO.		VOLATILE ORG.#624		40 ML.	4 DEG.C	155
DUPLICATE-2	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	156
DUPLICATE-2	E.C.JORDAN CO.		EXT. ORGANICS#625		1000 ML.	4 DEG.C	157
DUPLICATE-2	E.C.JORDAN CO.		DISSOLVED ORG. CARBON	FILT	60 ML	HCL	158
DUPLICATE-2	E.C.JORDAN CO.		DIS. FE/CU/CD/MN	FILT	250 ML.	HNO3	159

FIGURE 7-2
EXAMPLE SAMPLE MANIFEST

PAGE ___ OF ___

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME
SAMPLERS (SIGNATURE)	

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	SAMPLE TYPE												REMARKS INDICATE SOIL/WATER/AIR SEDIMENT/SLUDGE

RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)
RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)
RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED FOR DISPOSAL BY: (SIGNATURE)	DATE / TIME	REMARKS	

FIGURE 7-3

EC JORDAN CO.

Shipping

The standard procedure followed for shipping environmental samples to the analytical laboratory is:

1. All shipping of environmental samples collected by Jordan personnel must be done through Federal Express or equivalent overnight delivery service.

2. Prior to leaving for the field, the person responsible for sample collection must notify the LSC of the number, type and approximate collection and shipment dates for the samples. If the number, type or date of shipment changes due to site constraints or program changes, the task leader must notify the LSC of the changes. This notification from the field also needs to occur when sample shipments will arrive on Saturdays. The LSC will coordinate sample pick-up with the laboratory.

3. If prompt shipping and laboratory receipt of the samples cannot be guaranteed (i.e. Sunday arrival), the samplers will be responsible for proper storage of the samples until adequate transportation arrangements can be made.

4. Project Managers must notify the LSC when samples collected by clients are going to be shipped to the laboratory.

The LSC keeps the laboratory informed of all field sampling activities. This communication is critical to allow the laboratory enough time to prepare for the samples' arrival.

The samples are shipped to the laboratory together with the COC documents, and the ARF.

Figure 7-4 is an example sample tracking form. This form provides the initial information the LSC requires. The laboratory is notified from the field by telephone of shipment. Sample collection and shipment documentation are sent to the LSC. Sample receipt log, COC and ARF are returned to the LSC by the laboratory.

Due to the nature of the IRP, additional sample/data tracking procedures are employed. The procedure described below allows each TD to verify receipt of analytical data for his Task's samples and provides a dynamic means for assessing the status of a sampling/analysis event. The tracking report also provides a cross reference between field sample identification and laboratory sample identification.

SAMPLE TRACKING FORM

SAMPLE SITE NAME/CODE: _____

TASK NO. _____

E.C. JORDAN JOB NO. _____

SAMPLING PERSONNEL: _____

DATE SAMPLED	DATE SHIPPED	ECJ SAMPLE LOCATION	TYPE OF (1) SAMPLE	E.P.A. TRAFFIC REPORT NO	ANALYTICAL LABORATORY	REQUIRED ANALYSIS (2)								
						VOA	BNA	PEST PCB	METALS					

COMMENTS: _____

(1) SW - SURFACE WATER
GW - GROUNDWATER
S - SOLID
L - LEACHATE
M - MIXED MEDIA
O - OTHER

(2) TOP HALF OF BOX = PROPOSED ANALYSIS
BOTTOM HALF OF BOX = ANALYSIS ACTUALLY REQUESTED

FIGURE 7-4
E.C. JORDAN CO.

7.3 DATA TRACKING & HANDLING

7.3.1 Data Tracking

1. Prior to initiating a sampling episode, create a task-specific Sample Tracking Form (Figure 7-4). Enter the E.C. Jordan sample location, type sample (media), and then place an "X" in the top half of each square of the column for which an analysis is proposed. Copy the resulting tracking form, along with projected sampling dates and name of analytical laboratory, and send it to the LSC. The LSC will then contact the analytical laboratory and pass on the above information.

2. While the sampling episode is underway, complete the task-specific Sample Tracking Form based on the chain-of-custody records. Enter the date sampled, date shipped, analytical laboratory, airbill number, and then place an "x" in the bottom half of each square in the column for which an analysis is actually requested. When entering field duplicates, identify it with a sample identifier plus a "D", i.e., MW-101D. If a replicate sample is sent to a second laboratory, identify it with a sample identifier plus a "R", i.e., MW-101R. Identify the second laboratory in the appropriate column. Send a copy of the resulting tracking form, along with a copy of all COCs and ARFs, to the LSC at the completion of the sampling episode.

3. The LSC will maintain an electronic sample tracking database. In addition to the information contained in the sample Tracking Form, the data base will keep track of when the data results are due, sample status, and any problems or changes encountered by the analytical laboratory. As analytical data are received from the laboratory, the samples will be logged in as "Analyses Received" in the sample tracking database. Results will then be forwarded to the Project Manager and stored in a task-specific trans-file.

7.3.2 Data Handling

1. Create a task-specific analytical data file. Be sure to modify the parameter list as appropriate for your particular investigation.

2. Enter the data:

   - Include all data modifiers, i.e. "B", "J" or brackets.

   - Do <u>not</u> enter any data not generated by Jordan without specific authorization from the QAO.

   - Enter all 'Tentatively Identified Compounds' with a spectral match greater than 90 percent.

   - Do <u>not</u> separate data packages unless a copy of the data package cover letter is attached to all parts of the package.

3. Check the data entered for accuracy and completeness.

4. Update the data tracking form as described in Data Tracking #3 above.

8.0 CALIBRATION PROCEDURES AND FREQUENCY

8.1 CALIBRATION PROCEDURES FOR LABORATORY EQUIPMENT

These procedures are described in the Standard Operating Procedures prepared by the participating laboratory submitted separately.

8.2 CALIBRATION PROCEDURES AND FREQUENCY FOR FIELD INSTRUMENTS

Each piece of equipment will be calibrated prior to each day's use. Data is recorded on the form shown as Figure 8-1. The procedures described below apply to the specific instrument noted. If other instruments are used, the manufacturer's calibration procedures are followed.

8.2.1 Y.S.I. S-C-T Meter (Model No. 33)

Temperature Probe.

1. Using a National Bureau of Standards-approved thermometer, immerse both probes into a beaker of water and note any differences for the field probe.

2. Recalibrate as necessary.

Specific Conductance Meter.

1. Calibrate meter and probe using the calibration control and the red-line on the meter dial (Y.S.I. S-C-T Meter, Model No. 33).

2. Turn the function switch to read conductivity x 10 and then depress the cell test button, noting the deflection. If the needle falls more than 2 percent of the reading, clean the probe and retest.

3. Using at least two buffer solutions, which will most likely bracket the expected values for conductivity, note accuracy of the water and probe and clean probe if necessary.

8.2.2 Specific Ion Meter

pH Probe.

1. Place electrodes and buffer solutions in a water bath at the temperature of the water to be sampled. After temperature equilibrium, measure temperature and adjust the temperature compensation knob for this temperature.

2. If using refillable probes, remove electrode cap and check that filling solution is above the filling mark.

FIELD INSTRUMENTATION QUALITY ASSURANCE RECORD

PAGE _____ OF _____

PROJECT [ ] JOB NO. [ ] DATE [ ]

EQUIPMENT TYPE/I.D.	BATTERY CONDITION	CALIBRATION INFORMATION
_____	_____	pH 4 _____ pH 7 _____ pH 10 _____
_____	_____	pH 4 _____ pH 7 _____ pH 10 _____
_____	_____	pH 4 _____ pH 7 _____ pH 10 _____
_____	_____	COND. STD. ____ / ____ COND. STD. ____ / ____
_____	_____	COND. STD. ____ / ____ COND. STD. ____ / ____
_____	_____	COND. STD. ____ / ____ COND. STD. ____ / ____
DISSOLVED OXYGEN		
_____	_____	AVERAGE WINKLE VALUE _____ METER VALUE ____ ppm CORR _____
REDOX		
_____	_____	ZOBELL SOLUTION VALUE _____ METER VALUE _____ CORR _____
PHOTOIONIZATION METER		
_____	_____	ZERO/ ZERO AIR? [ ]YES [ ] NO SPAN GAS VALUE _____ ppm EQUIV.
		METER VALUE _____ ppm EQUIV.
OTHER		
_____	_____	_____

FLUIDS MATERIALS RECORD

DEIONIZED WATER SOURCE: [ ] ECJ STAGING [ ] PORTABLE SYSTEM [ ] OTHER _____

TRIP BLANK WATER SOURCE: [ ] ECJ LAB, LOT NO. _____ [ ] OTHER, I.D. _____

DECONTAMINATION FLUID: [ ] METHYL HYDRATE, LOT NO. _____ [ ] OTHER _____ LOT NO. _____

SAMPLER BLANK WATER SOURCE: [ ] ECJ STAGING [ ] PORTABLE SYSTEM [ ] OTHER _____

HNO3/D.I. RINCE SOLUTION: [ ] ECJ STAGING, I.D. _____

PRESERVATION CHEMICAL LOT I.D.'s: CHEMICALS' USED: [ ] HNO3 LOT NO. _____ [ ] H2SO4 LOT NO. _____
[ ] HCL LOT NO. _____ [ ] NAOH LOT NO. _____
MANUF/TYPE _____ LOT NO. _____ [ ] ZNAOC LOT NO. _____ [ ] _____

FILTRATION PAPER I.D.: MANUF/TYPE _____ LOT NO. _____

STANDARDS: MANUF. _____ LOT NO. _____

SAMPLER SIGNATURE _____

FIGURE 8-1

3. Immerse the probe in the pH 7 buffer solution and adjust the calibration control to read the appropriate pH. Check the pH buffer solution for correct pH value at the equilibrated temperature.

4. Remove the probe, rinse with distilled water and then immerse in either the pH 4 or pH 10 buffer solution, depending on the expected pH of the sample.

5. If the meter does not register the correct pH for that buffer solution, adjust the calibration knob on the back of the instrument to obtain the pH of the buffer.

6. After rinsing, insert the pH probe into the flow cell and allow the probe to come to equilibrium with the sample water.

7. The pH probe is stored in the ambient air overnight.

Eh Probe.

1. Check that the platinum probe is clean and the platinum band or tip is unoxidized. If dirty, polish with emery paper.

2. Immerse the standard solution, Zobell solution, and probe in a water bath at the temperature of the water to be sampled. After the temperature has equilibrated, immerse the probe and the reference probe, if required, into the Zobell solution. Record the mV reading and the temperature and compare with the expected value (±10-20 mV).

3. Rinse the probe with distilled water or probes and insert into the flow cell. Allow for temperature equilibration and record the sample Eh.

4. At the end of the day, the probes should be stored in water.

8.2.3 Tripar Analyzer

Temperature Calibration.

Temperature Zero Adjustment - Connect the temperature sensor and select temperature as the display parameter. Remove the rear access cover exposing the sensor calibration potentiometers.

Prepare an ice water slurry and place the temperature sensor in the solution. Allow the temperature sensor to stabilize for approximately one minute while stirring the sensor in the solution vigorously. Using the adjustment tool provided in the rear cover, adjust the temperature "zero" potentiometer for a reading of 0.00°C on the system display.

Temperature Span Adjustment - Prepare a test solution to be used for temperature calibration. A beaker of water at room temperature works well as it will not be changing rapidly in temperature. Place the Tripar temperature sensor in the test solution and allow to stabilize for ap-

proximately one minute. Using a precision laboratory thermometer, measure the temperature of the test solution. At the Tripar rear panel, adjust the temperature "CAL" potentiometer until the Tripar display reads the value of the calibration solution.

Best results will be obtained if the temperature "ZERO" and "SPAN" calibration procedures are repeated.

Conductivity Calibration. From time to time, it will be required to calibrate the Tripar conductivity circuit. A simple two-point calibration procedure is utilized by first adjusting the conductivity zero and then the span.

Conductivity Zero Adjustment - With the conductivity sensor clean, dry, and in air, adjust the conductivity "zero" potentiometer for a reading of 0000 on the Tripar display.

Conductivity Span Adjustment - Totally immerse the Tripar conductivity sensor in calibration solution of known conductance. Note that the reading displayed on the Tripar is a temperature corrected value to 25°C. Therefore, the value of the standard solution must be calculated to 25°C. Also, the value of the calibration solution should fall in the upper 50 percent of the ranges to be calibrated; i.e., adjustment of the 1000 micromho/cm range should be accomplished with a 500 to 1000 micromho/cm standard. Once the sensor has stabilized in the solution for approximately one minute, adjust the conductivity "CAL" potentiometer at the Tripar rear panel for a reading on the display equal to the temperature corrected value of the standard solution.

Best results will be obtained if the conductivity zero and span procedures are repeated.

pH Calibration.

pH Standardization - The pH sensor should be standardized before each use after long storage. First, moisten the electrode body with tap water and carefully remove the plastic storage cap covering the tip of the electrode. Care should be taken not to bend the body of the electrode as this can result in damage to the internal element.

For first time use after long storage, immerse the lower end of the electrode in tap water for 30 minutes. This hydrates the pH bulb and prepares the ceramic wick for contact with test solutions. If air bubbles are present in the pH bulb, shake the electrode downward to fill the bulb with solution.

Prepare a small sample of pH 7.00 buffer solution and measure the temperature of the buffer. Rinse the pH electrode with distilled water and immerse the pH bulb in the reference buffer. Set the compensation dial in the Tripar front panel to the temperature of the buffer, allow several minutes for the sensor to reach equilibrium and stir the sensor slightly to dislodge any possible air bubbles from the electrode tip. Using the "Standardize" potentiometer, adjust for a reading of 7.00 on the Tripar display.

pH Slope Adjustment - Very infrequently, the pH slope adjustment may require re-calibration. This adjustment is available at the Tripar readout rear panel. To accomplish this adjustment, prepare a test solution of pH 4.00 or 10.00. Measure the temperature of the solution and make the appropriate setting at the pH "Compensation" dial. Rinse the pH electrode in distilled water and immerse in the buffer solution. Allow several minutes for the sensor to equilibrate and stir the electrode slightly. Using the pH "Slope" potentiometer available at the rear panel, adjust the Tripar readout module for a reading equal to the value of the buffer solution. For best results, the pH "Standardize" and "Slope" adjustments should be repeated at least once.

Note that some interference may be seen on the pH reading if the Tripar conductivity sensor is present in the same test solution as the pH sensor.

8.2.4 Photoionization Meters

HNU - With the probe attached to the instrument turn the function switch to the battery check position. The needle on the meter should read within or above the green battery area on the scale plate. If the needle is in the lower position of the battery arc, the instrument should be recharged prior to any calibration. If red LED comes "on", the battery should be recharged. Next, turn the function switch to the on position. In this position the UV light source should be on.

To zero the instrument, turn the function switch to the standby position and rotate the zero potentiometer until the meter reads zero. Clockwise rotation of the zero potentiometer produces an upscale deflection while counterclockwise rotation yields a downscale deflection. If the span adjustment setting is changed after zero is set, the zero should be rechecked and adjusted if necessary. Wait 15-20 seconds to ensure that the zero reading is stable. If necessary, readjust the zero.

The instrument is now ready for calibration by switching the function switch to the proper measurement range.

Using non-toxic analyzed gas mixtures available from the manufacturer in pressurized containers, connect the cylinder with the analyzed gas mixture to the end of the probe with a piece of tubing. Open the valve of the pressurized container until a slight flow is indicated and the instrument draws in the volume of sample required for detection. Now adjust the span potentiometer so that the instrument is reading the stated value of the calibration gas.

If the instrument span setting is changed, the instrument should be turned back to the standby position and the electronic zero should be readjusted if necessary. If the instrument does not calibrate, it may be necessary to clean the probe or the lamp connection.

Photovac T.I.P. - Turn power switch on by first pulling knob out and then up. Allow T.I.P. to warm up for 5 minutes prior to use. Turn span knob to max (9) and zero knob to zero. Attach "zero air" cylinder to T.I.P. inlet using PVC

tubing. Zero instrument using zero knob only. (T.I.P. is very sensitive so stable reading of absolute zero is difficult and not necessary to achieve.) Next, attach isobutylene cylinder to T.I.P. inlet. Use the span knob to adjust T.I.P. reading to the concentration number on the isobutylene cylinder (usually 60 ppm). Remove cylinder. T.I.P. is now calibrated and ready for use. (Calibration should be checked often as T.I.P. has tendency to drift.) When finished, turn power off by pulling switch out and down. Recharge instrument overnight. (Battery charger must be pushed into place and then screwed into bottom of T.I.P.)

8.2.5 Organic Vapor Analyzer

The following information is presented as general guidelines. Specific OVA field protocols are generally site-specific and would be included with the site QAPP addendum.

Equipment Set-up:

Set up the Photovac 10A10 in a temperature-stable environment at least eight to ten hours before beginning analyses. Attach AC power cord to Photovac and plug into 110V power outlet. Attach recorder AC power cord to Linear recorder and plug into 110V power outlet. If fully charged, internal battery packs provide 6 to 8 hours operation as a portable instrument.

Connect coaxial cable to "output" jack on Photovac, and plug opposite end into +/- input jacks on records. If positive meter reading on the Photovac gives negative recorder response, reverse polarity of recorder by reversing plug in +/- jacks. Attach gas supply to either "carrier in" port and measure flow rate on "vent" and "out" ports with a bubble flow meter. Proper flow rate is 10-15 mℓ/min during analysis; ~5 mℓ/min on standby or overnight. Reduce flow rate for overnight flush by adjusting the air tank pressure regulator. Note: Use only "Zerograde" or better air as carrier. Plastic tubing is preferred for the connection.

Equipment Operation:

Use only air-tight syringes with sharp pointed needles to introduce samples into the Photovac. Any bend in the needle will damage the septum and analyzer will not be reliable. Pierce the septum of the sample container and rinse the syringe three or four times by working the plunger back and forth before filling with sample. Remove syringe and quickly adjust volume and make injection with no hesitation. Never remove or loosen caps or valves on sample containers. Once the septum on a sample container is pierced, complete all analyses on that sample as soon as possible, as some loss of contaminants may occur.

Never interrupt the carrier gas (air) supply without first turning the detector off! Change air tanks when pressure reaches ~300 psig, or at the end of the day if analyses are to be performed the following day (detector off while changing).

Set Photovac attenuation on 100 and range on x1. Start gas flow at 10 mℓ/min. Place "charge" switch in off position and turn detector switch on 30 minutes

prior to beginning of analysis. Turn recorder chart drive off, and with the input voltage switch set at 100 mV, turn the recorder power on. Using the "zero" and "attenuation" knobs on the recorder, set so that a zero reading on the Photovac meter gives zero plot on the recorder, and so that 100 reading on Photovac gives full scale reading on recorder. (Turn the "offset" knob on the Photovac to make meter reading change.)

Turn the "offset" knob fully counterclockwise. Meter reading should be 20-50 percent of full scale. If higher, either the air supply is contaminated or the column needs to be flushed. The instrument can still be used in this condition, but the detector can easily be overloaded. Wait until reading is 20-50 percent if possible before analysis. Set the attenuation on the Photovac to the desired setting (e.g., 100 for "unknown" or dirty samples; 10 for low ppm standards or clean samples).

Rotate the offset knob clockwise until meter (and recorder) reads ~10 percent of full scale. Set the column selector switch to the desired column. Use column #1 (10 inches long) for screening unknown samples by injecting a small (~ five-$\mu\ell$) amount in port #1 to determine how much sample to inject in column #2 (four feet long) for analytical purposes. Use the results of this initial small injection on column #1 to avoid overloading column #2. If column #2 is overloaded, <u>it may take hours or even days before it is useful again</u>.

Reset the offset (if necessary) to give 10 percent full scale reading. Wait for meter to stabilize. Set recorder chart speed to 1 cm/min and turn chart drive on (flip switch up to cm/min setting). Inject sample or standard into proper port in a smooth motion and note on the recorder chart the moment of injection. Note on the chromatogram the sample or standard identification, volume injected, column #, range and attenuation (e.g., 100 x 1), chart speed and date.

Let chromatogram run until all compounds have eluted and the baseline has stabilized before making another injection (~15-20 minutes for column #1, ~30-60 minutes for column #2). Run standard mix every five or six samples to monitor changes in retention times or response. To interpret chromatograms, measure retention times from point of injection (1 cm = 1 min, or appropriate scale). Measure peak height from baseline to estimate quantity of a given compound, relating sample peak retention time and height to that of known standards. Peak height is directly proportional to concentration and to volume injected (e.g., if a 50 $\mu\ell$ injection of a 5 ppm standard gives a 5 cm peak with retention time of 114 seconds, a sample with a 3 cm peak at 112 seconds may contain 3 ppm of the same compounds if 50 $\mu\ell$ was injected).

<u>Typical Standards, Retention Times, Response Factors for the Photovac 10A10</u>. The retention times and response factors below are estimates based on laboratory work under controlled conditions (20°C and a carrier flow of 10-15 mℓ/min). Actual retention times and response factors must be acquired in the field under identical conditions to those under which samples will be run.

A table like that shown below must be generated prior to analysis of actual samples. Documentation must also include attenuation settings, column identification, head pressure and ambient conditions.

Compound	Mixed Standard Concentration (ppm)	Retention Time (seconds)	Response 50 $\mu\ell$ Injection (cm)
methylene chloride	5.0	50	~10
1,1-dichloroethane	10.0	63	4.5
1,2-dichloroethane	20.0	100	4.5
benzene	1.0	110	6.5
toluene	2.0	285	5.8
1,1,2,2-tetrachloroethylene	2.0	340	7.1
chlorobenzene	2.0	435	7.3
xylenes	10.0	615,665,800	1.0,4.3,1.3

9.0 ANALYTICAL PROCEDURES

9.1 SELECTION OF PARAMETERS

Laboratory analyses may be scheduled for air, water, sediment, soil or waste samples. Based on historical information regarding potentially hazardous material use and disposal, previous site assessments and legislative mandates, Jordan may select some or all of the following parameter groups for analysis at a particular site:

- volatile organics;
- extractable organics;
- pesticides/PCBs;
- elements/inorganics; and
- extraction procedure toxicity (EPTox).

Any additional laboratory analyses will be presented and their selection justified in the site-specific QAPP addendum. Individual contaminants comprising the analytical fractions noted above are contained in USEPA's Hazardous Substance List and/or the analytical methods selected.

9.2 SELECTION OF PROCEDURES

The analytical procedures appropriate for the majority of this program were selected based upon the IRP's legislative mandate - CERCLA. The level of analytical quality and forensic documentation indicated by this mandate normally leads to a selection of the USEPA CLP Caucus Organics Protocol (COP) and Caucus Inorganics Protocol (CIP). These state-of-the-art analytical protocols were developed with the basic requirement of legally defensible data outputs as a central criterion. Analytical protocols and data deliverables are specified in USEPA's solicitation Statement of Work for the CLP.

In some instances, however, the above protocols are not appropriate. For example, the implementation of a water supply study would require the analytical procedures to be selected based upon the requirements of the Safe Drinking Water Act.

Each site-specific QAP addendum will list the methods selected for that task. A typical summary appears as Table 9-1. Note that the selection of CLP methods requires that the laboratory analyze matrix spike and matrix spike duplicate (MS/MSD) samples as part of laboratory QC. The sampling program must provide sufficient sample to accomplish this. For every 20 sample batches or for a group of samples less than 20 collected within a 30 day period, one sample set must be collected in triplicate. The location of triplicate sampling should be selected to best enhance the achievement of project objectives.

TABLE 9-1
EXAMPLE SUMMARY OF ANALYTICAL METHODS FOR SITE-SPECIFIC QAP ADDENDUM

ANALYTICAL DATA

MATRIX/PARAMETER		ANALYTICAL METHOD
Site 19B. Maintenance Area Around Hangers		
Water:	Purgeable Organics	EPA Method 624
	Semivolatile Organics	EPA Method 625
	Pesticides/PCBs	EPA Method 608
	PP Metals	EPA Method 200.7
Site 20B. Abandoned Underground Storage Tanks and Fuel Pits		
Water:	Purgeable Organics	EPA Method 624
	Semivolatile Organics	EPA Method 625
	Pesticides/PCBs	EPA Method 608
	PP Metals	EPA Method 200.7
Site 21B. Rubble Landfill		
Soil:	Purgeable Organics	EPA Method 8240
	Semivolatile Organics	EPA Method 8250
	Pesticides/PCBs	EPA Method 8080
	PP Metals	EPA Method 6010
Site 22B. Old Fire Demonstration Area		
Soil:	Lead	EPA Method 6010
Site 23B. Drainage Ditch Leading to Sandy Creek		
Sediment:	Purgeable Organics	EPA Method 8240
	Semivolatile Organics	EPA Method 8250
	Pesticides/PCBs	EPA Method 8080
	PP Metals	EPA Method 6010
Soil:	Lead	EPA Method 6010
	Polynuclear Aromatic Hydrocarbons	EPA Method 8100
Water:	Purgeable Organics	EPA Method 624
	Semivolatile Organics	EPA Method 625
	Pesticides/PCBs	EPA Method 608
	PP Metals	EPA Method 200.7

10.0 DATA REDUCTION, INTERPRETATION, VALIDATION AND REPORTING

Data reduction is the process of converting measurement system outputs to an expression of the parameter which is consistent with the comparability objective. Calculations made during data reduction are described in the referenced analytical methods.

Interpretation of measurements by Jordan is a systematic process of reviewing a body of data to provide assurance that the data are adequate for their intended use. The process includes the following activities:

- auditing measurement system calibration and calibration verification;
- auditing QC activities;
- screening data sets for outliers;
- reviewing data for technical credibility vs. the sample site setting;
- auditing field sample data records and COC;
- checking intermediate calculations; and
- certifying the process above.

Field data collection and interpretation will follow the process illustrated as Figure 10-1. Prior to data collection, determinations are made regarding the data to be gathered in the field and the methodology to be used. Once the data are obtained, they will be reviewed and assessed as to their adequacy. If it is determined that the initial data collection concept did not provide adequate data, the entire process may need to be repeated to identify and correct data inadequacies.

For the IRP projects, formal data validation in accordance with USEPA's functional guidelines will not be performed by Jordan with the exception of interpretation to account for laboratory method blank contamination. However, the analytical events will be documented and forensic records kept to allow validation to occur at a later date, if required.

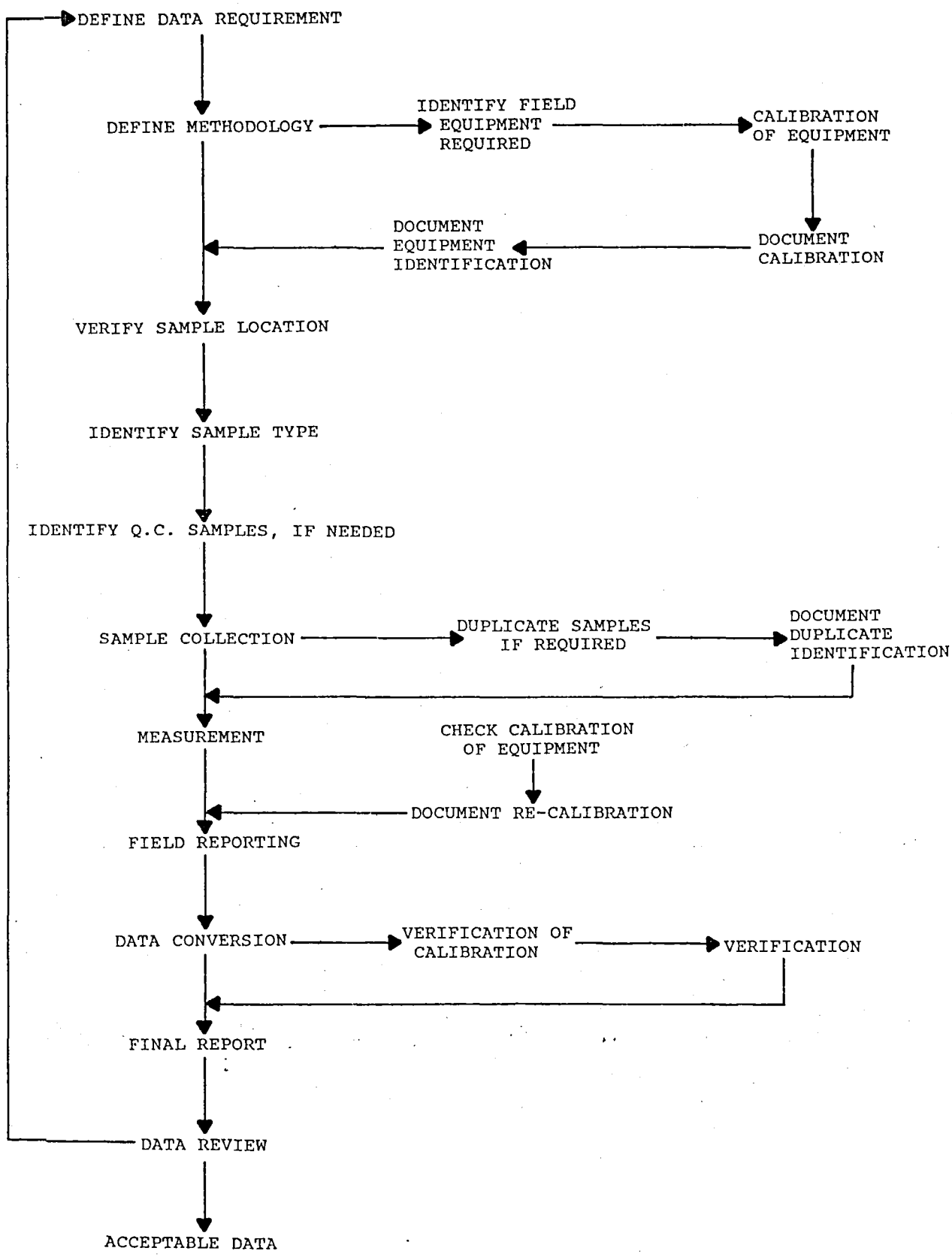

FIGURE 10-1
FIELD DATA COLLECTION AND VALIDATION

11.0 INTERNAL QUALITY CONTROL

11.1 MEASUREMENT SYSTEMS

Quality control procedures have been established for Jordan's field activities. Field QC activities include the use of calibration standards and blanks for pH, specific conductance, temperature and photoionization measurements. Special samples to be submitted to the laboratory include:

- trip blanks;
- duplicates;
- sampler blanks; and
- filtration blanks.

These samples provide a quantitative basis for evaluating the data reported.

Although the number of QC samples changes, the types of field QC samples remain the same, regardless of the level of QC implemented. Table 11.1 lists the percentage of field QC samples by level for each sample matrix per event. A sampling event is considered to be from time for sampling personnel arrive at the site until these be from the time the sampling personnel arrive at the site until these personnel leave for more than 24 hours. An event may span more than one day.

Table 11.1
Field Quality Control Samples Per Sampling Event

Type of sample	Level D		Level C		Level E	
	Metal	Organic	Metal	Organic	Metal	Organic
Trip blank (for volatiles only)	NA[1]	1/cooler	NA[1]	1/cooler	NA[1]	1/cooler
Equipment rinsate[2]	1/source/event for all levels and all analytes					
Field duplicates[3]	10%	10%	10%	10%	5%	5%
Referee duplicates[3]	collect at direction of IRP Engineer in Charge					

NOTE:

[1] NA - Not applicable

[2] Samples are collected daily; however, only samples from every other day are analyzed. Other samples are held and analyzed only if evidence of contamination exists.

[3] The duplicate must be taken from the same sample which will become the laboratory matrix/spike duplicate for organics or for the sample used as a duplicate in inorganic analysis.

Trip Blanks

Trip Blanks are defined as samples that originate from analyte-free water taken from the laboratory to the sampling site, placed in sample vials in the field, and returned to the laboratory with the volatile organic samples. One trip blank should be prepared in the file and accompany each cooler containing volatile organic aromatics (VOAs), should be stored at the laboratory with the samples, and analyzed with the sample set. Trip blanks are only analyzed for VOAs.

Equipment Sampler Rinsates

Equipment rinsates are the final analyte-free water rinse from equipment cleaning and are collected daily during a sampling event. Initially, samples from every other day should be analyzed. If analytes pertinent to the project are found in the rinsate, the remaining samples must be analyzed. The results from the blanks will be used to qualify the levels of analytes in the samples. This qualification is made during data validation. The rinsates are analyzed for the sample analytes as the samples which are collected that day.

Field Blanks

Field blanks, also known as source water samples, are the water used in decontamination and steam cleaning. At a minimum, one sample from each event and each source of water will be collected and analyzed. These should be collected in the appropriate container for the desired water analysis.

Field Duplicates/Splits

Duplicates or splits for soil or sediment samples, except VOA samples are collected, composited and then split. If the samples are collected from a split spoon, the contents of the spoon should be quartered, each quarter mixed separately and then a sample jar filled with equal portions from each quarter. VOA samples are not mixed, but taken as grab samples. If the samples are collected using "California Tubes", the laboratory should be instructed to analyze both an original and a duplicate sample from each tube.

Duplicates for water samples are collected as follows: All VOA vials (for the sample and duplicate) are filled first. The samples and duplicates for the remaining parameters are composited as follows: The bottles for a parameter (ex: semi) including those for the duplicates are filled by dividing the contents of each bailer or sampling device between all the bottles for that particular parameter until they are filled.

The matrix constitutes soil, water, or waste, from a given site. All the duplicates will be sent to the primary laboratory responsible for analysis. The same samples used for field duplicates will be taken in sufficient volume to be split by the laboratory and be used as the laboratory duplicate or matrix spike. This means that for the duplicate sample, there will be the normal sample analysis, and the laboratory matrix split/matrix spike duplicate analysis.

Referee Laboratory Duplicates

Duplicates/splits will be sent to the referee QA laboratory if regulators (state of region) collect split samples or if a special problem occurs in sample analysis or collection. These duplicates/split are collected and analyzed in addition to the field duplicates mentioned in the previous paragraph. These are collected only at the direction of the IRP Engineer in Charge. To differentiate these samples from field duplicates, they will be identified as Replicates.

Completeness

Completeness of scheduled sample collection will be controlled in the field by comparing a computer generated label inventory with samples actually collected each day. Daily checking of field data sheets and comparison of transport and chain-of-custody logs will provide further control of documentation and completeness.

Evaluating Laboratory Assays of QC Control Samples and Field Replicates

Establishment of specific criteria for evaluation depends to a great extent on the number of field and quality control samples for each media sampled, the quality of chemical data generated and how the data will be used in interpreting, evaluating and assessing the site. Chemical assay results of a particular sample may be used for more than one purpose. Chemical assay results of quality control samples may be considered differently depending on how the data will be used.

At least the following items are evaluated by the professional responsible for assessing site conditions:

- Quality of Laboratory Data:
  - acceptable
  - provisional
  - unacceptable

- Method Limitations:
  - dynamic range
  - accuracy
  - method detection limits (MDL)
  - practical quantitation level (PQL)
  - precision

- Sampling/Analysis Scope and Results:
  - number of replicates at one location
  - number of samples on site/media
  - background/downgradient distribution
  - consistency/trends of chemical assay data collected at site
  - agreement with existing site information

- Use of Data:
  - chemical distribution and transport at the site (generally order of magnitude comparisons)
  - compliance with standards, regulations, response objectives
  - presence or absence of chemical
  - treatability
  - disposal method for media containing chemicals
  - risk assessment
  - litigation

11.2 QUALITY REVIEW OF STUDIES AND REPORT PREPARATION

The purpose of quality reviews through the course of studies, designs and reports is to ensure that the service, designs and documents produced by each department meet currently accepted professional standards. The level of effort for each assignment will vary depending on type of assignment, duration and size. Review of small projects may entail periodic discussions between Technical Staff, the TD and PM. Quality control on larger assignments may require that the review personnel be involved. Quality control reviews should be scheduled on a routine basis, but the option of holding a QC review at any time is always open. The time required to plan, schedule, and conduct QC reviews should be considered part of all other design, writing and checking phases of a project.

Each assignment is normally divided into phases for internal QC reviews. At each phase, the review should include client goals, contractual commitments, technical merit, timing, budget, assignment of appropriate personnel, department coordination, project problem resolution, documentation, and consistency with company policy. Key elements to the success of any QC review are identification of problem areas, communication to implement solutions, and follow-up. Due to the complexity and interlocking nature of the IRP tasks, reviews have been scheduled weekly to ensure rapid communication.

Quality control during the preparation of studies and reports relies on documentation of data utilized and peer review of conclusions drawn from the assembled data base. The comparability objective established for the project is of particular importance when data are derived from many sources (i.e., the data base is comprised of secondary measurements). Documentation of secondary data typically is accomplished via data verification/tracking checklists with accompanying written criteria describing "acceptable" data to insure consistency in data selection. This allows all data base components to be traced to the primary generator and forces a review of data quality as the data base is developed. All project personnel are responsible for utilization and monitoring of this process; compliance is audited by the QAO. Upon completion of the data base, data interpretation, evaluation, and report preparation commence. Interpretation may require consultation with Jordan's statistician and/or use of computerized statistical routines. Documentation is also prepared for statistical manipulation methodologies. Data evaluation incorporates peer review to provide broad-based insight to data correlations and interactions.

To enhance the professional quality of the company's studies and reports, discipline managers will also:

- require that reports refer to and are consistent in scope with the project proposal and contract; and

- require that report language and contents be chosen to foster client's understanding of risks and uncertainties by distinguishing fact from opinion and identifying risks and limitations in a clear and informative manner.

Implementation of QC for reports involves the use of a review routing and sign-off forms. The Technical Director provides final review and release for all deliverables.

12.0 AUDITS

Quality assurance audits are performed to assure and document that QC measures are being utilized to provide data of acceptable quality and that subsequent calculations, interpretation and other project outputs are checked and validated. Both scheduled and unscheduled audits are provided for in the QA program.

System and performance audits may be conducted by the QAO. The TRB may conduct project audits of calculations, interpretations and reports which are based on the measurement system outputs.

12.1 SYSTEMS AUDIT

A system audit may be conducted on all components of measurement systems to determine proper selection and utilization. The systems audit includes evaluation of both field and laboratory procedures.

Organization and Personnel. The project organization is reviewed for compliance with the proposed organization and for clarity of assigned responsibility. Personnel assigned to the project will be reviewed to determine that assigned responsibility, skill and training of the personnel are properly matched. The Task Manager maintains firsthand knowledge of his team's capabilities and will discuss the organization's efficacy with the QAO. Assigned personnel may be interviewed by the QAO during an audit.

Facilities and Equipment. The audit will address whether field equipment and analytical instruments are selected and used to meet requirements specified by the project objectives stated in the QAPP. Equipment and facilities provided for personnel health and safety may also be evaluated. Calibration and documentation procedures for instruments used in the field also receives attention.

Analytical Methodology. A review of analytical methodology in regard to the data requirements for the project will be performed. An on-site observation of analyst technique, data reduction and record keeping may be performed if determined necessary. Periodic review of precision and accuracy data is essential.

Sampling and Sample Handling Procedure. An audit of scheduled samples vs samples collected vs samples received for analysis may be performed. Field documentation may be reviewed. If deemed necessary, a site visit will be made to assure that designated control procedures are practiced during sampling activities.

Data Handling. During a system audit, the QAO will review data handling procedures with the TD. Accuracy, consistency, documentation, and appropriate selection of methodologies will be discussed.

12.2 PERFORMANCE AUDIT

These audits are intended primarily for analytical data generation system and are provided in the laboratory's QAP.

12.3 PROJECT REVIEW

Project reviews are scheduled and conducted by the department responsible for the project. The intent of project reviews is to assess scope compliance and overall technical quality of the contracted services. Senior technical staff, selected by the Department Manager, apply the accumulated experience of the company to a service during the conduct of the work. A project review is appropriate at, for instance, work plan finalization, selection of design criteria, end of field program, determination of conclusion and recom-mendations, or the traditional stages of design completion. Documentation of the project review, especially identified action items and their follow-up, is essential to maximizing the utility of these reviews. Figure 12-1 provides an example project review record.

12.4 QA AUDIT REPORT

A written report of the QA project audit is prepared to include:

- an assessment of project team status in each of the major project areas;
- clear statements of areas requiring improvement or problems to be corrected. Recommendation and assistance will be provided regarding proposed corrective actions or system improvements. If no action is required, the report will state that the QA audit was satisfactorily completed; and
- a timetable for any corrective action required.

Figure 12-2 provides an example QA Audit Report. Distribution of the report will include the TRB, CO, TD, and PM.

FIGURE 12-1
PROJECT REVIEW RECORD

Project Name:
Project No.:
Site/Location:
Client:
Project Type:

Date:
Project Professional:

Department:

Objective of the Review:

Reviewers: 1.
2.
3.

Consensus Review Comments:

1.

2.

3.

4.

5.

Follow-up Actions:

1.

2.

3.

4.

5.

Date Follow-up Completed:

Project Professional:_____

Department Manager:_____

Distribute when completed to: VP-QA, Dept. Mgr., Project File, Reviewers

FIGURE 12-2
QUALITY ASSURANCE AUDIT REPORT

Project: _____

Project No.: _____ Quality Assurance Coordinator: _____

Project Aspects Audited: _____

Laboratory/Technical Director: _____

Audit Conducted By: _____ for the period _____ to _____

Date of Audit: _____

Personnel Interviewed: _____

Purpose and Objectives of the Project Aspects Audited

Brief Description of the Sampling and Analytical Requirements

FIGURE 12-2 (Continued)
RESULTS OF THE QUALITY ASSURANCE AUDIT

Organization and Personnel

Facilities Utilized

Analytical Methodologies

FIGURE 12-2 (Continued)
RESULTS OF THE QUALITY ASSURANCE AUDIT

Sampling and Sample Handling

Quality Control Measures Utilized

Data Handling

FIGURE 12-2 (Continued)
RESULTS OF THE QUALITY ASSURANCE AUDIT

Quality Assurance Deficiencies

Recommended Corrective Actions and Schedule

Signed Date

Title

Distribution:

Reviewed by Date

Title

13.0 PREVENTIVE MAINTENANCE

13.1 ANALYTICAL INSTRUMENTATION

Preventive maintenance of analytical instrumentation is addressed by the selected laboratories' standard operating procedures.

13.2 FIELD INSTRUMENTS

Preventive maintenance of field equipment is performed by analysts and staging area staff and routinely precedes each sampling event; more extensive maintenance is performed on the basis of hours in use. Sampling crews report on the performance of the equipment after each sampling event. Critical spare parts are kept in stock.

14.0 DATA ASSESSMENT

14.1 GENERAL

The purpose of data quality assessment is to assure that data generated under the program are accurate and consistent with project objectives. The quality of data will be assessed based on the precision, accuracy, consistency and completeness of the data that are generated.

Data quality assessment will be conducted in three phases:

Phase 1

Prior to data collection, sampling and analysis procedures are evaluated in regard to their ability to generate the appropriate, technically acceptable information required to achieve project objectives. This QAPP meets this requirement by establishing project objectives defined in terms of parameters, analytical methods, and required sampling protocols.

Phase 2

During data collection, results will be assessed to assure that the selected procedures are efficient and effective and that the data generated provides sufficient information to achieve project objectives. The appropriateness of the precision and accuracy of selected measurement systems will also be evaluated. In general, evaluation of data will be based on performance audits, results of duplicate and spiked sample analyses, and review of completeness objectives.

Documentation may include:

- number of replicate samples collected;
- number of replicate, spike and field blank samples analyzed;
- identification of statistical techniques, if used, to measure central tendency, dispersion, or testing for outliers;
- use of historical data and its reference; and
- identification of analytical method.

Phase 3

Following completion of data collection activities, an assessment of the adequacy of the data base generated in regard to completing project objectives will be undertaken by the QAO and Task Manager. Recommendations for improved quality control will be developed, if appropriate. In the event that data gaps are identified, the auditor may recommend the collection of additional raw data to fully support the project's findings and recommendations.

Each phase of the assessment will be conducted in conjunction with appropriate project staff.

14.2 PROCEDURES TO ASSESS PRECISION AND ACCURACY

Assessment of precision and accuracy of analytical data is accomplished via review of duplicate analyses (precision) and surrogate spike recovery (accuracy) both in reagent water and sample matrices. Precision is generally expressed as the coefficient of variation (CV). Accuracy is expressed as percent recovery. Precision must be assessed for each matrix since distribution of contaminants may be non-homogeneous, especially in non-water matrices. Precision in samples must be reviewed with knowledge of the matrix and level of analyte present. Corrective action or documentation of substandard precision is a laboratory responsibility. Accuracy, too, must recognize the impact of matrix interferences. Optional surrogate/spike recoveries are generally specified by the analytical method for reagent water under defined conditions. Each method which provides quality control requirements and acceptance criteria also specifies the method of generating the data to be reviewed. It is the laboratory's responsibility to attempt to identify the source of substandard recoveries and either take corrective action or document the cause.

Calculations are presented below:

$$\%R = \frac{\text{observed value}}{\text{theoretical value}} \times 100$$

$$CV = (S/X) \times 100$$

where %R = percent recovery

CV = coefficient of variation

S = sample standard deviation

X = mean value of data set

Completeness is generally assessed as a percentage of data intended to be generated, and is most often utilized in Phase 3 of the data assessment process.

15.0 CORRECTIVE ACTION

Corrective or preventive action is required when potential or existing conditions are identified that may have an adverse impact on data quantity or quality. Corrective action could be immediate or long-term. In general any member of the program staff who identifies a condition adversely affecting quality can initiate corrective action by notifying in writing his or her supervisor and the QAO. The written communication will identify the condition and explain how it may affect data quality or quantity.

15.1 IMMEDIATE CORRECTIVE ACTION

Immediate corrective action is usually applied to spontaneous, non-recurring problems, such as an instrument malfunction. The individual who detects or suspects nonconformance to previously established criteria or protocol in equipment, instruments, data, methods, etc., will immediately notify his/her supervisor. The supervisor and the appropriate task leader will then investigate the extent of the problem and take the necessary corrective steps. If a large quantity of data is affected, the task leader must prepare a memorandum to the Project Manager and the QAO. These individuals will collectively decide how to proceed. If the problem is limited in scope, the task leader will decide on the corrective action measure, document the solution and notify the Technical Director and the QAO in memorandum form.

15.2 LONG-TERM CORRECTIVE ACTION

Long-term corrective action procedures are devised and implemented to prevent the recurrence of a potentially serious problem. The QAO will be notified of the problem and will conduct an investigation to determine the severity and extent of the problem. He will then file a corrective action request with the Technical Director and Technical Review Board (TRB). In case of dispute between the TRB and the PM, the Corporate Officer (CO) will make a final determination for the company.

Corrective actions may also be initiated as a result of other activities, including:

- Performance Audits;
- System Audits;
- Laboratory/field comparison studies; and
- QA project audits conducted by the TRB or QAO.

The QAO will be responsible for documenting all notifications, recommendations, and final decisions. The PM and the QAO will be jointly responsible for notifying program staff and implementing the agreed upon course of action. The QAO will be responsible for verifying the efficacy of the implemented actions. The development and implementation of preventive and corrective actions will be timed, to the extent possible, so as to not adversely impact either project schedules or subsequent data generation/processing activities. The QAO will also be responsible for developing and implementing routine program controls to minimize the need for corrective action.

16.0 REPORTS TO MANAGEMENT

Summary audit reports may be prepared coincident to the completion of each Task to inform task staff and management of QA status. A final audit report for each project will also be prepared. The reports would include:

- periodic assessment of measurement data accuracy, precision and completeness;
- results of performance audits and/or systems audits;
- significant QA problems and recommended solutions for future projects; and
- status of solutions to any problems previously identified.

Additionally, any incidents requiring corrective action will be fully documented. Procedurally, the QAO will prepare the reports to management. These reports will be addressed to the Technical Director and the Technical Review Board. The summary of findings shall be factual, concise and complete. Any required supporting information will be appended to the report.

APPENDIX A

QUALITY ASSURANCE PROJECT PLAN ADDENDUM FORMAT

Task Quality Assurance Plan Addendum

IRP - SITE NAME

Task: (Number & Title)

Task Objective:

Subtasks	Standard Protocol Selected
Sample Wells	reference section # of QAPP or explain protocol to be used

Task Organization

Name	Function

Subcontractors	Function

Local Contacts	Function

Insert Sampling Data

Sample Identification/Cross Reference

ECJ ID No.	Sample Locations

APPENDIX D

HEALTH AND SAFETY PLAN

E.C. JORDAN COMPANY
HEALTH AND SAFETY PROGRAM

PREPARED BY

E.C. JORDAN CO.
PORTLAND, MAINE

SEPTEMBER 1985
REVISED OCTOBER 1988

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1.0 INTRODUCTION

The E.C. Jordan Co. (Jordan) began a formal program of site risk assessment and implementation of mitigative health and safety programs in March 1981. At that time, existing departmental policies/practices were collected and reviewed, additional needs identified and a corporate personnel health and safety plan drafted.

Currently, Jordan's Health and Safety Supervisor (HSS), with the aid of the ten-member Personnel Health and Safety Committee (PHSC) regularly reviews health and safety issues, updates practices as new information becomes available, oversees administration of the Health Monitoring Program and provides guidance for personnel training as appropriate. The PHSC is a corporate entity, effectively precluding any departmental and contract pressures on health and safety policy decisions.

Each project site is classified hazardous or non-hazardous by the HSS after a review of available data. Prior to on-site activities at those sites classified as hazardous, a health and safety plan (Appendix A) must be completed by the project engineer/scientist. This is accomplished by a review of available information on the site to assess the potential risks and provide an initial determination of personal protection requirements. The health and safety plan is subsequently reviewed and must be approved by the HSS. The designated Site Health and Safety Officer (HSO) monitors actual site conditions and may alter these requirements as needed. In all cases, personnel safety is the paramount factor in decision-making.

2.0 HEALTH MONITORING AND SAFETY PROGRAM

To protect the health and safety of employees assigned to work at hazardous waste sites, the Jordan has developed and implemented a Health and Safety Program. This program is administered by the Health and Safety Supervisor with aid from a committee consisting of representatives of Jordan technical department staffs with support from medical advisors. All personnel on-site must be enrolled in the Health Monitoring Program and must receive training appropriate for their assigned function.

In addition to Jordan employees, subcontractors and consultants working on hazardous waste sites will be enrolled in an equivalent Health Monitoring Program and receive health and safety indoctrination prior to commencing work on the site. Indoctrination, training and periodic followup is conducted as appropriate. Indoctrination and training includes:

- site history;
- inventory of site chemicals known or suspected (will be updated and reviewed at each stage of the field investigation program);
- project organization;
- work plan review;
- project documentation;
- review of site safety plan (site safety plans are updated as new information becomes available)
- review of decontamination procedures;
- proper use and care of personal protective equipment;
- proper calibration and use of monitoring equipment;
- emergency response procedures;
- accident reporting procedures; and
- contingency plans.

The site-specific information required to address the areas noted above is presented in summary safety plans prepared for each site. The plans are intended to provide a framework within which information may be updated and ongoing decisions made regarding actual health and safety concerns at the site. The summary site safety plan format is presented as Appendix A.

3.0 MEDICAL SURVEILLANCE PROCEDURES

3.1 Health Monitoring Program

All on-site Jordan personnel and laboratory staff must be enrolled in the Health Monitoring Program which is implemented through Executive Health Examiners, New York, NY. Executive Health Examiners consists of a team of physicians and support personnel who specialize in toxicology. This program consists of an initial medical examination to establish the employee's general health profile and provides important baseline laboratory data for later comparative study. The contents of the initial comprehensive physical examination and laboratory testing routine is given in Table 3-1. Follow-up examinations are completed for all personnel enrolled in the health monitoring progam on an annual basis, or more frequently if project assignments warrant testing following specific field activities. Followup examinations are tailored to the exposures recorded by the individual.

3.2 Review of Exposure Symptoms

Symptoms of exposure to hazardous materials will be reviewed for each site in order to indicate to personnel the recognized signs of possible exposure to those materials. This information will be supplemented with a discussion of the need for objectivity in the personal health assessment to account for normal reaction to stressful situations. The HSO will be watchful for outward evidences of changes in worker health. These outward symptons may include skin irritations, skin discoloration, eye irritation, muscular soreness, fatigue, nervousness or irritability, intolerance to heat or cold or loss of appetite. Employees will routinely be asked to assess their general state of health during the project.

Special medical monitoring may be identified for certain sites.

TABLE 3-1

BASELINE HEALTH MONITORING PROGRAM

1. PHYSICAL EXAMINATION

a. Medical history
b. Medical examination
c. Vision:
   - o near/distant
   - o color
d. Audiometry
e. Radiology: PA/LAT
f. Spirometry
g. Electrocardiogram

2. LABORATORY ANALYSIS

a. Complete Blood counts and chemistries

-- white blood count
differential cell counts
methemoglobin
uric acid
lactic dehydrogenase (LDH)
alkaline phosphatase
calcium
phosphorous
cholesterol
urea nitrogen (BUN)
glucose
albumin
gobulin
total protein
total bilirubin
serum glutamic oxalacetic transaminase (SGOT)
hemoglobin and/or hematocrit

c. Urine Analysis

-- color and character
specific gravity
pH
protein
acetone
glucose
microscopic examination

4.0 TRAINING

All personnel working on a Jordan site, who may potentially be exposed to toxic substances or hazardous materials, will have participated in an initial and annual refresher and/or supervisory training, as appropriate, as well as site specific training prior to the commencement of their on-site assignment. The initial Health and Safety Training Program consists of the forty (40) hour training required and designated by the OSHA standard 29 CFR 1910.120. In addition to the initial training, Jordan also employs eight (8) hour annual refresher and supervisory training elements. This general personnel training is augmented by site specific training regarding site hazards and specialized problems and protocols.

4.1 Initial Training

All site assigned personnel who are potentially exposed to toxic substances or hazardous materials will be required to participate in a training course on hazardous waste site operations. This training is required under provisions of the OSHA standard and must consist of forty hours covering the following subjects:

- Familiarity with the regulations and implications of OSHA regulations 29 CFR 1910.120.
- Familiarity with the organizational structure responsible for site health and safety.
- Explanation of the medial surveillance requirements including recognition of health hazards.
- Instruction in the use and maintenance of personal protective equipment.
- The identification and analysis of site chemical and physical hazards.
- Instruction regarding monitoring equipment including personnel and environmental sampling instruments.
- Site control and decontamination procedures.
- Contingency planning.
- Confined Space entry procedures.

4.2 Annual Refresher/Supervisory Training

On an annual basis, all personnel required to have participated in the initial training will be provided an eight (8) hour refresher training course. Those personnel with either site supervisory or health and safety responsibilities will also have eight (8) additional hours of training beyond the initial forty

hours. The eight (8) hour supervisory training meets the requirements of the annual refresher.

4.3 Site Specific Training

All personnel assigned to an E.C. Jordan site must participate in the site specific training presentation. The site specific training will cover the major elements of the site Health and Safety Plan (HASP) as well as the health and safety procedures regarding an individual's specific job responsibilities and tasks. The site HSO or H&S designee shall provide this training before an individual is permitted to work in a down range position on any site.

4.4 Other Training

Additional training shall be provided as determined by the Health and Safety Manager (HSM) or the Health and Safety Supervisor (HSS). Such training may include additional refreshers on personal protective equipment, instrumentation, CPR, First Aid or any other pertinent health or safety related subject.

5.0 PERSONAL PROTECTION LEVEL DETERMINATION

The level of personal protective equipment required shall be determined by the type and levels of waste or spill material present at the site where project personnel may be exposed. In situations where the types of waste or spill material on-site are unknown, the hazards are not clearly established or the situation changes during on-site activities, the HSO must make a reasonable determination of the level of protection that will assure the safety of investigators and response personnel until the potential hazards have been determined through monitoring, sampling, informational assessment, laboratory analyses or other reliable methods. Once the hazards have been determined, protective levels commensurate with the hazards will be used. Protection requirements will be evaluated on a continuous basis to reflect new information as it is acquired.

Preparation of site-specific plans will be based on the site-specific information made available through site files, RAMP and FIT reports, as well as any other sources identified.

The levels of protection utilized by E.C. Jordan Co. are presented below:

Level A. Level A protection must be selected when the HSO makes a reasonable determination that the highest available level of respiratory, skin and eye protection is needed. It should be noted that while Level A provides maximum available protection, it does not protect against all possible hazards. Consideration of the heat stress that can arise from wearing Level A protection should also enter into the subtask leaders decision. (Comfort is not a decision factor, but heat stress will influence work rate, scheduling, and other work practices.)

Level B. The HSO must select Level B protection when the highest level of respiratory protection is needed, but hazardous material exposure to the few unprotected areas of the body (e.g., the back of the neck) is unlikely.

Level C. The HSO may select Level C when the required level of respiratory protection is known, or reasonably assumed to be, not greater than the level of protection afforded by full face air purifying respirators; and hazardous materials exposure to the few unprotected areas of the body (e.g., the back of the neck) is unlikely. Level C requires carrying an emergency escape respirator.

Level D. Level D is the basic work uniform, selected when site hazards are judged to be minimal. Investigators and response personnel, however, must not be permitted to work in civilian clothes. Level D often requires carrying an escape respirator.

Fit testing of safety equipment is an important part of establishing adequate respiratory protection (see also Appendix F). Fit testing is accomplished prior to site explorations and each individual is assigned a fitted respirator for the duration of the project. These are tagged for identification. The equipment used for each level of protection is shown in Table 5.1.

TABLE 5-1
Protective Gear

	Level D	Level C	Level B	Level A
Action Level	0	0 to 5	5-500	500-1000
Respirator Type[2]	Escape	Full Face & Escape	SCBA	SCBA
Clothing				
o Boots	X	X	X	X
o Safety glasses or equivalent	X	X	X	
o Hard hat	X	X	X	
o Gloves, inner and outer	X	X	X	X
o Booties		X	X	X
o Coveralls	X	X	X	
o Chemical protective coveralls		X	X	
o Totally encapsulated suit				X

[1] Action levels are defined as air quality degradation from background levels, in ppm, by volatile contaminants as measured by a photoionization meter calibrated in the clean (support) zone. The action required is review of contaminants and reassessment of appropriate protective gear by the Site Health and Safety Officer.

[2] Use of an air purifying respirator is allowed only where identification of constituents has occurred and appropriate respirator cartridges have been obtained. (Refer to Appendix G, Figure 1)

[3] It must be recognized that a photoionzation meter's relative response varie with each compound. Action levels should be reviewed (when constituents are known) to determine appropriate modifications.

It should be recognized that situations exist where different combinations of respiratory and dermal protective gear are appropriate, e.g., where splash protection is required but no respiratory hazard exists. The HSO may elect a modification of the above specified combinations.

5.1 Potential Hazards On-Site

Table 5-2 includes a typical data summary concerning the toxicity of chemicals that may be found in soil and water on-site. A similar table will be included in the summary site safety plan if appropriate.

A review of physical hazards must also be performed.

T[illegible] 5-2
CHEMICAL TOXICIT[illegible]ND OTHER INFORMATION

Chemical	TLV (ppm)	ACC or STEL (ppm)	Physical State	Skin Penetration	Dermal Toxicity	Potency	LD_{50} (mg/kg) oral(rat)	Remarks
Phenols carbolic acid monohydroxybenzene	5 skin	10	Colorless to brown-black; solid or thick liquid				414 344(mice)	Absorption from spilling phenolic solution on skin may be very rapid. Death has resulted due to absorption of phenol through skin. Symptoms: irritates eyes, nose, throat. May cause anorexia. Contact: Skin burn, tremor, convulsion Target Organ: liver, kidneys, skin, pancreas First Aid. Swallow: water, vomit. Skin: soap wash. Incompatibilities: Strong oxidizers; calcium hypochlorite Toxicity[1]: 3; Persistence[2]: 1
Acetone [CH_3COCH_3] Dimethyl ketone ketone propane	750	1000	liquid; mint-like odor	+++	local	++	9750 1297(mice)	Symptoms: irritates eyes, nose, throat; narcotic in high concentrations Target Organ: respiratory system, skin First Aid: Swallow: water, vomit Skin: soap wash Incompatibilities: oxidizing materials, acids. Fire hazard when exposed to heat or flame. Toxicity[1]: 1; Persistence[2]: 0
Chloroform* [$CHCl_3$] trichloromethane	10	50	colorless liquid sweet odor				800 LC_{LO}(mice) = 28 ppm	Causes irritation of the conjunctiva, dilation of the pupils and reduces reaction to light. Prolonged inhalation will bring on paralysis accompanied by cardiac failure. Symptoms: dizziness, mental dullness, nausea, headache, fatigue, eye and skin irritant Target organs: liver, kidneys, heart First Aid: Swallow: Ipecac, vomit Skin: soap wash Incompatibilties: strong caustics; chemically active metals: Al, Mg-powder, Na, K Toxicity[1]: 2, Persistence[2]: 3

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TABLE 5-2
CHEMICAL TOXICITY AND OTHER INFORMATION
(continued)

Chemical	TLV (ppm)	ACC or STEL (ppm)	Physical State	Skin Penetration	Dermal Toxicity	Potency	LD_{50} (mg/kg) oral(rat)	Remarks
Benzene* $[C_6H_6]$ benzol	1	25	colorless liquid with aromatic odor	++	local systematic	++ +++		Poisoning occurs most commonly through inhalation; also penetrates through skin. Symptoms: irritates eyes, nose, respiratory system, giddiness, head, nausea, staggered gait; fatigue, depresssion, abdominal pain Target organ: blood, CNS, skin, bone marrow eyes, respiratory system First Aid: Swallow: NO VOMIT Skin: soap wash Incompatibilities: strong oxidizers, chlorine, bromine with iron. Dangerous when exposed to heat or flame. Toxicity[1]: 2; Persistence[2]: 1
Trichloroethylene ethylene trichloride tridene TCE	50	200	colorless liquid, sweet odor				4920 1900(dog)	Symptoms: headache, vertigo, vision distortion, tremors, somnolence, nausea, vomit, irritates eyes, cardiac arrythmias, paresthesias Target organ: respiratory system, heart, liver, kidneys, CNS, skin. First Aid: Swallow: Ipecac, vomit Skin: soap wash immediately Incompatibles: strong caustics; chemically active metals: Ba, Li, Na, Mg, liquid O_2, Al, O_2, KNO_3, Ti Persistence[2]: 3

TABLE 5-2
CHEMICAL TOXICITY AND OTHER INFORMATION
(continued)

Chemical	TLV (ppm)	ACC or STEL (ppm)	Physical State	Skin Penetration	Dermal Toxicity	Potency	LD_{50} (mg/kg) oral(rat)	Remarks
Toluene [$C_6H_5CH_3$] toluol phenyl methane methyl benzene	100 skin	150	liquid	+	local systematic	+ +	5000 TC_{LO} Human = 200 ppm	Symptoms: fatigue, confusion, euphoria, dizzy, headache, dialated pupils, lack of appetite, nervousness, insomnia Target organ: CNS, liver, kidneys, skin First Aid: Swallow: NO VOMIT Skin: soap wash Incompatibilities: strong oxidizers Toxicity[1]: 2; Persistence[2]: 1
Xylene [$C_6H_4(CH_3)_2$] xylol 1,2-dimethyl benzene	100	150	liquid, colorless; aromatic odors		local systematic		LD_{LO}= 500 mg/kg	Symptoms: dizziness, excitement, drowsiness incoordination, staggering gait, irritates eyes nose and throat, corneal vacuolization, nausea, vomit, abdominal pain Target organ: CNS, eyes, GI tract, blood, liver, kidneys, skin First Aid: Swallow: NO VOMIT Skin: soap wash Incompatibilities: strong oxidizers; dangerous when exposed to heat or open flame. Toxicity[1]: 2; Persistence[2]: 1
1,1,2,2-Tetrachloroethylene ethylene tetrachloride Perchloroethylene [$CCl_2=CCl_2$]	50		colorless liquid; sweet odor				LD_{LO}(dog) = 4000 TC_{LO} Human = 230 ppm	Liquid can cause injuries to eyes, toxic by inhalation. Symptoms: 200 ppm or higher causes irritation of nose, throat, vomiting, nausea, drowsiness Target organ: liver, kidneys, eyes, upper respiratory system, CNS First Aid: Swallow: Ipecac, vomit Skin: soap wash. Incompatibilities: strong oxidizers; chemically active metals such as: Ba, Li, Be.

TABLE 5-2
CHEMICAL TOXICITY AND OTHER INFORMATION
(continued)

Chemical	TLV (ppm)	ACC or STEL (ppm)	Physical State	Skin Penetration	Dermal Toxicity	Potency	LD_{50} (mg/kg) oral(rat)	Remarks
1,2-Dichloroethane* [$ClCH_2CH_2Cl$] ethylene chloride glycol dichloride ethylene dichloride	10	15	clear liquid with sweet odor	++	local systematic	++ ++	770	High to moderate toxicity via dermal and oral routes. It has specific effects on the cornea. Dermatitis in man has been observed. Symptoms: irritation of eyes, nose and throat, followed by dizziness, nausea, vomitting, increasing stuper, cyanosis, rapid pulse and los of consciousness. Target organ: respiratory system, liver, kidneys, skin, eyes. First Aid: Swallow: Ipecac, vomit.
Chlorobenzene [C_6H_5Cl] monochlorobenzene chlorobenzol	75 (350 mg/m^3)	--	colorless liquid				2910	Symptoms: irritates eyes, nose, causes drowsiness incoordination, skin irritation, Target organ: respiratory system, eyes, skin, ears, liver First Aid: NO VOMIT Incompatibilities: strong oxidizers, reacts violently with $AgClO_4$ Toxicity[1]: 2; Persistence[2]: 2
Ethyl benzene [$C_2H_5C_6H_3$] phenyl ethane ethyl benzol	100	125	colorless liquid with aromatic odor	++	local systematic	++ +++	3500 TC_{LO}(Human) = 100 ppm 4 hrs.	Symptoms: irritant to eyes and mucous membrane, headache, narcotic Target organ: eyes, upper respiratory system First Aid: NO VOMIT Incompatibilities: oxiding materials; dangerous when exposed to heat or flame.
1,2-dichloroethylene [ClCH=CHCl] acetylene dichloride dioform	200	250	colorless liquid slightly acrid odor				770	Has produced liver and kidney injury in experimental animals. Symptoms: irritable to eyes, respitory system, causes depression. Target organ: respiratory system, eyes, ears

E 5-2
CHEMICAL TOXICITY AND OTHER INFORMATION
(continued)

Chemical	TLV (ppm)	ACC or STEL (ppm)	Physical State	Skin Penetration	Dermal Toxicity	Potency	LD_{50} (mg/kg) oral(rat)	Remarks
								First Aid: Swallow: Ipecac, vomit Incompatibilities: strong oxidizers, dangerous when exposed to heat or flame. Reacts violently with KOH, Na, NaOH.
Methylene chloride [CH_2Cl_2] dichloromethane methylene dichloride	100	500	colorless liquid	++	local systematic	++ +++	2136 TC_{LO}(Human) -500 ppm 8 hrs.	Dangerous to eyes. It induces narcosis; can cause dermatitis with prolonged exposure, highly volatile. It can decompose by contact with hot surfaces and open flame and produce toxic fumes. Symptoms: fatigue, weak, sleepy; limbs numb or tingling Target organ: skin, CVS, eyes, CNS First Aid: Swallow: Ipecac, vomit Incompatibilities: reacts violently with Li, Na, K, terbutoxite; strong oxidizers and caustics
Mesitylene [$(CH_3)_3C_6H_3$] 1,3,5-trimethyl benzene			liquid, peculiar odor				LD_{LO}1500 TC_{LO}(Human) = 10 ppm	Causes CNS disturbances. Incompatibilities: violent with HNO_3
Dioctyl phthalate di-sec-octyl phthalate	5 mg/m^3		light, colored liquid				31,000	Toxicity: low to none via oral and dermal routes produce GI symptoms.
1,1,2-Trichloroethane $CHCl_2CH_2Cl$ vinyl trichloride beta trichloroethane	10		colorless liquid, sweet odor					Toxicity: high via subcutaneous and intravenous routes; has narcotic properties; low via inhalation, oral or dermal Symptoms: local irritant to eyes, nose and lungs Target organs: CNS, eyes, nose, liver, kidneys First Aid: Swallow: Ipecac, vomit Skin: soap wash Incompatibilities: strong oxidizers and caustics; active metals: Al, Mg powder, Na, K.

TABLE 5-2
CHEMICAL TOXICITY AND OTHER INFORMATION
(continued)

hemical	TLV mg/m³	ACC or STEL mg/m³	Physical State	Remarks
admium* ust and fumes	.05	0.2	Silver/white/blue tinged metal compounds have different appearances.	Continuous exposure to cadmium may cause irreversible lung injury, abnormal lung function and kidney disease. Increased incidence of prostatic cancer, kidney and and respiratory cancer in cadmium workers has been observed. Dust or powder is flammable, toxic gases may be released in a fire. Symptoms: Inhalation: irritation of nose and throat, 0.5 to 2.5 mg/m³ exposure can cause non-fatal lung inflamation. 4 to 10 hours exposure - severe chest pain, persistent cough, and difficulty in breathing. Eye: Irritation Ingestion: A dose of 15-30 mg of metal or soluble salt may cause increased salivation, chocking, vomiting, abdominal pain, etc. First Aid: Ingestion: Conscious person - give large amounts of water immediately and seek medical advice. Incompatabilities: Strong oxidizers, elemental sulfur, selenium, zinc, hydrobenzoic acid, ammonium nitrate.
hromium (II) and (III) Hexavalent (VI)*	0.5 0.05		Steel gray metal or silver metal powder.	The toxicity of chromium varies with different chromium compounds. Chromic acids and chromates appear to be more toxic than chromium metal dust, insoluble chromium salts, and soluble chromic and chromous salts. Exposure to certain hexavalent chromium compounds is associated with an increased lung cancer incidence in humans. Symptoms: Inhalation: Dust may cause irritation of nose, throat, respiratory passages, and lungs. Repeated or prolonged exposure to chromic acid or dust may cause ulceration and perforation of the nasal septum. Skin: Dermatitis, repeated exposure may cause an allergic skin rash. Incompatabilities: Alkalies, dil H_2SO4 & HCl.
opper Fume Dust & mist as copper	 0.2 1.0		Reddish Lustrous metal	Symptoms: Inhalation: Copper and Copper oxide fumes may cause metal fume fever - chills, fever, aching muscles, dry mouth and throat, headache, nausea, vomiting, diarrhea and stomach pains. Skin: May cause irritation - metal solutions can cause swelling and itching. Ingestion: May cause stomach pain, nausea, vomiting and diarrhea from ingestion of 10 mg of copper by an adult and 8.5 mg by a child. Long Term: No long term effects from inhalation or ingestion reported. Copper fragment in cornea may cause cataracts. First Aid: Ingestion: Seek medical attention. (Pennillamine or triethylenetetramine dihydrochloride may be beneficial in reducing body burden.)

BLE 5-2
CHEMICAL TOXICITY AND OTHER INFORMATION
(continued)

Chemical	TLV mg/m³	ACC or STEL mg/m³	Physical State	Remarks
				Incompatabilities: Acetylene gas, magnesium metal, oxidizing agents.
Cyanide Compounds KCN NaCN	5 (Skin)		White solids with faint almond odor	Cyanide compounds of sodium and potassium can affect the body if inhaled or in contact with eyes and skin or ingested. Sufficient cyanide may be absorbed through the skin to cause fatal poisioning. Symptoms: Low level of exposure causes weakness, headache, confusion, may cause nausea and vomiting. Irritation to nose and skin. High exposure causes rapid loss of consciousness, stop breathing and death. First Aid: Obtain medical advice immediately and follow instruction in first aid kit. A first aid kit should contain minimum of 48 ampules each of 0.3 ml amyl nitrate and complete instructions for use. Trained medical personnel should have physician's kit which includes an addition to amyl nitrate, sterile sodium nitrite solution 3% and sterile sodium thiosulfate solution (25%). Incompatibilities: In closed containers it may form toxic concentration of HCN gas. Strong oxidizers such as chlorates, nitrates, acid or acid salts Cyanide salt may react with CO_2 in air to form HCN
Hydrogen Cyanide (gas or liquid)			Colorless or pale blue liquid or gas, bitter almond odor.	Symptoms and First Aid are similar to cyanide. However, liquid or gas is very toxic and additional precautions are required. (HCN odor should be treated as poor warning. Although odor threshold of 0.1 ppm is below the permissible exposure limit the sense of smell is easily fatigued and wide individual variation in the minimum odor threshold is known.) First Aid: Same as cyanide. Incompatibilities: Bases - caustic and ammonia may cause violent polymerization and explosion. Liquid HCN will attack some forms of plastics, rubber and coatings.
Lead Lead Chloride* Lead Nitrate*	0.15	0.45	Bluish white or silvery gray solid.	Lead is a cumulative poison. Increasing amount builds up in the body and eventually a point is reached where symptoms and disability may occur. Lead dust carried home may cause symptoms in other family members. Symptoms: Long term exposure: decreased physical fitness, fatigue, sleep distrubances headache, aching bones, constipation, decreased appetite, and abdominal pain. Inhalation of large amounts of lead may lead to seizures, coma and death.

TABLE 5-2
CHEMICAL TOXICITY AND OTHER INFORMATION
(continued)

Chemical	TLV mg/m^3	ACC or STEL mg/m^3	Physical State	Remarks
				First Aid: Get medical attention. Ingestion: If victim is conscious, give water. Incompatibilities: Reacts violently with potassium.
Nickel and	1		Silvery White workable metal	Nickel is an insoluble metal, but most common salts are soluble.
Soluble Nickel Compounds	0.1	0.3	White or colored crystal or powder	Symptoms: (From nickel dust and salts.) Inhalation: Dust and mists can cause lung irritation, shortness of breath, coughing and wheezing. Skin: Itching, burning and sores referred to as "nickel itch". Eyes: Irritation and damage to cornea. Ingestion: Giddiness and nausea Long term exposure, in addition to symptoms listed above, impairment of sense of smell, chest pain, destruction of nasal tissues and asthmatic lung disease. Dust inhalation has been associated with an increased risk of lung and nasal cancer. First Aid: Ingestion: large amounts of water. Seek medical attention. Incompatibilities: Nickel dust is flammable. Reacts violently with fluorine, strong mineral acids; ammonium nitrate, etc.
Zinc Zinc Chloride*			Blue powder	Zinc is considered an essential trace element, necessary for normal growth and development. Most zinc compounds have a relatively low order of toxicity however, occupational exposure to zinc chloride and zinc oxide has been associated with adverse health effects. Spontaneous combustion may occur if zinc dust is stored in a damp place. Zinc dust forms an explosive mixture with air. Symptoms: Inhalation: Inhalation of mists of fumes may cause respiratory or gastrointestional irritation, shortness of breath, a feeling of constriction in the chest and coughing with phlegm and bloody sputum. It may also produce a cyanosis, resulting in a blue color of the skin and lip. Exposure to freshly formed zinc oxide fumes can cause a flu-like illness called metal fume fever, with symptoms similar to those encountered with viral influenza. Skin: Skin contact with zinc chloride may produce dermatitis. Ingestion: 12 grams of zinc metal over two days has caused sluggishness, light headedness; a staggering gait and difficulty in writing. Incompatibilities: Acids, strong alkalies, amines, chlorides, chlorates, nitrates, oxides, fluroine, S, CB_2.

NOTES

TLV - Threshold Limit Value
ACC - Acceptable Ceiling Concentration
STEL - Short Term Exposure Limit

* Suspected carcinogens, teratogens or mutagens.
** First Aid: Unless specified, first aid for all of the listed chemicals are as follows:
Eyes: immediately wash with copious quantity of cold water
Skin: Flush with water promptly
Breath: Artificial respiration
Swallow: Water, vomit
\+ Slight Hazard
++ Moderate Hazard
+++ Extreme Hazard

[1]Toxicity Ratings:

	Toxicity Rating	
No toxicity (none)	0	Material causes no harm in any condition or produces toxic effects on humans in very unusual circumstances or in very large dosage.
Slight toxicity (low)	1	
Moderate toxicity	2	
Severe toxicity	3	

[2]Persistence or each hazardous substance is evaluated on its biodegradability as follows:

	Assigned Value
Easily biodegradable compounds	0
Straight chain hydrocarbons	1
Substituted and other ring compounds	2
Metals, polycyclic compounds and halogenated hydrocarbons	3

6.0 WORKER SAFETY PROCEDURES

6.1 General

Workers will be expected to adhere to the established safety practices for their respective specialties (e.g., drilling, laboratory analysis, construction, etc.). The need to exercise caution in the performance of specific work tasks is made more acute due to weather conditions, restricted mobility and reduced peripheral vision caused by the protective gear itself, the need to maintain the integrity of the protective gear and the increased difficulty in communicating caused by respirators. Work at the site will be conducted according to established protocol and guidelines for the safety and health of all involved. Among the most important of these principles for working at a hazardous waste site are:

1. In any unknown situation, always assume the worst conditions and plan responses accordingly.

2. Employ the buddy system. Establish and maintain communication. In addition to radio communications, it is advisable to develop a set of hand signals as conditions may greatly impair verbal communications.

3. Minimize contact with excavated or contaminated materials. Plan work areas, decontamination areas and procedures to accomplish this. Do not place equipment on drums or on the ground. Do not sit on drums or other materials.

4. Employ disposable items when possible to minimize risks during decontamination and possible cross-contamination during sample-handing. This will require a common sense approach to potential risks and costs.

5. Smoking, eating, or drinking after entering the work zone and before decontamination will not be allowed. Oral ingestion of contaminants is probably the second most likely means of introduction of the toxic substances into the body (inhalation being first).

6. Avoid heat and other work stresses related to wearing the protective gear. Work breaks should be planned to prevent stress related accidents or fatigue. Appendix E provides a summary heat stress casualty prevention plan.

7. Maintain monitoring systems. Conditions can change quickly if subsurface areas of contamination are penetrated.

8. Conflicting situations which may arise concerning safety requirements and working conditions must be addressed and resolved rapidly by the HSO to relieve any motivations or pressures to circumvent established safety policy.

9. Unauthorized breaches of specified safety protocol will not be allowed. Personnel unwilling or unable to comply with the established procedures will be replaced. Any changes in established procedure should be documented on the form provided. The change should have a very specific, valid basis and must be approved by the HSO.

10. Be observant of not only one's own immediate surroundings but also that of others. Everyone will be working under constraints to awareness and it is a team effort to notice and warn of impending dangerous situations. Extra precautions are necessary when working near heavy equipment while utilizing personnel protective gear. Vision, hearing and communication are restricted by the protective gear.

11. Use of contact lenses will not be allowed on-site. These prevent proper flushing should corrosive or lachrymous substances enter the eyes.

12. Sites potentially requiring Level C or B protection will require the removal of facial hair (except moustaches) to allow a proper facepiece fit.

13. Rigorous contingency planning, and dissemination of plans to all personnel minimizes the impact of rapidly changing safety protocols in response to changing site conditions.

14. Withdrawal from a hazardous situation to reassess procedures is the preferred course of action.

15. Be aware that chemical contaminants may mimick or enhance symptoms of other illnesses or intoxication. Avoid excess use of alcohol and working with an illness during field investigation assignments.

16. The site leader, the HSO and sampling personnel shall maintain records in a bound notebook recording daily activities, meetings, facts, incidents, data, etc., relating to the project. These record books will remain on the site during the full duration of the project so that replacement personnel may add information in the same record book, maintaining continuity. These notebooks and daily records will become part of the permanent project file. Examples of forms, records and logs to be used at each site are given in Appendix C and D.

6.2 Site Entry Procedures

In most cases, Jordan teams are not the first on-site investigators. Considerable knowledge of site history and current status allows the preparation of a HASP with reasonable assurance that personnel are adequately protected. In the event that sufficient site information is not available to perform a summary risk assessment and assign the appropriate level of personal protective equipment, the following procedures should be followed. It must be understood that verification of the level of contamination (even with background information) will always require some of the steps below.

1. Recognize that Jordan's presence on-site implies a perceived contamination potential by the client.

2. Assume that the site is contaminated and conduct a site safety reconnaissance.

   - establish contamination reduction zone (decontamination area);

   - at the highest level of protection practicable, survey site beginning with a perimeter survey and gradually covering all areas of proposed activity with (as appropriate):

     - HNU photoionizer;
     - organic vapor analyzer;
     - radiation survey meter;
     - personal air sampling pumps;
     - chemically reactive indicating tubes;
     - oxygen deficiency meter; and
     - explosive mixture meter.

   - establish "hot zone"; and

   - review data, assess risk and select the appropriate level of protection.

3. Prepare summary site HASP and document all data acquired.

7.0 SITE SAFETY EQUIPMENT

In addition to personal protective gear designated for the assigned level, various monitoring and safety equipment is maintained on-site. Minimum on-site equipment will generally include:

- Photoionization meter;
- Combustible gas indicator (explosimeter);
- Oxygen meter or oxygen deficiency alarm;
- Chemically reactive indicating tubes (specific to the site hazards);
- Fire extinguishers;
- First aid kits;
- Eye wash station;
- Radiation survey meter or radiation alert;
- Transportation suitable for emergency response; and
- Organic vapor analyzer (optional).

Additional equipment may be specified and obtained as field conditions dictate.

8.0 EMERGENCY PLANNING

8.1 Emergency Medical Services

Prior to site investigation or activity on hazardous sites, nearby health facilities will be evaluated to determine their capabilities in relation to the needs of on-site project staff. Criteria such as emergency department physician coverage, decontamination capabilities and available medical specialists are evaluated.

- On-site First Aid

  - An industrial first-aid kit will be provided at the work site and contents of the kit will be checked weekly and restocked as necessary. Other equipment may include: oxygen, backboard and straps, splints, and a cervical collar.

  - At least one person qualified to perform first aid will be present on-site at all times during work activity. This person will have earned a certificate in first-aid training from the American Red Cross or will have received equivalent training. Designated first aides will receive regular review training from the American Red Cross or an equivalent session.

  - An emergency shower and eye-wash station will be provided at the work site, as well as flushing water for decontamination of boots, gloves, clothing, tools, etc.

- Transportation to Emergency Treatment:

  - A vehicle will be available at all times for use in transporting personnel to the hospital (in the event an ambulance is unnecessary or unavailable).

  - Personnel stretchers will be located at the work site for use in transporting personnel to the vehicle. Alternate transportation routes to area hospitals will be established prior to on-site activity.

8.2 Contingency Planning

Prior to commencement of on-site activities, field personnel will review safety considerations with the HSO. The HSO is responsible for adherence to the designated safety precautions and assumes the role of on-site coordinator in an emergency response situation.

All on-site personnel will be familiarized with both the primary and secondary route to the nearest hospital (which may be shown on a Figure or local map) as well as the location of the nearest working telephone or radio communication device. Each will receive a list of emergency phone numbers as shown in Appendix I.

The local hospital and emergency response team will be advised in advance by the HSO of the work to be performed. The hospital will also be briefed on the availability of personnel health data and technical support through Executive Health Examiners.

Emergency communication will be required to ensure positive pre-planned notification of emergency authorities in the event of episodes requiring initiation of contingency plans.

- The communication will be coordinated with local agencies, fire department, police, ambulance and hospital emergency room.

- Two-way radio communication may need to be established in the field, and a site alarm capable of warning site personnel and summoning assistance will be maintained (air horns).

- Emergency evacuation for residents of nearby homes is an unlikely event, but a person will be designated on-site to be responsible for implementing the contingency plan. The person will be made aware of the total number of households within a radius of 2,000 feet. Appendix I will provide the emergency contacts that will be required and an additional table will provide a list of residences and identifiable operations in the area in the event that evacuation is judged to be a possibility for a particular site.

- Prior to any activity, personnel will investigate possible routes of evacuation.

A copy of an accident report form is provided in Appendix C. It should be filled out by the HSO and filed with the individual's supervisor and a copy retained in the project records if an accident occurs.

8.3 Potential Hazards

The most common hazards associated with hazardous waste site investigation include: 1) accidents; 2) contact or ingestion of hazardous materials; 3) explosion; and 4) fire.

8.3.1 Accidents. Accidents must be handled on a case by case basis. Minor cuts, bruises, muscle pulls, etc., will still allow the injured person to undergo reasonably normal decontamination procedures prior to receiving direct first aid. More serious injuries may not permit complete decontamination procedures to be undertaken, particularly if the nature of the injury is such that the victim should not be moved. The nature and degree of surface contamination at a site is generally low enough that emergency vehicles could reach the victim on-site without undue hazard. However, in the event that access on-site is limited, accident victims may be transported to a point accessible by an ambulance by Jordan personnel trained for this response.

8.3.2 Contact and/or Ingestion of Hazardous Materials. Properly prescribed and maintained protective clothing and adherence to established safety procedures are designed to minimize this hazard. However, it is still a possibility that contact or ingestion of materials may occur. One possibility for exposure is the puncture of a buried drum of liquid during drilling operations which might cause the drum contents to contact personnel. Standard first aid procedures should be followed. The drilling rig will have a tank of water which may be useful in some circumstances, particularly to flush contaminants off any exposed skin areas. Eye wash bottles will also be maintained at the site in case of emergencies. In cases of ingestion or other

than minor contact with known substances, the local Poison Control Center and hospital should be contacted and the victim brought there immediately for further treatment and observation.

8.3.3 Explosion. The drilling crew should be keenly aware of combustible gas meter readings and withdraw at any indication of imminently hazardous conditions (greater than 20% LEL). The detection of such conditions shall be reported to local agencies for potential execution of the evacuation plan should the situation be assessed as warranting such response.

8.3.4 Fire. The combustible gas meter also warns of imminent fire hazards at borings. The greatest fire hazard at the site should be recognized as handling the fluids (e.g., methanol, acetone) used for certain decontamination procedures. No smoking or open flames are allowed on site. Carbon dioxide fire extinguishers will be kept at the drilling rig, and the decontamination area/ field office. The Fire Department, previously informed of site activities, will be called as needed.

8.4 Evacuation Response Levels

Evacuation responses will occur at three levels: (1) withdraw from immediate work area (100+ feet upwind); (2) site evacuation; and (3) evacuation of surrounding area. Anticipated conditions which might require these responses are described below:

Withdrawal Up-Wind (100 or more feet).

- Sensing ambient air conditions as containing greater contaminant concentrations than guidelines allow for the type of respiratory protection being worn. The work party may return upon donning greater respiratory protection and/or assessing the situation as transient and past.

- Breach in protective clothing or minor accident. The party may return when tear or other malfunction is repaired and first aid or decontamination has been administered.

- Respirator malfunctions and must be replaced.

Site Evacuation.

- Sensing ambient air conditions as containing explosive and persistent levels of combustible gas or excessive levels of toxic gases
- Fire or major accident

- Imminent explosion or explosion

Surrounding Area Evacuation.

- Persistent, unsuppressable release of toxic or explosive vapors from test pits or borings (possible pressure release from punctured drum). Air quality should be monitored at several distances downwind to assess danger to surrounding area before initiating this response.

8.5 Evacuation Procedures

8.5.1 Withdrawal Upwind. The work party will continually note general wind directions while on-site. (A simple wind sock may be set up near the work site for visual determinations.) Upon noting the conditions warranting movement away from the work site, the crew will move upwind a distance of approximately 100 feet or further as indicated by the site monitoring instruments. Donning SCBA and a safety harness and line, the HSO and a member of the crew may return to the work site to determine if the condition noted was transient or persistent. If persistent, then an alarm should be raised to notify on-site personnel of the situation and the need to leave the site or don SCBA. An attempt should be made to to decrease emissions only if greater respiratory protection is donned. The Health and Safety Supervisor (HSS) and client will be notified of conditions. When access to the site is restricted and escape may thus be hindered, the crew may be instructed to evacuate the site rather than move upwind, especially if withdrawal upwind moves the crew away from escape routes.

8.5.2 Site Evacuation. Upon determination of conditions warranting site evacuation, the work party will proceed upwind of the work site and notify the security force, HSO and the field office of site conditions. If the decontamination area is upwind and greater than 500 feet from the work site, the crew will pass quickly through decontamination to remove contaminated outer suits. If the hazard is toxic gas, respirators will be retained. The crew will proceed to the field office to assess the situation. There the respirators may be removed (if instrumentation indicates an acceptable condition). As more facts are determined from the field crew, these will be relayed to the appropriate agencies. The advisability and type of further response action will be coordinated and carried out by the HSO.

8.5.3 Evacuation of Surrounding Area. When the HSO determines that conditions warrant evacuation of downwind residences and commercial operations, the local agencies will be notified and assistance requested. Designated on-site personnel will initiate evacuation of the immediate off-site area without delay.

9.0 DECONTAMINATION

9.1 Personnel Decontamination Procedure

Decontamination procedures are carried out by all personnel leaving hazardous waste sites. Under no circumstances (except emergency evacuation) will personnel be allowed to leave the site prior to decontamination. Generalized procedures for removal of protective clothing are as follows:

1. Drop tools, monitors, samples, and trash at designated drop stations (i.e. plastic containers or drop sheets).

2. Step into the designated shuffle pit area and scuff feet to remove gross amounts of dirt from outer boots.

3. Scrub outer boots and outer gloves with decon solution or detergent and water. Rinse with water.

4. Remove tape from outer boots and remove boots; discard in disposal container.

5. Remove tape from outer gloves and remove gloves; discard in disposal container.

6. If the worker has left the exclusion zone to change the air tank on his/her SCBA, or the canister on his/her air purifying respirator, this is the last step in the decontamination procedure. The tank or cartridge should be exchanged, new outer gloves and boot covers donned, the joints taped, and the worker returns to duty.

7. Remove outer garments and discard in disposal container.

8. Remove respirator and place or hang in the designated area.

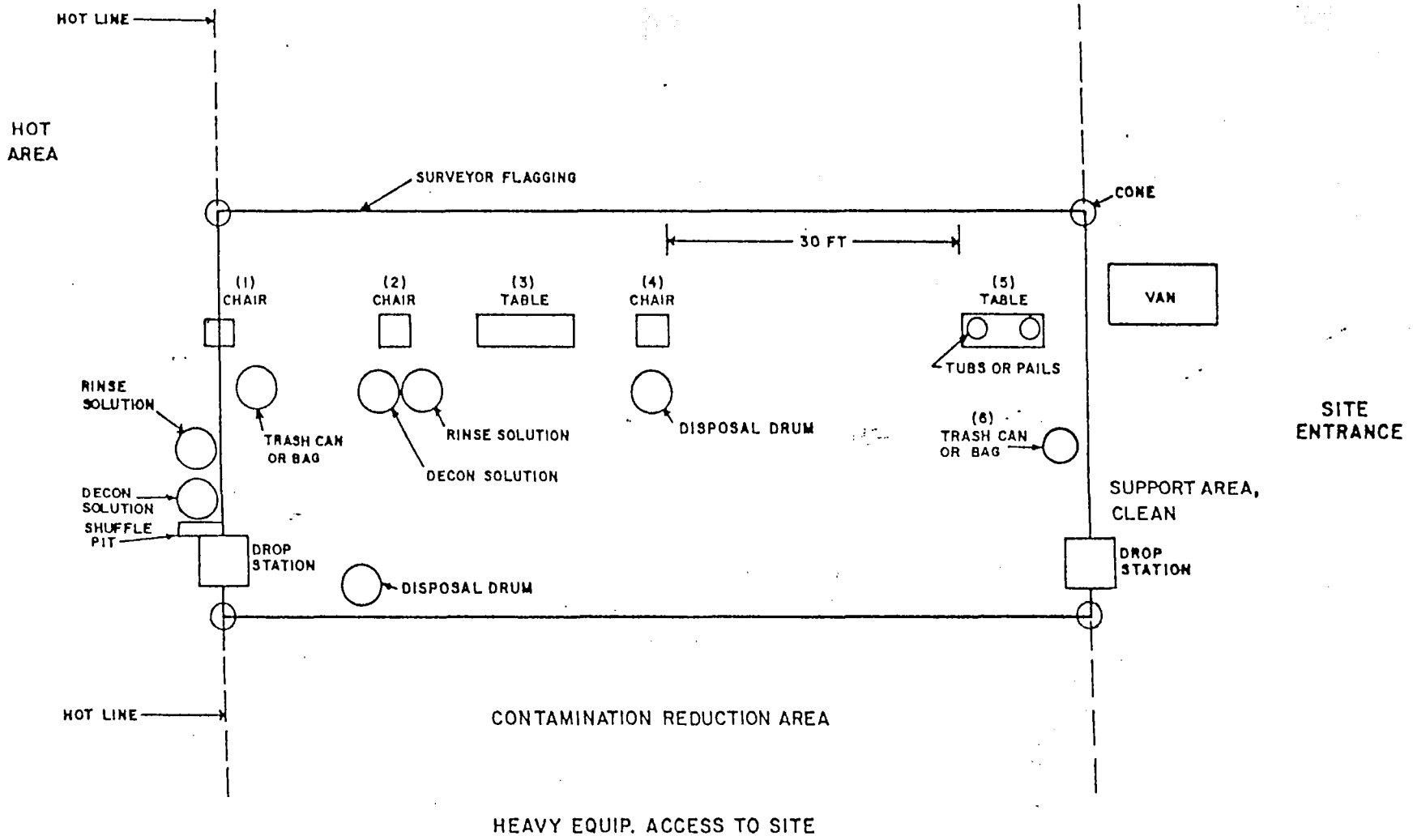
9. Remove inner gloves and discard in disposal container.

10. If the site requires use of a decontamination trailer, all personnel must shower before leaving the site at the end of the work day.

Note: Disposable items (Tyvek coveralls, inner gloves, and latex overboots) will be changed on a daily basis unless there is reason for changing sooner. Dual respirator canisters will be changed daily unless more frequent changes are deemed appropriate by site surveillance data or personnel assessment.

Pressurized sprayers or other designated equipment will be available in the decontamination area for wash down and cleaning of personnel, samples and equipment.

A schematic of a typical decontamination area is shown in Figure 9-1.



TASK

(1) WASH OUTER BOOTS - RINSE BOOTS - DISPOSE
(2) WASH OUTER GLOVES - RINSE GLOVES - DISPOSE
(3) SCBA TANK CHANGE OVER TABLE W/SPARE TANKS
(4) REMOVE OUTER GARMET - DISPOSE
(5) REMOVE SCBA, WASH MASK IN PAILS OR TUBS
(6) REMOVE INNER GLOVES - DISPOSE

NOT TO SCALE

TYPICAL PERSONNEL DECONTAMINATION STATION

E.C. JORDAN CO

9.2 Equipment Decontamination

Equipment to be decontaminated during the project may include: (1) drill rig; (2) tools; (3) monitoring equipment; (4) respirators; (5) sample containers; (6) truck or trailer and (7) laboratory equipment.

All decontamination will be done by personnel in protective gear appropriate for the level of decontamination, determined by the Site Safety Officer. The decontamination work tasks will be split or rotated among support and work crews. Decontamination procedures within the trailer (if used) should take place only after other personnel have cleared the "hot area", moved to the clean area and the door between the two areas closed.

Miscellaneous tools and samplers will be dropped into a plastic pail, tub or other container. They will be brushed off and rinsed (outside, if possible) and transferred into a second pail to be carried to further decontamination stations. They will be washed with a detergent solution, rinsed with methanol or acetone (if required), rinsed with a detergent solution and finally rinsed with clean water.

9.2.1 Drilling Rig and Tools. It is anticipated that the drill rigs will be contaminated during test pit/borehole activities. They will be cleaned with high pressure water or portable high pressure steam followed by soap and water wash and rinse. Loose material will be removed by brush. The person performing this activity will usually be at the level of protection utilized during the personnel and monitoring equipment decontamination.

9.2.2 Sample Containers. Exterior surfaces of sample bottles will be decontaminated prior to packing for transportation to the analytical laboratory. Sample containers will be wiped clean at the sample site, but it will be difficult to keep the sample containers completely clean. The samples will be taken to the decontamination area. Here they will be further cleaned as necessary and transferred to a clean carrier and the sample identities noted and checked off against the chain-of-custody record. The samples, now in a clean carrier, will be stored in a secure area prior to shipment.

9.2.3 Monitoring Equipment. Monitoring equipment will be protected as much as possible from contamination by draping, masking or otherwise covering as much of the instruments as possible with plastic without hindering the operation of the unit. The HNU meter, for example, can be placed in a clear plastic bag which allows reading of the scale and operation of the knobs. The HNU sensor can be partially wrapped, keeping the sensor tip and discharge port clear.

The contaminated equipment will be taken from the drop area and the protective coverings removed and disposed of in the appropriate containers. Any dirt or obvious contamination will be brushed or wiped with a disposable paper wipe. The units can then be taken inside in a clean plastic tub, wiped off with damp disposable wipes and dried. The units will be checked, standardized and recharged as necessary for the next day's operation. They will then be prepared with new protective coverings.

9.2.4 Respirators. Respirators will be decontaminated daily. Taken from the drop area, the masks will be disassembled, the cartridges set aside and the rest placed in a cleansing solution. (Parts will be precoded, e.g., #1 on all parts of mask #1). After an appropriate time within the solution, the parts

will be removed and rinsed off with tap water. The old cartridges will be discarded into the contaminated trash container for disposal. In the morning the masks will be re-assembled and new cartridges installed if appropriate. Personnel will inspect their own masks to be sure of proper readjustment of straps for proper fit (see also Appendix F).

9.2.5 Decontamination Trailer or Truck and Staging Area. The decontamination trailer or truck, if used, will be cleaned daily. This will include vacuuming with a vacuum having a water filter to capture dust particles. The area will be wet mopped with cleanser and clean water. Work bench areas will be wiped down. Wash buckets and the cleaning area will be decontaminated and made ready for the next day's use.

9.2.6 Laboratory Equipment. Sample handling areas and equipment will be cleaned/wiped down daily. Disposable wipes will be used and discarded into a plastic bag. These will subsequently be taken to and placed in the disposal drum for final disposition. For final cleanup, all equipment will be disassembled and decontaminated. Any equipment which cannot be satisfactorily decontaminated will be disposed of (e.g., glassware, covers for surfaces) as previously indicated.

10.0 DOCUMENTATION AND RECORDKEEPING

Samples of field activity documentation forms are attached (see Appendix C). Minimum documentation consists of:

- daily field records kept by the site technical leader or designee;
- site surveillance record kept by the Site Safety Officer;
- sampling - related records kept by sample collection team;
- chain-of-custody records for each sample collected; and
- daily exposure record for each person on-site.

11.0 UPDATING OF HEALTH AND SAFETY PLAN

The HSO is responsible for maintaining proper documentation regarding the daily safety log. If any deficiency is encountered in the health and safety plan, a report will be prepared and forwarded to the HSS at Jordan and copies sent to the project manager and technical director. The HSO will immediately initiate necessary changes to improve protection of field staff.

During the remedial investigation process or after initial field investigation, any new chemical hazard encountered will be evaluted and safety plans modified to reflect the effect of that chemical hazard. Similarly, any physical hazards that are discovered will be addressed by the HSO and reported.

12.0 HEALTH AND SAFETY AUDIT PROCEDURES

Regular health and safety audits shall be conducted to assure compliance with health and safety policy and procedures. Auditing may be performed on any Jordan site by the HSS or the Corporate Health and Safety Manager (HSM), and will include health and safety evaluations of all work activities. The audits will be an unannounced evaluation of sites selected at the discretion of the HSS or HSM with a goal of 10 percent of active sites being subject to audits each quarter.

The results of each site health and safety audit will be summarized into an audit report that is provided to the site HSO, the Project Manager and the Operational Group Manager charged with responsibility for the project. Where the audit report identifies deficiencies, it will be the Project Manager's responsibility to promptly implement corrective action. The corrective action undertaken will be outlined in a written report submitted to the HSS and the HSM. The HSM or the HSS shall retain the original audit report which has been signed by the Project Manager and the HSO to acknowledge their receipt of the audit's findings. Any mitigating comments submitted to the HSM or the HSS shall be appended to the original report.

13.0 REFERENCE GUIDES FOR HAZARDOUS MATERIALS

Reference guides for material classification determinations are:

1) Chris Hazardous Chemical Data, Manual II, U.S. Department of Transportation and U.S. Coast Guard, 1985.

2) Dangerous Properties of Industrial Materials, Sax, N.I., Sixth edition, Van Nostrand Reinhold Co., 1984.

3) Documentation of TLV's and BEI's, 5th Edition, American Conference of Governmental Hygienists, 1986.

4) Guidelines for the Selection of Chemical Protective Clothing, 3rd Edition, American Conference of Governmental Industrial Hygienists, Inc., 1987.

5) Guide to Portable Instrumentation for Assessing Airborne Pollutants Arising from Hazardous Wastes, Draft International Document in, International Organization of Legal Metrology.

6) Handbook of Chemistry & Physics, 64th Edition, CRC Press, 1984.

7) Hazardous Waste Operations and Emergency Response, Occupational Safety and Health Administration, 29 CFR 1910.120, 1986.

8) The Merck Index, 9th Edition, Merck, Sharp & Dohme Ltd., 1980.

9) NIOSH/OSHA/OSCG/EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, U.S. Department of Health and Human Services, Public Health Services, Centers for Disease Control, National Institute for Occupational Safety and Health, 1985.

10) Pocket Guide to Chemical Hazards, 1980 Edition, NIOSH/OSHA, DHEW (NIOSH) Publication No. 78-120.

11) Registry of Toxic Effects of Chemical Substances, 8th edition NIOSH, 1978.

12) Threshold Limit Values and Biological Exposure Indicies for 1987-1988, American Conference of Governmental Industrial Hygienists, 1987.

APPENDIX A

U.S. DEPARTMENT OF THE NAVY
OUTLYING LAND FIELD (OLF) BARIN
BALDWIN COUNTY
FOLEY, ALABAMA

SITE HEALTH AND SAFETY PLAN

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1.0 GENERAL

1.1 SCOPE AND PURPOSE

This Health and Safety Plan (HASP) was prepared in conformance with the C-E Environmental/E.C. Jordan Health and Safety Program and is intended to meet the requirements found in 29CFR 1910.120. As such, the HASP addresses all of the activities associated with the site investigation at the Outlying Landing Field (OLF) Barin in Foley, Alabama. Compliance with this HASP is required of all E.C. Jordan (Jordan) personnel, contractor personnel or third parties entering the site.

1.2 HEALTH AND SAFETY PERSONNEL

The following subsections briefly describe the health and safety designations and general responsibilities which will be employed for the OLF Barin project.

1.2.1 Health and Safety Manager

The Health and Safety Manager (HSM) for C-E Environmental, J.A. Reynolds, can be reached at (201) 992-2323 x264, in Roseland, New Jersey. The HSM has final authority to resolve health and safety issues that are not resolved at the site or through the Health and Safety Supervisor (HSS), and has overall responsibility for ensuring that the policies and procedures of this HASP are implemented by the Health and Safety Officer (HSO). In the various regions, the HSM may delegate additional functions to the Regional HSS.

1.2.2 Health and Safety Supervisor

The HSS for Jordan in the southeast region, Jack Davis may be reached at (904) 656-1293, in Tallahassee, Florida. The HSS is the health and safety professional serving as the C-E Environmental HSM's designee for this project. As such, the HSS will be responsible for (1) approval of the individual chosen to serve as the site HSO for this field operation; (2) review and approval of site specific HASPs developed by the HSO, as well as any significant changes made over time to the site HASP; (3) oversight of the daily efforts of the HSO; (4) resolution of site disputes involving health and safety issues; (5) implementation of the HASP by the HSO. The HSS will notify the HSM of any Stop Work Orders issued by an HSO.

1.2.3 Health and Safety Officer

Janet Burris has been approved as the HSO for the OLF Barin site by the Jordan HSS. The HSO is responsible for developing and implementing this site-specific HASP in accordance with the C-E Environmental/E.C. Jordan Health and Safety Program. The HSO will conduct safety inspections and investigate all accidents, illnesses, and incidents occurring on-site. The HSO will also conduct safety briefings and site-specific training for on-site personnel. As necessary, the HSO will accompany all U.S. Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA), or other governmental agency personnel visiting the site in response to health and

safety issues. The HSO, in consultation with the HSS, is responsible for updating and modifying this HASP as site or environmental conditions change.

The HSO is vested with the authority to stop site operations (STOP WORK AUTHORITY) if he/she determines that an imminent health or safety hazard or other potentially dangerous situation exists. The HSO is to immediately notify the HSS of any Stop Work Orders issued. The HSO may also recommend to the HSS or HSM that the downrange authorization of individual site personnel be revoked for health and/or safety reasons.

The HSO, through the HSS, ensures that all personnel entering the OLF Barin site are qualified for downrange deployment, in accordance with the C-E Environmental/E.C. Jordan Health and Safety Program requirements.

1.3 TRAINING

Training, as defined under the C-E Environmental/E.C. Jordan Health and Safety Program Section 4.0, and meeting the requirements of 29 CFR 1910.120, is required for all personnel entering potentially contaminated areas of this site. Personnel without the required training will not be permitted in a downrange position.

1.4 MEDICAL SURVEILLANCE

All personnel entering potentially contaminated areas of this site must be medically qualified for site assignment as determined by a medical surveillance program, such as that outlined in the C-E Environmental/E.C. Jordan Health and Safety Program, Section 3.0. Personnel without medical clearance will not be permitted in a downrange position.

2.0 SITE CHARACTERIZATION AND ANALYSIS

2.1 SITE NAME, LOCATION AND SIZE

Barin Field is located in southwest Alabama (Baldwin County), approximately 40 miles southeast of Mobile, 35 miles west of Pensacola, Florida and 10 miles north of the Gulf of Mexico (Figure 2-1). The City of Foley (population 4,490) is approximately 2 miles to the west and the City of Elberta (population 558) is about 2 miles to the east. Present day, Barin Field consists of approximately 490 acres, compared to the nearly 1,000 acres it once covered during World War II and the Korean conflict. The majority of land at the field is covered by grass and three active airstrips. Currently, only a small portion of the airfield is used by based personnel for operations and equipment storage.

2.2 SCOPE OF WORK

The field investigations at OLF Barin Field will consist of geophysical investigations, monitoring well installation, well development and purging, soil and groundwater sampling and general field data collection.

2.3 SITE HISTORY

The U.S. Navy acquired OLF Barin from the City of Foley, Alabama. At the time of acquisition near the beginning of WWII, the site consisted of three airstrips covering 310 acres. The Navy acquired another 655 acres east of the original airport to build another three airstrips and an administration and housing area. The facility was commissioned as Naval Auxiliary Air Station (NAAS) Barin on December 5, 1942.

NAAS Barin was used for basic and advanced air training as well as an indoctrination center for enlisted personnel. By the end of WWII NAAS Barin consisted of four large hangars, a fuel system with 60 field pits, approximately 65 structures used to support station personnel and six airstrips. On January 5, 1947 NAAS Barin was deactivated. Reactivation of Barin was started in early 1952 and the airfield remained open throughout the Korean conflict until 1959.

After the airfield was closed in 1959, the original airfield on the west side of the facility was transferred back to the City of Foley. The administration and housing area north of the hangars was sold to private parties. The four large hangars and all other buildings left on the remaining Navy property were dismantled. Flight operations did not return to Barin until 1985 when pilots from Naval Air Station (NAS) Whiting Field, Milton, Florida, began using the old runways for touch and go landings.

NAS Whiting Field began construction of a crash crew building in 1985. The station was officially reopened on May 27, 1988 and renamed Outlying Landing Field (OLF) Barin. The existing layout of OLF Barin is shown in Figure 2-2.

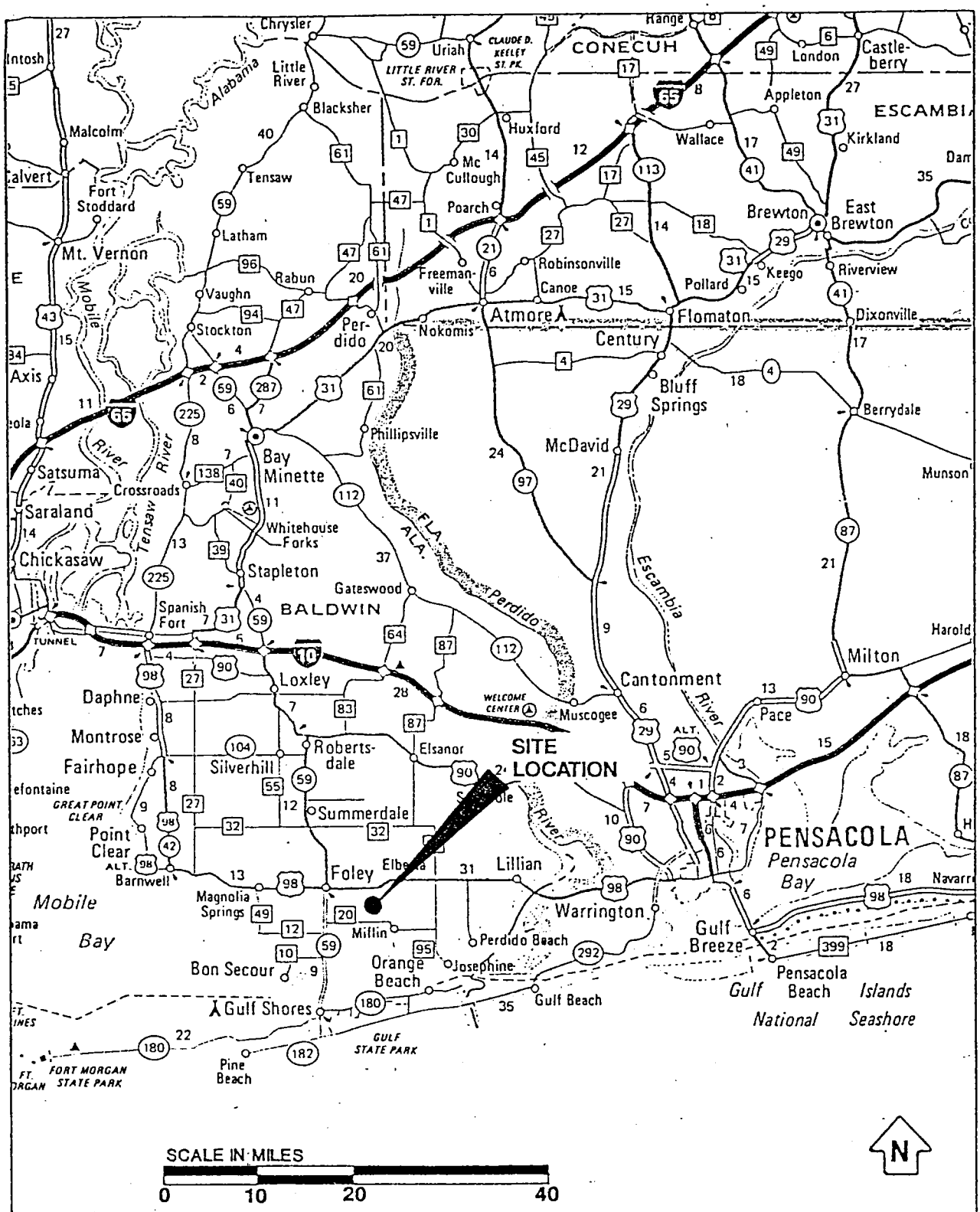
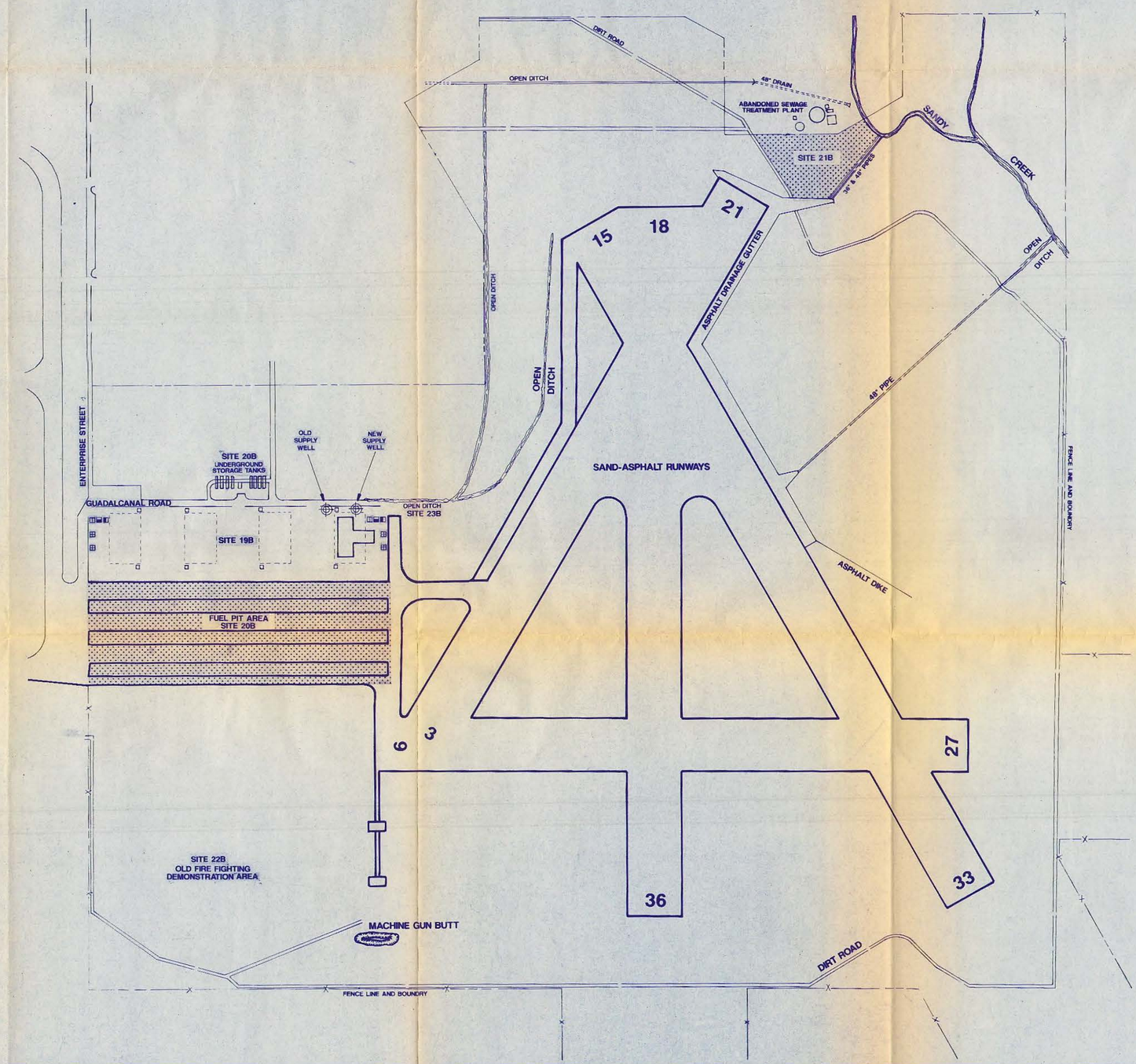


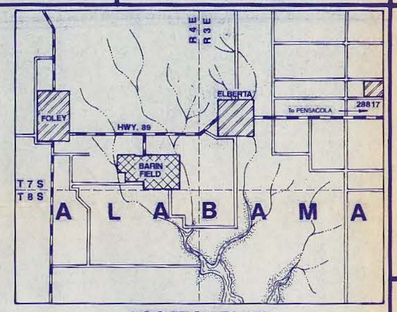
FIGURE 2-1

LOCATION OF OLF BARIN
FOLEY, ALABAMA

WORK PLAN
SITE INSPECTION

OLF BARIN
FOLEY, ALABAMA





LOCATION PLAN

SCALE: 1" = 2 MILES

N

LEGEND

- APPROX. LOCATION OF WASTE OIL TANKS
- APPROX. LOCATION OF KEROSENE TANKS
- APPROX. LOCATION OF USED OIL TANKS
- APPROX. LOCATION OF WASH RACKS
- APPROX. LOCATION OF LUBE OIL TANKS
- DISMANTLED HANGERS
- FENCE LINE / BOUNDARY
- PROPERTY LINE
- FENCED BOUNDARY

SCALE IN FEET

0 300 600

NAS DWG. No.	REFERENCE DRAWINGS
29007	MAP OF BARIN FIELD, NAVAL AIR BASIC TRAINING, PENSACOLA, FLORIDA; SHOWING CONDITIONS ON JUNE 30, 1950
IV-2	OLF BARIN EXISTING CONDITIONS, NAS WHITING FIELD MASTER PLAN, SEPTEMBER 1988

SURVEY BY: DATE:

SURVEY FILE NO.:

FIELD BOOK No.

No.	REV.	DATE	STATUS	MF	BY	CHKD	APPD

E.C. JORDAN CO.
ENGINEERS & SCIENTISTS

CLIENT: SOUTHERN DIVISION NAVFACENGCOM

DESIGN		
DRAWN	W.W.	3-89
CHKD.		
DEPT. HD.		
PROCESS		
PROJ. MGR.		
CLIENT		
SCALE		

TITLE: **SITE LOCATIONS**

OLF BARIN
FOLEY, ALABAMA

PROJ. NO. 5898-03 REV.

DWG. NO. 2-2

HANLAN & SPILLER CO. INC. 125871

As stated above, during World War II, and again during the Korean conflict, NAAS Barin was utilized to train pilots and for aircraft maintenance. Numerous types of solvents, oils, and fuels were used by maintenance personnel in these operations. In 1988, a drinking water supply well located at OLF Barin was discovered to be contaminated with trans-1,2-dichloroethylene, tetrachloroethylene, and trichloroethane. At this time the source of contamination is not known.

In accordance with the Department of the Navy's (DON) Installation Restoration (IR) Program, OLF Barin is being investigated to determine the extent of soil and groundwater contamination. The IR Program is implemented in several phases, each of which utilizes information obtained during the previous phase. The first phase is Site Discovery and Notification and consists of recognizing the potential for the existence of a problem. Subsequent to Site Discovery, a Preliminary Assessment (PA) is conducted. The PA consists of a records search and personnel interviews to collect and evaluate evidence supporting the existence of any potential contamination problems. A Preliminary Assessment for OLF Barin was conducted by the Naval Energy and Environmental Support Activity (NEESA) in December 1988. Five potential contaminant sources were identified in the PA, and a Site Inspection (SI) was recommended. The five sites are:

Site 19B - maintenance area around the hangers,
Site 20B - abandoned underground storage tanks and fuel pits,
Site 21B - rubble landfill,
Site 22B - old fire fighting demonstration area, and
Site 23B - drainage ditch leading to Sandy Creek

2.4 HAZARDOUS SUBSTANCES/CONDITIONS

Hazardous substances which are known to have been stored or used at OLF Barin include numerous solvents, waste oil, lubricating oil, penetrating oil, diesel, kerosene, aviation gasoline, automobile gasoline, heating oil and mineral spirits. Chemical constituents of these listed hazardous substances include: lead; benzene, ethylbenzene, toluene, total xylene (BETX); ethylene dibromide (EDB); polynuclear aromatic hydrocarbons (PAHs); tetrachloroethylene (PCE); trichloroethylene (TCE); carbon tetrachloride; trichloroethane (TCA) and trans-1,2-dichloroethylene (trans-1,2-DCE). Table 2-1 contains general physical characteristics of the above listed chemicals as well as the odor threshold, threshold limit value and other remarks. The following information is a brief summary of the physical characteristics and health risks associated with each of the substances (where information could be found).

Benzene is a watery, colorless liquid with a pleasant aromatic odor. It is a moderate irritant in small amounts both as a gas and as a liquid. If inhaled in large amounts it attacks the central nervous system, possibly resulting in coma and/or respiratory arrest. Chronic poisoning causes leukemia.

Ethylbenzene is a colorless aromatic liquid. It is a moderate skin irritant in gaseous form. Inhalation of high concentrations of the gas may cause temporary irritation of the nose, dizziness, and depression. The liquid form can blister the skin if not washed off immediately.

TABLE 2-1
CONTAMINANTS OF CONCERN

CHEMICAL	APPROXIMATE ODOR THRESHOLD (ppm)	TLV (ppm)	PHYSICAL CHARACTERISTICS	DERMAL TOXICITY	REMARKS
Benzene	4.7	1	Colorless liquid, pleasant aromatic odor	Moderate skin irritant	Inhalation of large amounts attacks central nervous system; chronic poisoning causes leukemia.
Ethylbenzene	140	100	Colorless liquid, aromatic odor	Moderate skin irritant	Liquid blisters skin; inhalation results in dizziness, depression.
Toluene	0.17	100	Colorless liquid, pleasant aromatic odor	Mild skin irritant	Ingestion or aspiration can cause pulmonary edema, depressed respiration.
Xylene	0.05	200	Colorless liquid, aromatic odor	Moderate skin irritant	Inhalation causes headache and dizziness; vapors irritate eyes; can be fatal if ingested.
Lead	--	--	Soft, ductile, gray metal, soluble in water containing a weak acid	--	Lead poisoning may cause fatigue, anemia, abdominal pains, and neurological damage.
Ethylene Dibromide	--	20	Clear liquid, mild sweet odor	--	--

TABLE 2-1 (CONTINUED)
CONTAMINANTS OF CONCERN

CHEMICAL	APPROXIMATE ODOR THRESHOLD (ppm)	TLV (ppm)	PHYSICAL CHARACTERISTICS	DERMAL TOXICITY	REMARKS
Tetrachloroethylene	--	100	Colorless liquid; either-like odor	Moderate skin and eye irritant	Inhalation, ingestion or contact may irritate eyes, nose or throat flush face or neck; vertigo, dizziness, incoordination and headache.
Trichloroethylene	--	100	Colorless liquid; sweet odor like chloroform	Toxic by inhalation; moderate skin and eye irritant	Inhalation, ingestion or contact may cause headache, vertigo, visual disturbance, tremors, sommolence, nausea and vomiting; cardiac arrhythmias; paresthesias.
Carbon tetrachloride	--	* 5	Colorless liquid with an either-like odor (sweetish)	Moderate skin and eye irritant; moderately toxic	Inhalation, absorption, ingestion or contact may cause CNS depression, liver and/or kidney damage, and skin irritation; suspected carcinogen.
Trichloroethane	--	10	Colorless liquid; sweet odor like chloroform	Toxic; eye and skin irritant; absorbed by skin	Inhalation, skin absorption, ingestion or contact may cause CNS depression, liver and kidney damage; eye and nose irritation.
Trans-1,2-Dichloro-ethylene	--	200	Colorless liquid; pleasant odor	Moderately toxic by ingestion, inhalation and skin contact	Inhalation, ingestion or contact may cause irritation of eyes and respiratory system; CNS depressison; flammable.

Notes: CNS - Central Nervous System

Toluene is a watery, colorless liquid with a pleasant aromatic odor. It is a mild skin irritant. Inhalation of high concentrations of the gas can cause temporary irritation of the eyes or respiratory system. If the liquid form is allowed to remain on the skin for a long period of time irritation and reddening of the skin may occur. Ingestion or aspiration of the liquid causes depressed respiration and pulmonary edema, and can result in kidney or liver damage.

Xylene is a colorless, watery liquid with a sweet odor. It is a moderate skin irritant. When present as a gas in high concentrations it can cause temporary irritation of the eyes or respiratory system, headache, and dizziness. The liquid form may cause irritation or reddening of the skin if not washed off for a prolonged period. If the liquid is aspirated into lungs it can result in severe coughing, distress, and rapidly developing pulmonary edema. If ingested, nausea, vomiting, cramps, headache, coma and even death can occur. Ingestion may also result in kidney and liver damage.

Tetraethyl lead is a colorless, oily liquid with a pleasant characteristic odor. It can cause intoxication by absorption through the skin or by inhalation. Ingestion causes fatigue, anemia, abdominal pains, constipation, and neurological damage.

EDB is a colorless, nonflammable liquid with a sweetish odor. It is a strong irritant to eyes and skin and is toxic by inhalation, ingestion and skin absorption. Laboratory test have shown it to be carcinogenic in test animals.

Polynuclear Aromatic Hydrocarbons (PAHs) for the purposes of this plan and study include those listed as parameters for EPA Method 610. Some of the more notable PAHs from this method include acenaphthene, anthracene, chrysene, fluorene, naphthalene, phenathrene and pyrene.

2.5 INITIAL SITE ENTRY

2.5.1 Initial Levels of Protection

Based on the available historical site information and current site conditions, the level of protection planned for initial site activities at the OLF Barin site is Level D. It should be noted however that this HASP allows for the upgrading of protection levels to conservatively preclude any potential for contamination to on-site personnel while not sacrificing protection on efficiency. During the initial reconnaissance, the team will perform air monitoring for total volatile organics to identify the presence of contaminants, as well as to assess the integrity of the site in consideration of safety for the proposed site investigation and sampling operations.

2.5.2 Initial Monitoring

Where the site information either shows the potential for ionizing radiation or "immediately dangerous to life or health" (IDLH) conditions, initial monitoring will consist (at a minimum) of an ionizing radiation survey and air monitoring using devices such as a combustible gas indicator, oxygen meter, and photoionization detectors (PID). It is intended that real-time monitoring instrumentation will be used to assist in the determination of the appropriate level of protection for the initial site entry team.

2.6 SITE RISKS

2.6.1 Health Hazards

The potential for exposure to site contaminants as described in Section 2.4, by field personnel working at the OLF Barin site does exist. However, at this time it is thought that the contamination associated with the site is mainly limited to groundwater and subsurface soils. Therefore, the health hazards associated with all non-intrusive on-site activities is considered to be low. The potential for exposure to site contaminants does however, increase during activities such as soil boring/soil sampling and groundwater sampling. Based on the types of materials that were used at the facility, the types of contaminants that could be found in the soils and groundwater can be divided into three categories: volatile organics, base/neutral and acid extractables and metals. The basis of classifying these materials is soley on their chemical properties. At one end of the spectrum are volatile organics which are fairly mobile, thereby increasing the risk of exposure. Metals, on the other hand, are fairly inert, resulting in a lesser chance of exposure based on current site condition. The actual health hazards associated with the site contaminants have been provided in Section 2.4 and Appendix B.

2.6.2 Safety Hazards

Safety hazards include those hazards which personnel may be exposed to that are unrelated to hazardous wastes. These include hazards such as heat stress, operation and presence around heavy equipment, lifting of objects, vehicle traffic and snake bites. Extreme caution should be exhibited by all personnel while conducting work around drill rigs, backhoes and other heavy equipment. During hot days personnel should take time to drink fluids and cool off to avoid overheating and symptoms related to heat stress (see Appendix E).

Lifting of heavy objects should be done with caution. Personnel should assist one another with moving heavy objects or use the appropriate equipment to accomplish these tasks. During all site activities personnel should be aware of the possibility of an encounter with poisonous snakes, particularly rattlesnakes.

2.6.3 Conclusion/Risk Assessment

The degree and associated risk of exposure to contaminants at the site are dependent on the chemical, its concentration, route of entry, and duration of exposure. The chemicals that are most likely to be present at the site based

on historical site records have been identified. The major route of entry for the materials at this site during intrusive activities is thought to be through inhalation (volatiles, dust-containing metals), and dermal contact with soils, sludges, and groundwater. Therefore, based on all available information (site conditions, potential on-site chemicals and their properties, exposure limits, etc.), hazards associated with working in the presence of these materials under present site conditions are considered moderately low, assuming appropriate health and safety practices are maintained.

3.0 SITE CONTROL

3.1 ZONATION

The site itself will normally be divided into three zones: the majority of the work area will be considered the Exclusion Zone, with limited areas serving as the Support Zone, and an area for decontamination called the Contamination Reduction Zone (CRZ). Figure 3-1 presents a schematic diagram of a typical site zonation and the associated equipment.

3.1.1 Exclusion Zone

The Exclusion Zone isolates the area of contaminant generation and restricts (to the extent possible) the spread of contamination from active areas of the site to support areas and off site locations. The Exclusion Zone is demarcated from the remainder of the site by the Hot Line(i.e., a tape line or physical barrier). Personnel entering into the Exclusion Zone must: (1) enter through the CRZ; (2) wear the prescribed level of protection (see: Section 4.3.1); and (3) be otherwise authorized to enter the Exclusion Zone (see: Section 1.3, 1.4, and 9.1). Any personnel, equipment or materials exiting the Exclusion Zone will be considered contaminated and will be subject to either decontamination, or will be containerized in uncontaminated devices.

Within the Exclusion Zone, specific locations or restricted areas (clearly marked or identified) will be established as necessary for particular locations or around specific site operations. In the case of well drilling or excavation operations, a restricted area will be established which includes a minimum thirty 30-foot radius from the drill rig or excavation operation. Other restricted areas may include drum areas, active site areas, sources of combustible gases or air contaminants or other dangerous areas as they are identified. Specific access for emergency services to areas for specific site operations will be established.

3.1.2 Contamination Reduction Zone

Moving out from the Exclusion Zone, starting at the Hot Line and continuing to the Contamination Control Line, is the CRZ. The CRZ is a transition zone between contaminated and uncontaminated areas of the site. When "hot" or contaminated personnel, equipment, or materials cross the Hot Line, they are assumed to be as "hot" or contaminated as they are going to be from site operations. Being subjected to the decontamination processes, they become less contaminated; when they reach the Contamination Control Line, they are clean and can exit this zone without spreading contamination.

Within the CRZ is the Contamination Reduction Corridor (CRC), where materials necessary for full personnel and portable equipment decontamination are kept. A separate facility will be established for heavy equipment decontamination. In addition, certain safety equipment such as emergency eye wash, fire extinguisher, stretcher and first aid kit are to be staged in this zone.

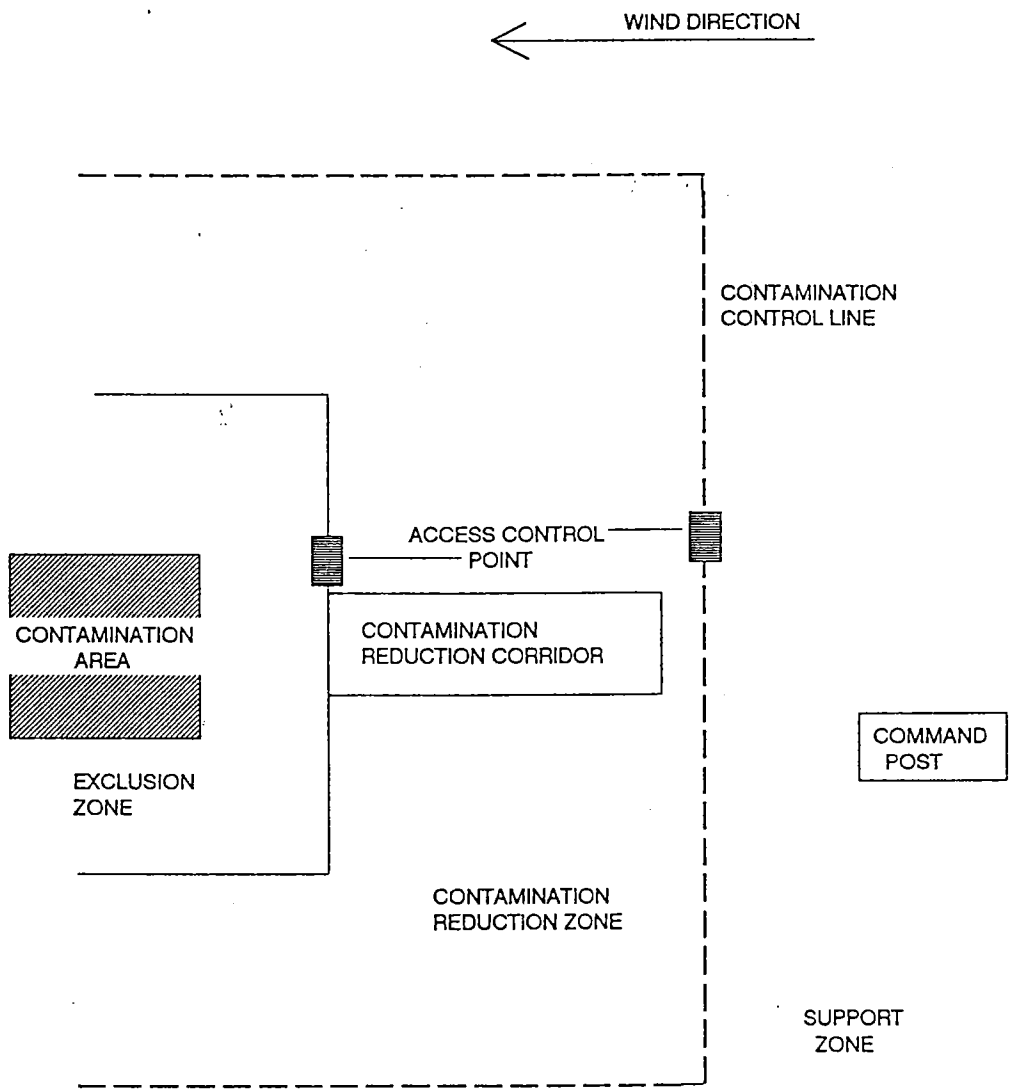


FIGURE 3-1
DIAGRAM OF SITE WORK ZONES

HEALTH AND SAFETY PLAN

OLF BARIN
FOLEY, ALABAMA

3.1.3 Support Zone

The Support Zone is the outermost zone of the site, separated from the CRZ by the Contamination Control Line and is considered a clean area. Movement of personnel and materials from this zone into the CRZ is generally unrestricted except as required through access points controlled for administrative purposes. However, only uncontaminated/decontaminated personnel or materials may enter this zone from the CRZ.

The Support Zone will contain the necessary support facilities (including personal hygiene facilities) for site operations and will serve as the communications center and source of emergency assistance to operations occurring in the Exclusion Zone and CRZ. A log of all persons entering the site will be maintained by the HSO, the field operations leader or site designee.

3.2 MEDICAL ASSISTANCE

The primary source of medical assistance for the OLF Barin project is:

South Baldwin Hospital
1613 North McKenzie Street
Foley, Alabama 36536
(205) 943-5051

The alternate source of medical assistance is:

Thomas Hospital
U.S. Highway 98 an Morphy Avenue
Fairhope, Alabama 36532
(205) 928-2375

4.0 ENGINEERING CONTROLS, WORK PRACTICES AND PERSONAL PROTECTIVE EQUIPMENT

4.1 ENGINEERING CONTROLS

Whenever needed, engineering controls (i.e., fans to blow volatilized chemicals away from the work area) will be used. Where possible, all site activities will be conducted upwind of areas which may be sources of contaminants that may volatilize into the breathing zone.

4.2 WORK PRACTICES

Workers will be expected to adhere to the established safe work practices for their respective specialties (e.g., drilling, laboratory analysis, construction). The need to exercise caution in the performance of specific work tasks is made more acute due to (1) weather conditions; (2) restricted mobility and reduced peripheral vision caused by the protective gear itself; (3) the need to maintain the integrity of the protective gear; and (4) the increased difficulty in communicating caused by respirators. Work at the site will be conducted according to established protocol and guidelines for the safety and health of all involved. Among the most important of these principles for working at a hazardous waste site are the following:

- In any unknown situation, always assume the worst conditions and plan responses accordingly.

- Employ the buddy system. Under no conditions will any person be permitted to enter into the exclusion zone of a site alone. Establish and maintain communication. In addition to radio communications, it is advisable to develop a set of hand signals as conditions may greatly impair verbal communications.

- Because no personal protective equipment is 100 percent effective, all personnel must minimize contact with excavated or contaminated materials. Plan work areas, decontamination areas and procedures accordingly. Do not place equipment on drums or on the ground. Do not sit on drums or other materials. Do not sit or kneel on the ground in the Exclusion Zone or CRZ. Avoid standing in or walking through puddles or stained soil.

- Smoking, eating, or drinking in the work area and before decontamination will not be allowed. Oral ingestion of contaminants is the second most likely means of introducing toxic substances into the body (inhalation is the first).

- Avoid heat and other work stresses related to wearing the protective gear. Work breaks should be planned to prevent stress-related accidents or fatigue.

- To the extent feasible, handling of contaminated materials should be done remotely, particularly when drummed or other containerized hazardous waste materials are found on-site. Every effort is to be made to identify the contents of any containers found on-site before they are subject to material-handling applications.

- Personnel must be observant of not only one's own immediate surroundings but also that of others. Everyone will be working under constraints; therefore, a team effort is needed to notice and warn of impending dangerous situations. Extra precautions are necessary when working near heavy equipment and while utilizing personnel protective gear as vision, hearing and communication can be restricted.

- Contact lenses are not allowed to be worn on-site; if corrosive or lachrymous substances enter the eyes, proper flushing is impeded.

- All facial hair that interferes with the face piece fit, must be removed prior to donning a respirator at all sites requiring Level C or B protection.

- Rigorous contingency planning and dissemination of plans to all personnel minimizes the impact of rapidly changing safety protocols in response to changing site conditions.

- Personnel must be aware that chemical contaminants may mimic or enhance symptoms of other illnesses or intoxication. Avoid excess use of alcohol or working with an illness during field investigation assignments.

- The site leader, HSO and sampling personnel shall maintain project records in a bound notebook (e.g., daily activities, meetings, incidents, and data). Notebooks will remain on-site for the duration of the project so that replacement personnel may add information in the same record book, maintaining continuity. These notebooks and daily records will become part of the permanent project file.

4.3 PERSONAL PROTECTIVE EQUIPMENT

4.3.1 Levels of Protection

The following descriptions provide the basic composition of the generally recognized protective ensembles that are to be used for site operations. Specific components for any level of protection will be selected based upon hazard assessment; additional elements will be added as necessary. Disposable protective clothing, gloves and other equipment, exclusive of respirators, should be used when feasible to minimize exposure risks during decontamination and possible cross-contamination during sample handling.

Level "A"

- Pressure demand full-facepiece Atmosphere Suppling Respirator (ASR)(if ASR is an airline respirator, it must have an escape self-contained breathing apparatus [SCBA]).
- Fully-encapsulating, chemical-resistant suit.
- Inner chemical-resistant gloves.
- Chemical-resistant safety boot/shoes.
- Two-way radio communications.
- Cooling unit*.
- Coveralls*.
- Hard Hat*.
- Disposable gloves and boot covers*.

Level "B"

- Pressure demand full-facepiece Atmosphere Suppling Respirator (if ASR is an airline respirator, it must have escape SCBA).
- Chemical-resistant clothing (coveralls and long-sleeved jacket; hooded, one- or two-piece chemical splash suit; disposable chemical-resistant one-piece suit).
- Inner and outer chemical-resistant gloves.
- Chemical-resistant safety boot/shoes.
- Hard hat.
- Two-way radio communications.
- Coveralls*.
- Disposable boot covers*.
- Face shield*.
- Long cotton underwear*.

Level "C"

- full-facepiece, air-purifying respirator with appropriate sorbents.
- Chemical-resistant clothing (coveralls and long-sleeved jacket; hooded, one-or two-piece chemical splash suit; disposable chemical-resistant one-piece suit).
- Inner and outer chemical-resistant gloves.
- Chemical-resistant safety boot/shoes.
- Hard hat.
- Two-way radio communications.
- Coveralls*.
- Disposable boot covers*.
- Face shield*.
- Escape mask*.
- Long cotton underwear*.

Level "D"

- Coveralls.
- Safety boot/shoes.
- Safety glasses or chemical splash goggles.
- Hard hat.
- Gloves*.
- Escape mask*.
- Face shield*.

* optional

4.3.2 Other Protective Equipment

Work boots should be constructed with steel toe-steel shank construction for added safety. In addition, protective ear equipment will be available on-site for personnel who should desire such because of excess noise during drilling or other activities.

4.3.3 Operational Levels of Protection

The proposed level of protection to be worn by field personnel for all site activities is Level D. However, should it become apparent during any phase of the field activities that conditions are different from those anticipated, the HSO will immediately withdraw all personnel from the site until health and safety conditions at the site are reevaluated.

5.0 MONITORING

The work environment will be monitored to ensure that Immediately Dangerous to Life or Health (IDLH) or other dangerous conditions are identified. At a minimum, this monitoring will include evaluations for combustible atmospheres, oxygen deficient environments, hazardous concentrations of airborne contaminants and radioactivity.

5.1 AIR SAMPLING

To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being employed at the site, and may be used as the basis for upgrading or downgrading the levels of protection, at the discretion of the site HSO.

The Photovac TIP Photoionization Detector (PID) will be used during on-site activities to monitor the ambient air quality in the breathing zone. The PID will be used primarily during drilling and sampling operations. During drilling the PID will be used continuously while auger advancement is taking place and intermittently during well placement and well development. During both soil and groundwater sampling activities the PID will be used intermittently to monitor the breathing zone. Examples of the PID and other types of air monitoring equipment are presented below.

- HNU IS101 and Photovac Tip photoionization detectors (PID). Like the OVA, the PID operates on the basis of ionization of the contaminant which results in a meter deflection proportional to the concentration of the contaminant. In thePID, the ionization is also caused by an ultraviolet (UV) light source. The strength of the UV (measured in electron volts or eV) determines what contaminants can be ionized. The Hnu can use three different strength UV sources including 9.6eV, 10.2eV and 11.7eV. Only the 10.2 and 11.7eV probes are currently available for field use. The TIP operates using a UV light source of 10.6eV. Calibration and maintenance will be performed in accordance with the manufacturers instructions.

- ISD Dual Detector. This meter monitors for combustible gases and oxygen. It would be used to determine (1) if an area contains concentrations of combustible gases in percentage of the lower explosive limit and (2) the percentage of oxygen. The equipment will be done in accordance with the manufacturer's instructions.

- NMS MX-241 (Explosimeter). This instrument is calibrated to methane and monitors combustible gases in the percentage of the lower explosive limit. The instrument will be calibrated in accordance with manufacturer's instructions.

- ISD HS267. This instrument is capable of monitoring for the presence of hydrogen sulfide in parts per million. The calibration of this instrument will be done in accordance with the manufacturer's instructions.

- Photovac Organic Vapor Analyzer (OVA) 10S50. The OVA is a total organic vapor analyzer that is capable of detecting volatile organics that can be ionized by ultraviolet light. The model 10S50 is commonly used on site to estimate the presence of volatile organics for purposes of crew protection, well screen placement and selection of samples for further analysis. The principle of operation is twofold: (1) the ambient temperature gas chromatograph (GC) which resolves mixtures of VOCs into individual components identified by retention time; and (2) detection accomplished by ionization in ultraviolet light. The charged component then moves to an electrode which in turn results in a meter deflection proportional to the concentration of the contaminant. Care must be exercised with interpreting the results of this instrument as it does not read out directly in parts per million (ppm) unless it is calibrated against the material being measured; therefore, results must be interpreted with care and conservatively. Calibration and maintenance will be performed in accordance with the manufacturers instructions.

- Detector tubes (MSA and Draeger). A colorimetric detector tube is a direct-reading instrument that consists of a glass tube impregnated with an indicating chemical, which is connected to a piston cylinder or bellows-type pump. A known volume of air is drawn through the glass tube. The contaminant in the air reacts with the indicator chemical, producing a stain the length of which is proportional to the contaminant's concentration. Care must be taken when using the detector tubes as the reliability of the results depends on proper calibration, the degree of stability of the reacting chemical, and the ambient temperature. Interfering gases or vapors can also positively or negatively affect the measured results. Calibration and maintenance will be performed in accordance with the manufacturer's instructions.

5.2 PERSONAL MONITORING: EQUIPMENT, MAINTENANCE, AND CALIBRATION

Personal monitoring will be undertaken to characterize the personal exposure of high risk employees to the hazardous substances encountered on-site. The types of personal monitoring equipment that will be used at the OLF Barin site will be dependent on conditions encountered during the field investigation. Examples of personal monitoring equipment that are available are presented below.

- Personal Sampling Pumps. These devices are capable of being worn by an employee and drawing an air sample through appropriate collection media. The units can be used to draw volumes from 0.2 to 3.0 liters per minute. Calibration is to be conducted using standard industrial hygiene protocols before and after each sampling session (i.e. each day's use).

- Passive Dosimeters or Gas Badges. These devices are nonmechanical collection devices for monitoring for organic vapor and various gases. They are worn by an employee and sent to an industrial hygiene laboratory for analysis.

- Thermoluminescent Dosimetry (TLD) Body Badges. These devices are nonmechanical collection devices used to monitor for x-ray, beta, and gamma radiation exposure. They are worn by an employee and sent to Tech/Ops Landauer, Inc., for analysis on a quarterly basis.

At this time, Jordan's on-site personnel will be required to wear their personal thermoluminenscent dosimetry (TLD) body badges. Other personal monitoring equipment is not scheduled for use at this time based on current anticipated site conditions.

5.3 OTHER

As stated above, no other personal monitoring equipment is foreseen for use at OLF Barin. In the event that additional equipment is found necessary a determination will be made as required.

6.0 DECONTAMINATION/DISPOSAL

All personnel and/or equipment leaving contaminated areas are subject to decontamination, which occurs in the CRZ (see Section 3.1). However, since all activities at OLF Barin are expected to take place in Level D protection, extensive personal decontamination procedures are not anticipated for this site. Procedures that will be used are as follows: Every attempt will be made to minimize physical contact with site soils and groundwater. Disposable gloves will be used and discarded as necessary. All work boots will be cleaned of excess dirt between sites and coveralls will be cleaned as deemed appropriate by field personnel.

6.1 PERSONNEL DECONTAMINATION

Decontamination procedures are carried out by all personnel leaving hazardous waste sites. Under no circumstances (except emergency evacuation) will personnel be allowed to leave the site prior to decontamination. Generalized procedures for removal of protective clothing are as follows:

1. Drop tools, monitors, samples and trash at designated drop stations. (i.e., plastic containers or drop sheets).

2. Step into designated shuffle pit area and scuff feet to remove gross amounts of dirt from outer boots.

3. Scrub outer boots and outer gloves with decontamination solution or detergent and water. Rinse with water.

4. Remove tape from outer boots and remove boots; discard in disposal container.

5. Remove tape from outer gloves and remove gloves; discard in disposal container.

6. If the worker has left the Exclusion Zone to change the air tank on his/her SCBA, or the canister on his/her air purifying respirator, this is the last step in the decontamination procedure. The tank or cartridge should be exchanged, new outer gloves and boot covers donned, the joints taped, and the worker returns to duty.

7. Remove outer garments and discard in disposal container.

8. Remove respirator and place or hang in the designated area.

9. Remove inner gloves and discard in disposal container.

10. If the site requires use of a decontamination trailer, all personnel must shower before leaving the site at the end of the work day.

Note: Disposable items (i.e., Tyvek coveralls, inner gloves, and latex overboots) will be changed on a daily basis unless there is reason for changing sooner. Dual respirator canisters will be changed

daily unless more frequent changes are deemed appropriate by site surveillance data or personnel assessment.

Pressurized sprayers or other designated equipment will be available in the decontamination area for wash down and cleaning of personnel, samples and equipment.

Respirators will be decontaminated daily and taken from the drop area. The masks will be disassembled, the cartridges set aside, and all other parts placed in a cleansing solution. Parts will be precoded (e.g., #1 on all parts of Mask #1). After an appropriate time within the solution, the parts will be removed and rinsed off with tap water. Old cartridges will be marked to indicate length of usage (i.e., if means to evaluate the cartridges' remaining utility are available) or will be discarded into the contaminated trash container for disposal. In the morning, the masks will be reassembled and new cartridges installed, if appropriate. Personnel will inspect their own masks and readjust the straps for proper fit.

Should site conditions warrant a change in level of personal protection, changes in personnel decontamination procedures will also be incorporated into the field investigation program.

6.2 SMALL EQUIPMENT DECONTAMINATION

Small equipment will be protected from contamination as much as possible by draping, masking, or otherwise covering the instruments with plastic (to the extent feasible) without hindering the operation of the unit. For example, the HNU meter can be placed in a clear plastic bag which allows reading of the scale and operating the knobs. The HNU sensor can be partially wrapped, keeping the sensor tip and discharge port clear.

The contaminated equipment will be taken from the drop area and the protective coverings removed and disposed of in the appropriate containers. Any dirt or obvious contamination will be brushed or wiped with a disposable paper wipe. The units can then be taken inside in a clean plastic tub, wiped off with damp disposable wipes and dried. The units will be checked, standardized and recharged as necessary for the next day's operation. They will then be prepared with new protective coverings.

6.3 HEAVY EQUIPMENT DECONTAMINATION

It is anticipated that the drilling rigs/backhoes will be contaminated during the borehole/test pitting activities. They will be cleaned with high pressure water or portable high pressure steam, followed by soap and water wash and rinse. Loose material will be removed by brush. The person performing this activity will usually be at least at the level of protection utilized during the personnel and monitoring equipment decontamination.

A decontamination pad will be constructed to allow the collection and storage of contaminated decontamination fluids in Department of Transportation (DOT)-approved 55 gallon drums. As with borehole cuttings and development water, this requirement of containerizing decontamination fluids may be waived if approval is given, in writing, by Southern Division's Engineer in Charge.

6.4 DISPOSAL OF DECONTAMINATED MATERIALS

All protective gear, decontamination fluids (both personal and equipment), and other disposable materials will be properly disposed (i.e., containerized) of at each site for later disposal. Disposable materials (e.g., gloves and Tyveks) will be double bagged and stored as is, or placed in DOT-approved 55 gallon drums.

7.0 EMERGENCY/CONTINGENCY PLAN

This section of the HASP identifies the emergency contingency planning that has been undertaken for operations at this site. Other sections of the HASP also provide information that would be used under emergency conditions. Refer to Appendix I for emergency telephone numbers, routes to emergency medical facilities and emergency signals.

7.1 PERSONNEL ROLES, LINES OF AUTHORITY AND COMMUNICATION

The site HSO is the primary authority for directing operations under emergency conditions. All communications both on- and off-site will be directed through the HSO.

7.2 EVACUATION

In the event that site evacuation is necessary, on-site personnel will move upwind of the site and determine further course of action. In the extremely unlikely event that the situation warrants the evacuation of OLF Barin and/or the surrounding area, base officials along with city and county emergency response personnel will be notified and the appropriate course of action taken.

7.2.1 Withdrawal Upwind

The work party will continually note general wind directions while on-site. (A simple wind sock may be set up near the work site for visual determinations). Upon noting the conditions warranting movement away from the work site, the crew will move upwind a distance of approximately 100 feet feet or further as indicated by the site monitoring instruments. Donning SCBA and a safety harness and line, the HSO or a member of the crew may return to the work site to determine if the condition noted was transient or persistent. If persistent, then an alarm should be raised to notify on-site personnel of the situation and the need to leave the site or don an SCBA. An attempt should be made to decrease emissions only if greater respiratory protection is donned. The HSO and client will be notified of conditions. When access to the site is restricted and escape may thus be hindered, the crew may be instructed to evacuate the site rather than move upwind, especially if withdrawal upwind moves the crew away from escape routes.

7.2.2 Site Evacuation

When conditions warrant site evacuation, the work party will proceed upwind of the work site and notify the security force, HSO and the field office of site conditions. If the decontamination area is upwind and greater than 500 feet from the work site, the crew will pass quickly through decontamination to remove contaminated outer suits. If the hazard is toxic gas, respirators will be retained. The crew will proceed to the field office to assess the situation. If instrumentation indicates an acceptable condition, respirators may be removed. As more information is received from the field crew, it will be relayed to the appropriate agencies. The advisability and type of further response action will be coordinated and carried out by the HSO.

7.2.3 Evacuation of Surrounding Area

When the HSO determines that conditions warrant evacuation of downwind residences and commercial operations, local agencies will be notified and assistance requested. Designated on-site personnel will initiate evacuation of the immediate off-site area without delay.

7.3 EMERGENCY MEDICAL TREATMENT/FIRST AID

First aid will be rendered to any person injured on-site, as appropriate. The injured person will then be transported to medical personnel for further examination and/or treatment. The preferred transport method is a professional emergency transportation service; however, when this is not readily available or would result in excessive delay, other transport is authorized. Under no circumstances will the injured person transport themselves to a medical facility for emergency treatment.

When an injury occurs in a downrange position, provisions for decontamination of the victim will be made. However, life-threatening conditions may preclude normal decontamination procedures. In such cases, arrangements will be made with the medical facility and transporter to provide for the situation.

Figure 7-1 presents the appropriate training which each of the potential Jordan field personnel has received up to the date of this HASP.

ON-SITE PERSONNEL TRAINING

TOPIC	HRS	T. VAUGHT	M. NUGENT	K. BUSEN	D. CRANE	K. PETERSON	M. DIBLIN	E. BLOMBERG	K. WARNER	R. GONZALEZ	H. HOOPER	M. CLARK	C. DOUSE	J. BURRIS
INTRODUCTION/REFRESHER	4	●	●	●	●	●	●	●	●	●	●	●	●	●
FIRST AID	8	●	●	●	●	●	●	●	●	●	●	●	●	●
CPR	8	●	●	●	●	●	●	●	●	●	●	●	●	●
NUS COURSE OR EQUIVALENT	30	●	●	●	●	●	●	●	●	●	●	●	●	●
OVA	16				●		●							●
PI METER	2				●	●	●							●
SCBA REVIEW	4			●	●									●
SAMPLING	–	●	●	●	●	●	●	●	●	●	●	●	●	●
HEALTH MONITORING	–	●	●	●	●	●	●	●	●	●	●	●	●	●

● INDICATES REQUIRED TRAINING COMPLETED

CERTIFIED BY _____

FIGURE 7-1

NAS WHITING FIELD
MILTON, FLORIDA

8.0 OTHER

8.1 ILLUMINATION

Site operations will not be permitted without adequate lighting. Therefore, unless provisions are made for artificial light, downrange operations must halt in time to permit personnel and equipment to exit the exclusion zone and proceed through decontamination before dusk. Conversely, operations would not be permitted to begin until adequate lighting is adequate.

8.2 SANITATION

Sanitation is not anticipated to be a concern. Facilities are available at OLF Barin and the field will have transportation readily available.

8.3 EXCAVATION

Site excavations created during site operations shall be shored or sloped to prevent accidental collapse and otherwise conducted in accordance with 29 CFR 1926 (Subpart P). Under no circumstances will site personnel enter into excavations that are not adequately shored or sloped. Where entry into an excavation does occur, and the excavation is considered a confined space, such an entry will be done in accordance with the confined space entry program (see Section 8.4). Site excavation are not planned for OLF Barin at this time.

8.4 CONFINED SPACE ENTRY

Confined space entry presents special problems and substantial risks to involved personnel (including those who might be called upon to attempt a rescue of initial entrants). Therefore, entry into a confined space is a MEANS OF LAST RESORT, and will only be permitted where no other mechanism is feasible to achieve the desired goal. Confined space entry will not be necessary to conduct field work at OLF Barin.

9.0 ADMINISTRATIVE

9.1 PERSONNEL AUTHORIZED DOWN RANGE

Personnel authorized to participate in downrange activities at this site have been reviewed and certified for site operations by the Site Manager and the HSS. Certification involves the completion of appropriate training, medical examination and a review of this site-specific HASP. All persons entering the site must utilize the buddy system, and check-in with the Site Manager and/or HSO before going downrange.

Certified E.C. Jordan Team Personnel:

*+R. Gonzalez	*+J. Davis
*+M. Diblin	*+K. Busen
*+E. Blomberg	*+T. Vaught
*+H. Hooper	
*+C. Douse	
*+K. Warner	
*+M. Clark	
*+R.M. Nugent	
*+D.P. Crane	
*+J. Burris	

Other Certified Personnel:

T. Allen	

* Current First Aid Training
\+ Current CPR Training

9.2 HASP APPROVALS

By their signature, the undersigned approved this HASP for applicability in the protection of the health and safety of all persons entering the OLF Barin site.

Health and Safety Officer	Date
Project Manager	Date
E.C. Jordan Health and Safety Supervisor	Date

9.3 FIELD TEAM REVIEW

I have read and reviewed the HASP for OLF Barin, understand the information contained, and agree to comply.

NAME: _____ DATE: _____

NAME: _____ DATE: _____

NAME: _____ DATE: _____

NAME: _____ DATE: _____

NAME: _____ DATE: _____

NAME: _____ DATE: _____

NAME: _____ DATE: _____

NAME: _____ DATE: _____

NAME: _____ DATE: _____

NAME: _____ DATE: _____

SITE/PROJECT: OLF Barin, Foley, Alabama

9.4 MEDICAL DATA SHEET

This Medical Data Sheet will be completed by all on-site personnel and will be kept in the Support Zone during site operations. It is in no way a substitute for the Medical Surveillance Program requirements consistent with the C-E Environmental Corporate Health and Safety Program for Hazardous Waste Sites. This data sheet will accompany any personnel when medical assistance or transport to hospital facilities is required. If more information is required, use the back of this sheet.

Project: _____

Name: _____

Home Address: _____

Home Phone: Area Code ( ) _____

DOB: _____ Height: _____ Weight: _____

In case of emergency, contact: _____ (wife) _____

Address: _____

Telephone (home): _____

Do you wear contacts? ( ) Yes (X) No

Allergies: _____

List medication taken regularly: _____

Particular sensitivities: _____

Previous/recent illnesses or exposures to hazardous chemicals: _____

_____

Name of Personal Physician: _____

Telephone: Area Code ( ) _____

Project: OLF Barin (NAS Whiting), Foley, Alabama

Name: Mark Diblin

Home Address: 2001 Old St. Augustine Road Apt. H-110

Tallahassee, Florida 32301

Home Phone: Area Code (904) 656-3162

DOB: 06-27-61 Height: 5'8" Weight: 150 lb

In case of emergency, contact: Melissa Diblin (wife)

Address: Same

Telephone (home): Area Code (904) 656-3162 (work): (904) 877-1978

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: None

Telephone: Area Code ( )

Project: OLF Barin (NAS Whiting), Foley, Alabama

Name: Kevin Warner

Home Address: 285 Whetherbine Way Tallahassee, Florida 32301

Home Phone: Area Code (904) 878-5651

DOB: 11-05-62 Height: 6'0" Weight: 200 lb

In case of emergency, contact: Mary Warner (wife)

Address: Same

Telephone: Same

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: None

Telephone: Area Code ( )

Project: OLF Barin (NAS Whiting), Foley, Alabama

Name: Jack Davis

Home Address: 513 Martin Street Tallahassee, Florida 32308

Home Phone: Area Code (904) 222-7073

DOB: 03-28-52 Height: 5'10" Weight: 165 lb

In case of emergency, contact: Cheryl S. Davis (wife)

Address: Same

Telephone: Same

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: Capital Health Plan

Telephone: Area Code (904) 386-3121

Project: OLF Barin (NAS Whiting), Foley, Alabama

Name: Eric A. Blomberg

Home Address: 1414-C Shallow Brook Tallahassee, Florida 32301

Home Phone: Area Code (904) 656-7915

DOB: 05-22-63 Height: 6'02" Weight: 180 lb

In case of emergency, contact: John Blomberg (father)

Address: 2900 Brookside Cr., Parkersburg, West Virginia 26104

Telephone: Area Code (304) 428-2074

Do you wear contacts? (X) Yes ( ) No

Allergies: Bee stings

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: None

Telephone: Area Code (904) 386-3121

Project: OLF Barin (NAS Whiting), Foley, Alabama

Name: Richard Xavier Gonzalez

Home Address: 1702 Ferndale Place Tallahassee, Florida 32301

Home Phone: Area Code (904) 942-0744

DOB: 09-02-55 Height: 5'10" Weight: 150 lb

In case of emergency, contact: Clara Gonzalez

Address: 1905 North Spring, Pensacola, Florida 32501

Telephone: Area Code (904) 438-4530

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: None

Telephone: Area Code ( )

Project: OLF Barin (NAS Whiting), Foley, Alabama

Name: Michael R. Clark

Home Address: 418 Grail Drive, Tallahassee, Florida 32301

Home Phone: Area Code (904) 878-3278

DOB: 10-10-52 Height: 6'0" Weight: 190 lb

In case of emergency, contact: Lorraine G. Clark (wife)

Address: Same

Telephone: (home) Area Code (904) 878-3278 (work) (904) 488-0300

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: None

Telephone: Area Code ( )

Project: OLF Barin (NAS Whiting), Foley, Alabama

Name: R. Michael Nugent

Home Address: 5375 Water Valley Drive, Tallahassee, Florida 32303

Home Phone: Area Code (904) 562-6454

DOB: 09-12-48 Height: 6'2" Weight: 175 lb

In case of emergency, contact: Julia Nugent (wife)

Address: Same

Telephone: (home) Area Code (904) 562-6454 (work) (904) 893-3181

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: None

Telephone: Area Code ( )

Project: OLF Barin (NAS Whiting), Foley, Alabama

Name: Raymond A. Allen, III

Home Address: 1998-C Larette Drive, Tallahassee, Florida 32301

Home Phone: Area Code (904) 878-2438

DOB: 3-26-59 Height: 5'9" Weight: 180 lb

In case of emergency, contact: Julie Allen (wife)

Address: Same

Telephone: Same

Do you wear contacts? ( ) Yes (X) No

Allergies: Erythromycin

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: Dr. Armour

Telephone: Area Code (904) 681-5435

Project: OLF Barin (NAS Whiting), Foley, Alabama

Name: Kenneth L. Busen

Home Address: Route 35, Box 2920, Tallahassee, Florida 32310

Home Phone: Area Code (904) 926-6037

DOB: 01-26-50 Height: 6'0" Weight: 172 lb

In case of emergency, contact: Karen Busen (wife)

Address: Same

Telephone: Same

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: Dr. Len Goff

Telephone: Area Code (904) 893-6706

Project: OLF Barin (NAS Whiting), Foley, Alabama

Name: Harry B. Hooper II

Home Address: 4425 Widgeon Way, Tallahassee, Florida 32303

Home Phone: Area Code (904) 562-5261

DOB: 04-25-48 Height: 5'11" Weight: 225 lb

In case of emergency, contact: Elena M. Hooper (wife)

Address: Same

Telephone: Same

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: lime eg. wet concrete

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: William T. Kepper, M.D.

Telephone: Area Code (904) 877-5143

Project: OLF Barin (NAS Whiting), Foley, Alabama

Name: Celora Y. Douse

Home Address: 2959 Appalachee parkway, Apt. E-3

Home Phone: Area Code (904) 942-4349

DOB: 07-30-63 Height: 5'03" Weight: 130 lb

In case of emergency, contact: Carolyn E. Douse (mother)

Address: 426 Kingston Street South, St. Petersburg, Florida 33711

Telephone: (813) 323-7004

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: Dr. Robert Steele

Telephone: Area Code (904) 878-5151

Project: OLF Barin (NAS Whiting), Foley, Alabama

Name: Tracie Lynn Vaught

Home Address: 2001 Old St. Augustine Road Apt M-108

Home Phone: Area Code (904) 942-1949

DOB: 10-07-59 Height: 5'10" Weight: 138 lb

In case of emergency, contact: Kile Fortune (sister)

Address: 5236 Row Trail Pace, Florida 33571

Telephone: (904) 994-6212

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: bee stings and ant bites

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: Dr. Byrd

Telephone: Area Code (904) 681-5430

APPENDIX B

CHRIS DATA SHEETS/MATERIAL SAFETY DATA SHEETS FOR CONTAMINANTS OF CONCERN

ANTHRACENE

ATH

Common Synonyms	Solid	White to yellow	Weak aromatic odor
Anthracin Paranaphthalene Green oil	Sinks in water.		

Stop discharge if possible. Keep people away.
Avoid contact with solid and dust.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Dust cloud may explode if ignited in an enclosed area.
Extinguish with water, dry chemicals, foam, or carbon dioxide.

Exposure

CALL FOR MEDICAL AID.

DUST
Irritating to eyes, nose and throat.
If inhaled will cause coughing or difficult breathing.
If in eyes, hold eyelids open and flush with plenty of water.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

SOLID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Should be removed

Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $C_{14}H_{10}$
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: Data not available
3.5 CAS Registry No.: 120-12-7

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: White to yellow
4.3 Odor: Weak aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Dust mask; goggles or face shield; rubber gloves
5.2 Symptoms Following Exposure: Inhalation of dust irritates nose and throat. Contact with eyes causes irritation.
5.3 Treatment of Exposure: INHALATION: move to fresh air. EYES: flush with water for 15 min.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Data not available
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Data not available
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 250°F
6.2 Flammable Limits in Air: 0.6% LEL
6.3 Fire Extinguishing Agents: Water, foam, dry chemical, carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Data not available
6.5 Special Hazards of Combustion Products: Data not available
6.6 Behavior in Fire: Data not available
6.7 Ignition Temperature: 1004°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: Data not available
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: 5 ppm/24 hr/trout & bluegill/no effect
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Various fluorescence grades; Scintillation grade; Technical grade, 90-98%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

II

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Not listed
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	1
Reactivity (Yellow)	-

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 178.23
12.3 Boiling Point at 1 atm: 646.2°F = 341.2°C = 614.4°K
12.4 Freezing Point: 421.7°F = 216.5°C = 489.7°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.24 at 20°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: -17,100 Btu/lb = -9,510 cal/g = -398 X 10^3 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 38.70 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

BENZENE

BNZ

Common Synonyms	Watery liquid	Colorless	Gasoline-like odor
Benzol Benzole	Floats on water. Flammable, irritating vapor is produced. Freezing point is 42°F.		

Avoid contact with liquid and vapor. Keep people away.
Wear goggles and self-contained breathing apparatus.
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

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

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold lids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-high flammability
Restrict access

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: C_6H_6
3.3 IMO/UN Designation: 3.2/1114
3.4 DOT ID No.: 1114
3.5 CAS Registry No.: 71-43-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Aromatic; rather pleasant aromatic odor; characteristic odor

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Hydrocarbon vapor canister, supplied air or a hose mask; hydrocarbon-insoluble rubber or plastic gloves; chemical goggles or face splash shield; hydrocarbon-insoluble apron such as neoprene.
5.2 Symptoms Following Exposure: Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possible death.
5.3 Treatment of Exposure: SKIN: flush with water followed by soap and water; remove contaminated clothing and wash skin. EYES: flush with plenty of water until irritation subsides. INHALATION: remove from exposure immediately. Call a physician. IF breathing is irregular or stopped, start resuscitation, administer oxygen.
5.4 Threshold Limit Value: 10 ppm
5.5 Short Term Inhalation Limits: 75 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Leukemia
5.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors may cause irritation of eyes or respiratory system. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 4.68 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 12°F C.C.
6.2 Flammable Limits in Air: 1.3%-7.9%
6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back
6.7 Ignition Temperature: 1097°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 6.0 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity:
5 ppm/6 hr/minnow/lethal/distilled water
20 ppm/24 hr/sunfish/TL_m/tap water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 1.2 lb/lb, 10 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity:
Industrial pure ____99+%
Thiophene-free ____99+%
Nitration ____99+%
Industrial 90% ____85+%
Reagent ____99+%
9.2 Storage Temperature: Open
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	3
Water Pollution	
Human Toxicity	3
Aquatic Toxicity	1
Aesthetic Effect	3
Reactivity	
Other Chemicals	2
Water	1
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 78.11
12.3 Boiling Point at 1 atm: 176°F = 80.1°C = 353.3°K
12.4 Freezing Point: 42.0°F = 5.5°C = 278.7°K
12.5 Critical Temperature: 552.0°F = 288.9°C = 562.1°K
12.6 Critical Pressure: 710 psia = 48.3 atm = 4.89 MN/m²
12.7 Specific Gravity: 0.879 at 20°C (liquid)
12.8 Liquid Surface Tension: 28.9 dynes/cm = 0.0289 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 35.0 dynes/cm = 0.035 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 2.7
12.11 Ratio of Specific Heats of Vapor (Gas): 1.061
12.12 Latent Heat of Vaporization: 169 Btu/lb = 94.1 cal/g = 3.94 X 10⁵ J/kg
12.13 Heat of Combustion: −17,460 Btu/lb = −9698 cal/g = −406.0 X 10⁵ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 30.45 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 3.22 psia

NOTES

CARBON TETRACHLORIDE

CBT

Common Synonyms

Carbon Tet
Tetrachloromethane
Benzinoform
Necatorina
Perchloromethane

Watery liquid · Colorless · Sweet odor

Sinks in water. Poisonous vapor is produced.

Avoid contact with liquid and vapor. Keep people away.
Wear goggles and self-contained breathing apparatus.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Notify local health and pollution control agencies.

Fire

Not flammable.
POISONOUS AND IRRITATING GASES ARE PRODUCED WHEN HEATED.
Wear goggles and self-contained breathing apparatus.

Exposure

CALL FOR MEDICAL AID.

VAPOR
POISONOUS IF INHALED.
Irritating to eyes
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen

LIQUID
POISONOUS IF SWALLOWED.
Irritating to skin and eyes.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.

Notify local health and pollution control officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-poison
Restrict access
Should be removed

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated hydrocarbon
3.2 Formula: CCl_4
3.3 IMO/UN Designation: 6.1/1846
3.4 DOT ID No.: 1846
3.5 CAS Registry No.: 56-23-5

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Sweetish, aromatic; moderately strong ethereal; somewhat resembling that of chloroform.

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Organic vapor canister with full face mask; protective clothing; rubber gloves.
5.2 Symptoms Following Exposure: Dizziness, incoordination, anesthesia; may be accompanied by nausea and liver damage. Kidney damage also occurs, often producing decrease or stopping of urinary output.
5.3 Treatment of Exposure: EYES AND SKIN: flush with plenty of water; for eyes, get medical attention. Remove contaminated clothing and wash before reuse. INHALATION: immediately remove to fresh air, keep patient warm and quiet and get medical attention promptly. Start artificial respiration if breathing stops. INGESTION: induce vomiting and get medical attention promptly. No specific antidote known.
5.4 Threshold Limit Value: 5 ppm
5.5 Short Term Inhalation Limits: 25 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg (rat)
5.7 Late Toxicity: Causes severe liver damage and death if ingested.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: Greater than 10 ppm
5.11 IDLH Value: 300 ppm

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Forms poisonous phosgene gas when exposed to open flames.
6.6 Behavior in Fire: Decomposes to form chlorine and phosgene
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 36

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Commercial; technical; USP
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	0
Health	
Vapor Irritant	2
Liquid or Solid Irritant	1
Poisons	4
Water Pollution	
Human Toxicity	2
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 153.83
12.3 Boiling Point at 1 atm: 170°F = 76.5°C = 349.7°K
12.4 Freezing Point: −9.4°F = −23.0°C = 250.2°K
12.5 Critical Temperature: 541°F = 283°C = 556°K
12.6 Critical Pressure: 660 psia = 45 atm = 4.6 MN/m²
12.7 Specific Gravity: 1.59 at 20°C (liquid)
12.8 Liquid Surface Tension: 27.0 dynes/cm = 0.027 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 45.0 dynes/cm = 0.045 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 5.3
12.11 Ratio of Specific Heats of Vapor (Gas): 1.111
12.12 Latent Heat of Vaporization: 84.2 Btu/lb = 46.8 cal/g = 1.959 X 10^5 J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 5.09 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 3.8 psia

NOTES

1,2-DICHLOROETHYLENE

DEL

Common Synonyms	Liquid	Colorless	Sweet pleasant odor
Acetylene dichloride sym-dichloroethylene Dioform cis-1, 2-dichloroethylene trans-1, 2-dichloroethylene	Sinks in water. Flammable, irritating vapor is produced.		

Wear goggles and self-contained breathing apparatus.
Shut off ignition sources. Call fire department.
Stop discharge if possible. Keep people away.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
POISONOUS GASES MAY BE PRODUCED IN FIRE.
Containers may explode in fire.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemicals, foam or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
If inhaled will cause dizziness, nausea, vomiting, or difficult breathing.
Move victim to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Harmful if swallowed.
If SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Restrict access
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $CICH = CHCl$
3.3 IMO/UN Designation: 3.2/1150
3.4 DOT ID No.: 1150
3.5 CAS Registry No.: 540-59-0

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Ethereal, slightly acrid; pleasant, chloroform-like

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Rubber gloves; safety goggles; air supply mask or self-contained breathing apparatus.
5.2 Symptoms Following Exposure: Inhalation causes nausea, vomiting, weakness, tremor, epigastric cramps, central nervous depression. Contact with liquid causes irritation of eyes and (on prolonged contact) skin. Ingestion causes slight depression to deep narcosis.
5.3 Treatment of Exposure: INHALATION: remove from further exposure; if breathing is difficult, give oxygen; if victim is not breathing, give artificial respiration, preferably mouth-to-mouth; give oxygen when breathing is resumed; call a physician. EYES: flush with water for at least 15 min. SKIN: wash well with soap and water. INGESTION: give gastric lavage and cathartics.
5.4 Threshold Limit Value: 200 ppm
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 2; oral LD_{50} = 770 mg/kg (rat)
5.7 Late Toxicity: Produces liver and kidney injury in experimental animals
5.8 Vapor (Gas) Irritant Characteristics: Data not available
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Data not available
5.11 IDLH Value: 4,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 37°F C.C.
6.2 Flammable Limits in Air: 9.7%-12.8%
6.3 Fire Extinguishing Agents: Dry chemical, foam, carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Phosgene and hydrogen chloride fumes may form in fires.
6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 860°F
6.8 Electrical Hazard: Data not available
6.9 Burning Rate: 2.6 mm/min.
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Will not occur under ordinary conditions of shipment. The reaction is not vigorous.
7.6 Inhibitor of Polymerization: None used
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Commercial
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X-Y

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	2

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 97.0
12.3 Boiling Point at 1 atm:
cis: 140°F = 60°C = 333°K
trans: 118°F = 48°C = 321°K
12.4 Freezing Point:
cis: −114°F = −81°C = 192°K
trans: −58°F = −50°C = 223°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity:
1.27 at 25°C (liquid)
12.8 Liquid Surface Tension:
24 dynes/cm = 0.024 N/m at 20°C
12.9 Liquid Water Interfacial Tension: (est.)
30 dynes/cm = 0.030 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 3.34
12.11 Ratio of Specific Heats of Vapor (Gas): 1.1468
12.12 Latent Heat of Vaporization:
130 Btu/lb = 72 cal/g = 3.0×10^4 J/kg
12.13 Heat of Combustion: −4,647.2 Btu/lb = −2,692.9 cal/g = -112.67×10^4 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

ETHYLBENZENE

ETB

Common Synonyms	Liquid	Colorless	Sweet, gasoline-like odor
Phenylethane EB	Floats on water. Flammable, irritating vapor is produced.		

Avoid contact with liquid and vapor. Keep people away.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

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

Water Pollution

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

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic hydrocarbon
3.2 Formula: $C_6H_5CH_2CH_3$
3.3 IMO/UN Designation: 3.3/1175
3.4 DOT ID No.: 1175
3.5 CAS Registry No.: 100-41-4

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Self-contained breathing apparatus; safety goggles.
5.2 Symptoms Following Exposure: Inhalation may cause irritation of nose, dizziness, depression. Moderate irritation of eye with corneal injury possible. Irritates skin and may cause blisters.
5.3 Treatment of Exposure: INHALATION: if ill effects occur, remove victim to fresh air, keep him warm and quiet, and get medical help promptly; if breathing stops, give artificial respiration. INGESTION: induce vomiting only upon physician's approval; material in lung may cause chemical pneumonitis. SKIN AND EYES: promptly flush with plenty of water (15 min. for eyes) and get medical attention; remove and wash contaminated clothing before reuse.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 200 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg (rat)
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.
5.10 Odor Threshold: 140 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 80°F O.C.; 59°F C.C.
6.2 Flammable Limits in Air: 1.0%-6.7%
6.3 Fire Extinguishing Agents: Foam (most effective), water fog, carbon dioxide or dry chemical.
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Irritating vapors are generated when heated.
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to the source of ignition and flash back.
6.7 Ignition Temperature: 860°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 5.8 mm/min.
6.10 Adiabatic Flame Temperature: Data Not Available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data Not Available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 29 ppm/96 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 2.8% (theor.), 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research grade: 99.98%; pure grade: 99.5%; technical grade: 99.0%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	2
Liquid or Solid Irritant	2
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.17
12.3 Boiling Point at 1 atm: 277.2°F = 136.2°C = 409.4°K
12.4 Freezing Point: —139°F = —95°C = 178°K
12.5 Critical Temperature: 651.0°F = 343.9°C = 617.1°K
12.6 Critical Pressure: 523 psia = 35.6 atm = 3.61 MN/m²
12.7 Specific Gravity: 0.867 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.2 dynes/cm = 0.0292 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 35.48 dynes/cm = 0.03548 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.071
12.12 Latent Heat of Vaporization: 144 Btu/lb = 80.1 cal/g = 3.35×10^5 J/kg
12.13 Heat of Combustion: —17,780 Btu/lb = —9877 cal/g = -413.5×10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data Not Available
12.26 Limiting Value: Data Not Available
12.27 Reid Vapor Pressure: 0.4 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data Not Available
6.12 Flame Temperature: Data Not Available

ETHYLENE DIBROMIDE

EDB

Common Synonyms	Liquid	Colorless	Sweet odor
1, 2-Dibromoethane Ethylene bromide Bromofume sym-Dibromoethane Dow-fume 40, W-10, W-15, W-40 Glycol dibromide	Sinks in water. Poisonous vapor is produced. Freezing point is 50°F.		

Stop discharge if possible. Keep people away.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
POISONOUS GASES ARE PRODUCED WHEN HEATED.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
POISONOUS IF INHALED.
Irritating to eyes, nose and throat.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED.
Irritating to skin and eyes.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated hydrocarbon
3.2 Formula: $BrCH_2CH_2Br$
3.3 IMO/UN Designation: 6.1/1605
3.4 DOT ID No.: 1605
3.5 CAS Registry No.: 106-93-4

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Mildly sweet; like chloroform

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Canister type mask or self-contained air mask; neoprene gloves; chemical safety goggles.
5.2 Symptoms Following Exposure: Local inflammation, blisters and ulcers on skin; irritation in lungs and organic injury to liver and kidneys; may be absorbed through skin.
5.3 Treatment of Exposure: Remove from exposure. Remove contaminated clothing. Wash skin with soap and water. Flush eyes with plenty of water. Consult physician.
5.4 Threshold Limit Value: 2 ppm
5.5 Short Term Inhalation Limits: 50 ppm for 5 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect if temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: 400 ppm

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Decomposition gases are toxic and irritating.
6.6 Behavior in Fire: Decomposes into toxic irritating gases. Reacts with hot metals such as aluminum and magnesium.
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data Not Available
6.11 Stoichiometric Air to Fuel Ratio: Data Not Available
6.12 Flame Temperature: Data Not Available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data Not Available
7.8 Reactivity Group: 36

8. WATER POLLUTION

8.1 Aquatic Toxicity: 16 mg/l/48 hr/bluegill/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Commercial
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-X

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	0
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	3
Water Pollution	
Human Toxicity	3
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 187.86
12.3 Boiling Point at 1 atm: 268°F = 131°C = 404°K
12.4 Freezing Point: 49.6°F = 9.8°C = 283.0°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 2.180 at 20°C (liquid)
12.8 Liquid Surface Tension: 38.75 dynes/cm = 0.03875 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.54 dynes/cm = 0.03654 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.109
12.12 Latent Heat of Vaporization: 82.1 Btu/lb = 45.6 cal/g = 1.91×10^5 J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 13.79 cal/g
12.26 Limiting Value: Data Not Available
12.27 Reid Vapor Pressure: 0.4 psia

NOTES

GASOLINES: AUTOMOTIVE (<4.23g lead/gal)

GAT

Common Synonyms	Watery liquid	Colorless to pale brown or pink	Gasoline odor
Motor spirit Petrol	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

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

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea or vomiting.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Disperse and flush

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: (Mixture of hydrocarbons)
3.3 IMO/UN Designation: 3.1/1203
3.4 DOT ID No.: 1203
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless to brown
4.3 Odor: Gasoline

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective goggles, gloves.
5.2 Symptoms Following Exposure: Irritation of mucous membranes and stimulation followed by depression of central nervous system. Breathing of vapor may also cause dizziness, headache, and incoordination or, in more severe cases, anesthesia, coma, and respiratory arrest. If liquid enters lungs, it will cause severe irritation, coughing, gagging, pulmonary edema, and, later, signs of bronchopneumonia and pneumonitis. Swallowing may cause irregular heartbeat.
5.3 Treatment of Exposure: INHALATION: maintain respiration and administer oxygen; enforce bed rest if liquid is in lungs. INGESTION: do NOT induce vomiting; stomach should be lavaged (by doctor) if appreciable quantity is swallowed. EYES: wash with copious quantity of water. SKIN: wipe off and wash with soap and water.
5.4 Threshold Limit Value: 300 ppm
5.5 Short Term Inhalation Limits: 500 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg.
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.25 ppm
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: −36°F C.C.
6.2 Flammable Limits in Air: 1.4%-7.4%
6.3 Fire Extinguishing Agents: Foam, carbon dioxide, dry chemical
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: None
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 853°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 33

8. WATER POLLUTION

8.1 Aquatic Toxicity:
90 ppm/24 hr/juvenile American shad/TL_m/fresh water
91 mg/1/24 hr/juvenile American shad/TL_m/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 8%, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Various octane ratings; military specifications
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	0
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm:
140—390°F
= 60—199°C = 333—472°K
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity:
0.7321 at 20°C (liquid)
12.8 Liquid Surface Tension:
19-23 dynes/cm
= 0.019—0.023 N/m at 20°C
12.9 Liquid Water Interfacial Tension:
49-51 dynes/cm
= 0.049—0.051 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 3.4
12.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1.054
12.12 Latent Heat of Vaporization:
130—150 Btu/lb = 71—81 cal/g
= 3.0 — 3.4 X 10^5 J/kg
12.13 Heat of Combustion: −18,720 Btu/lb
= −10,400 cal/g = 435.1 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 7.4 psia

NOTES

GASOLINES: AVIATION (< 4.86g lead/gal)

GAV

Common Synonyms	Watery liquid	Red, blue, green, brown or purple	Gasoline odor
	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemical, foam or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

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

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea or vomiting.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Disperse and flush

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: Not pertinent
3.3 IMO/UN Designation: 3.1/1203
3.4 DOT ID No.: 1203
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Red, blue, green, brown, purple
4.3 Odor: Gasoline

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective goggles, gloves.
5.2 Symptoms Following Exposure: INHALATION causes irritation of upper respiratory tract; central nervous system stimulation followed by depression of varying degrees ranging from dizziness, headache, and incoordination to anesthesia, coma, and respiratory arrest; irregular heartbeat is dangerous complication. ASPIRATION causes severe lung irritation with coughing, gagging, dyspnea, substernal distress, and rapidly developing pulmonary edema; later, signs of bronchopneumonia and pneumonitis; acute onset of central nervous system excitement followed by depression. INGESTION causes irritation of mucous membranes of throat, esophagus, and stomach; stimulation followed by depression of central nervous system; irregular heartbeat.
5.3 Treatment of Exposure: Seek medical attention. INHALATION: maintain respiration; give oxygen if needed. ASPIRATION: enforce bed rest; administer oxygen. INGESTION: do NOT induce vomiting; lavage carefully if appreciable quantity was ingested; guard against aspiration into lungs. EYES: wash with copious quantity of water. SKIN: wipe off and wash with soap and water.
5.4 Threshold Limit Value: 300 ppm
5.5 Short Term Inhalation Limits: 500 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.25 ppm
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: -50°F C.C.
6.2 Flammable Limits in Air: 1.2%-7.1%
6.3 Fire Extinguishing Agents: Foam, carbon dioxide, dry chemical
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: None
6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 824°F
6.8 Electrical Hazard: Class I, group D
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
90 ppm/24 hr/juvenile American shad/TL_m/fresh water
91 ppm/24 hr/juvenile American shad/TL_m/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 8%, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Grades 80/87, 100/130, and 115/145: Specification MIL-G-5572e
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	0
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: 160—340°F = 71—171°C = 344—444°K
12.4 Freezing Point: <76°F = <24.4°C = <297.6°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.711 at 15°C (liquid)
12.8 Liquid Surface Tension: 19—23 dynes/cm = 0.019—0.023 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 49—51 dynes/cm = 0.049—0.051 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 3.4
12.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1.054
12.12 Latent Heat of Vaporization: 130—150 Btu/lb = 71—81 cal/g = 3.0—3.4 X 10^5 J/kg
12.13 Heat of Combustion: —18,720 Btu/lb = —10,400 cal/g = —435.4 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

GASOLINES: STRAIGHT RUN

GSR

Common Synonyms	Watery liquid Colorless Gasoline odor Floats on water. Flammable, irritating vapor is produced.
Fire	FLAMMABLE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area.
Exposure	VAPOR Irritating to eyes, nose and throat. If inhaled, will cause dizziness, headache, difficult breathing or loss of consciousness. LIQUID Irritating to skin and eyes. If swallowed, will cause nausea or vomiting.
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Fouling to shoreline. May be dangerous if it enters water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Disperse and flush

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: Not pertinent
3.3 IMO/UN Designation: 3.1, 3.2/1203
3.4 DOT ID No.: 1203
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Gasoline

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective goggles, gloves.
5.2 Symptoms Following Exposure: INHALATION causes irritation of upper respiratory tract; central nervous system stimulation followed by depression of varying degrees ranging from dizziness, headache, and incoordination to anesthesia, coma, and respiratory arrest; irregular heartbeat is dangerous complication. ASPIRATION causes severe lung irritation with coughing, gagging, dyspnea, substernal distress, and rapidly developing pulmonary edema; later, signs of bronchopneumonia and pneumonitis; acute onset of central nervous system excitement followed by depression. INGESTION causes irritation of mucous membranes of throat, esophagus, and stomach; stimulation followed by depression of central nervous system; irregular heartbeat.
5.3 Treatment of Exposure: Seek medical attention. INHALATION: maintain respiration; give oxygen if needed. ASPIRATION: enforce bed rest; administer oxygen. INGESTION: do NOT induce vomiting; lavage carefully if appreciable quantity was ingested; guard against aspiration into lungs. EYES: wash with copious quantity of water. SKIN: wipe off and wash with soap and water.
5.4 Threshold Limit Value: 300 ppm
5.5 Short Term Inhalation Limits: 500 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.25 ppm
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: (a) <0°F C.C. (b) 0-73°F C.C.
6.2 Flammable Limits in Air: (a) 1.3%-7.1%
6.3 Fire Extinguishing Agents: Dry chemical, foam, carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: None
6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: Data not available
6.8 Electrical Hazard: Class I, group D
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 33

8. WATER POLLUTION

8.1 Aquatic Toxicity:
90 ppm/24 hr/juvenile American shad/TL_m/fresh water
91 ppm/24 hr/juvenile American shad/TL_m/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 8%, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Composition varies with range of distillation temperatures used.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	0
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: 58-275°F = 14—135°C = 287—408°K
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.71-0.747 at 15°C (liquid)
12.8 Liquid Surface Tension: 19-23 dynes/cm = 0.019-0.023 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 49-51 dynes/cm = 0.049-0.051 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 3.4
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: 130—150 Btu/lb = 71—81 cal/g = 3.0—3.4 X 10^5 J/kg
12.13 Heat of Combustion: —18,720 Btu/lb = —10,400 cal/g = —435.4 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

KEROSENE

KRS

Common Synonyms	Watery liquid	Colorless	Fuel oil odor
Illuminating oil Kerosene Range oil Fuel oil No. 1 Jet Fuel: JP-1	Floats on water.		

Stop discharge if possible.
Call fire department.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

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

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: C_nH_{2n+2}
3.3 IMO/UN Designation: 3.3/1223
3.4 DOT ID No.: 1223
3.5 CAS Registry No.: 8008-20-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless to light brown
4.3 Odor: Characteristic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective gloves; goggles or face shield.
5.2 Symptoms Following Exposure: Vapor causes slight irritation of eyes and nose. Liquid irritates stomach; if taken into lungs, causes coughing, distress, and rapidly developing pulmonary edema.
5.3 Treatment of Exposure: ASPIRATION: enforce bed rest; administer oxygen; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: wash with plenty of water. SKIN: wipe off and wash with soap and water.
5.4 Threshold Limit Value: 200 ppm
5.5 Short Term Inhalation Limits: 2500 mg/m³ for 60 min.
5.6 Toxicity by Ingestion: Grade 1; LD_{50} = 5 to 15 g/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 1 ppm
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 100°F (min.)C.C.
6.2 Flammable Limits in Air: 0.7%-5%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 444°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 33

8. WATER POLLUTION

8.1 Aquatic Toxicity: 2990 ppm/24 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 53%, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Light hydrocarbon distillate: 100%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Combustible liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	2.
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	1
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	1
Aesthetic Effect	3
Reactivity	
Other Chemicals	0
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	2
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: 392-500°F = 200—260°C = 473—533°K
12.4 Freezing Point: —50°F = —45.6°C = 227.6°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.80 at 15°C (liquid)
12.8 Liquid Surface Tension: 23-32 dynes/cm = 0.023-0.032 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 47-49 dynes/cm = 0.047-0.049 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: 110 Btu/lb = 60 cal/g = 2.5 X 10⁴ J/kg
12.13 Heat of Combustion: —18,540 Btu/lb = —10,300 cal/g = —431.24 X 10³ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.1 psia

NOTES

Lead (Pb)

Physical and Chemical Description: Pb, soft, ductile, gray metal, insoluble in water but dissolves slowly in water containing a weak acid. Since lead is an element, it will remain indefinitely once released to the environment.

Uses: Lead is used in electroplating, radiation protection devices, plastics, electronic equipment, storage batteries, gasoline anti-knock additivies, and pigments.

Toxicity in Water: The hazards of human exposure to lead are well known. Symptoms of lead poisoning include fatigue, anemia, abdominal pains, constipation, and neurological damage. The Florida Primary Drinking Water Standard (F.A.C. 17-22) for lead is 50 ug/l.

The toxic effects of lead on aquatic organisms is strongly dependent on the water hardness. To protect freshwater aquatic life at hardnesses of 50, 100, and 200 mg/l as $CaCO_3$, the concentrations of lead should not exceed 0.75, 3.8, and 20 ug/l, respectively. To protect saltwater life, lead should not exceed 25 ug/l (EPA, 1979).

Classification: Hazardous Substance (EPA)

Hazardous Waste Constituent (EPA)

Priority Toxic Pollutant (EPA)

MINERAL SPIRITS

MNS

Common Synonyms	Watery liquid	Colorless	Gasoline-like odor
Petroleum spirits Naphtha	Floats on water.		

Stop discharge if possible.
Call fire department.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Extinguish with water, dry chemical, foam, or carbon dioxide.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

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

Water Pollution

Effect of low concentrations on aquatic life is unknown.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: Not applicable
3.3 IMO/UN Designation: 3.3/1300
3.4 DOT ID No.: 1300
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Like gasoline

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Plastic gloves; goggles or face shield (as for gasoline).
5.2 Symptoms Following Exposure: INHALATION: mild irritation of respiratory tract. ASPIRATION: severe lung irritation and rapidly developing pulmonary edema; central nervous system excitement followed by depression. INGESTION: irritation of stomach.
5.3 Treatment of Exposure: INHALATION: remove victim to fresh air. ASPIRATION: enforce bed rest; give oxygen; call a doctor. INGESTION: do NOT induce vomiting; guard against aspiration into lungs. EYES: wash with copious amounts of water. SKIN: wipe off and wash with soap and water.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: 4000-7000 ppm for 60 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors are nonirritating to the eyes and throat.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 105—140°F C.C., depending on grade
6.2 Flammable Limits in Air: 0.8%-5.0%
6.3 Fire Extinguishing Agents: Foam, carbon dioxide, dry chemical
6.4 Fire Extinguishing Agents Not to be Used: Do not use straight hose water stream.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 540°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 33

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 8%, 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Various grades available. 70-100% of the materials are derived from petroleum, and 0-30% are aromatic hydrocarbons like benzene and toluene. Flash points vary with the exact composition but are usually above 100°F.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Combustible liquid
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	2
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: 310—395°F = 154—202°C = 428—475°K
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.78 at 20°C (liquid)
12.8 Liquid Surface Tension: Data not available
12.9 Liquid Water Interfacial Tension: Data not available
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1.030
12.12 Latent Heat of Vaporization: Data not available
12.13 Heat of Combustion: Data not available
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.13 psia

NOTES

Naphthalene ($C_{10}H_8$)

Physical and Chemical Description: white crystalline solid with a characteristic "moth ball" odor. Naphthalene is more dense than water (sp. gr. 1.145) and has a solubility of 30,000 - 40,000 ug/l @ 25°C. It melts at 80°C but will sublime (volatilize from a solid) at room temperature. Naphthalene is considered a polynuclear aromatic hydrocarbon (PAH).

Uses: intermediate in dye production and formation of solvents, lubricants, and motor fuels. Used directly as a moth repellant.

Toxicity: Naphthalene may be absorbed by inhalation, ingestion or skin or eye contact. Chronic exposure can cause cataracts, kidney disease and red blood cell breakdown, especially in infants and individuals deficient in the enzyme G6PD. Naphthalene has been shown to be nonmutagenic and noncarcinogenic.

Classification: Hazardous Substance (EPA)

Hazardous Waste (EPA)

Priority Toxic Pollutant (EPA)

Persistance: Naphthalene can oxidize in the presence of light and air, 50% after 14 days in one study. Microbial degradation has also been demonstrated in the laboratory in solutions as concentrated as 3.3 ug/l. Little breakdown is expected, however, under the dark, anaerobic conditions characteristic of in-situ ground water.

Phenanthrene ($C_{14}H_{10}$)

Physical and Chemical Description: colorless, monoclinic crystals soluble in water, 1,000-1,300 ug/l @ 2.5°C, specific gravity = 1.179. Phenanthrene is a PAH.

Uses: dyes, explosives, a natural constituent of coal tar and of diesel oil (0.35%).

Toxicity: Phenanthrene has been identified as a mild allergen and human dermal photosensitizer. Limited acute and chromic animal experiments show it to be of low to moderate toxicity.

Classification: none

Fluorene ($C_{13}H_{10}$)

Physical and Chemical Description: Combustible white solid having a density of 1.20 and a water solubility of 1980 ug/l.

Uses: Manufacture of dyestuffs.

Toxicity: Little specific information is available about the toxicity of fluorene but it is a polynuclear aromatic hydrocarbon (PAH), a group which contains known human carcinogens.

Classification: None

OILS: DIESEL

ODS

Common Synonyms	Oily liquid	Yellow-brown	Lube or fuel oil odor
Fuel oil 1-D Fuel oil 2-D	Floats on water.		

Stop discharge if possible.
Call fire department.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

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

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: Not applicable
3.3 IMO/UN Designation: 3.1/1270
3.4 DOT ID No.: 1270
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Light brown
4.3 Odor: Like fuel oil

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Goggles or face shield.
5.2 Symptoms Following Exposure: If liquid is ingested, an increased frequency of bowel movements will occur.
5.3 Treatment of Exposure: INGESTION: do NOT induce vomiting. SKIN: wipe off, wash with soap and water. EYES: wash with copious amounts of water for at least 15 min.
5.4 Threshold Limit Value: No single TLV applicable.
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 1; LD_{50} = 5 to 15 g/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: (1-D) 100°F C.C.; (2-D) 125°F C.C.
6.2 Flammable Limits in Air: 1.3-6.0 vol.%
6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: (1-D) 350-625°F (2-D) 490-545°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 33

8. WATER POLLUTION

8.1 Aquatic Toxicity: 204 mg/l/24 hr/juvenile American shad/TL_m/salt water
8.2 Waterfowl Toxicity: >20 ml/kg /LD_{50}/mallards
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Diesel Fuel 1-D (ASTM); Diesel Fuel 2-D (ASTM)
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Combustible liquid
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	2
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: 550—640°F = 288—338°C = 561—612°K
12.4 Freezing Point: 0 to —30°F = —18 to —34°C = 255 to 239°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.841 at 16°C (liquid)
12.8 Liquid Surface Tension: (est.) 25 dynes/cm = 0.025 N/m at 20°C
12.9 Liquid Water Interfacial Tension: (est.) 50 dynes/cm = 0.05 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: —18,400 Btu/lb = —10,200 cal/g = 429 X 10^3 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Varies

NOTES

OILS, MISCELLANEOUS: LUBRICATING

OLB

Common Synonyms	Oily liquid	Yellow-brown	Lube oil odor
Crankcase oil Transmission oil Motor oil	Floats on water.		

Stop discharge if possible.
Call fire department.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Extinguish with dry chemical, foam or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.

Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: Not applicable
3.3 IMO/UN Designation: 3.3/1270
3.4 DOT ID No.: 1270
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Yellow fluorescent
4.3 Odor: Characteristic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective gloves; goggles or face shield.
5.2 Symptoms Following Exposure: INGESTION: minimal gastrointestinal tract irritation; increased frequency of bowel passage may occur. ASPIRATION: pulmonary irritation is normally minimal but may become more severe several hours after exposure.
5.3 Treatment of Exposure: INGESTION: do NOT lavage or induce vomiting. ASPIRATION: treatment probably not required; delayed development of pulmonary irritation can be detected by serial chest x-rays. EYES: wash with copious quantity of water. SKIN: wipe off and wash with soap and water.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 1; LD_{50} = 5 to 15 g/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 300°F C.C.
6.2 Flammable Limits in Air: Data not available
6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water or foam may cause frothing.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 500°F-700°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 33

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Various viscosities
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Not listed
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	1
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: Very high
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: (est.) 0.902 at 20°C (liquid)
12.8 Liquid Surface Tension: 36-37.5 dynes/cm = 0.036—0.0375 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 33—54 dynes/cm = 0.033—0.054 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: —18,486 Btu/lb = —10,270 cal/g = —429.98 X 10^3 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

OILS, MISCELLANEOUS: PENETRATING

OPT

Common Synonyms	Oily liquid	Yellow	Motor oil-like odor
Preservative oil Water displacing oil	Floats on water.		

Stop discharge if possible.
Call fire department.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.

Exposure

CALL FOR MEDICAL AID.

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

Water Pollution

Effect of low concentrations on aquatic life is unknown.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: Not applicable
3.3 IMO/UN Designation: 3.3/1270
3.4 DOT ID No.: 1270
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Yellowish
4.3 Odor: Like motor oil

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective gloves; goggles or face shield.
5.2 Symptoms Following Exposure: Liquid may irritate stomach and increase frequency of bowel movements.
5.3 Treatment of Exposure: INGESTION: have victim drink water or milk; do NOT induce vomiting. ASPIRATION: check for delayed development of pulmonary irritation by serial x-rays. EYES: wash with copious amounts of water. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: Data not available
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 1; LD_{50} = 5 to 15 g/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of skin.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 295°F
6.2 Flammable Limits in Air: Data not available
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water or foam may cause frothing.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: Data not available
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Data not available
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 33

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Commercial
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Not listed
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: Very high
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.8961 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.8 dynes/cm = 0.0298 N/m at 24°C
12.9 Liquid Water Interfacial Tension: 5.5 dynes/cm = 0.0055 N/m at 22°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: (est.) —18,000 Btu/lb = —10,000 cal/g = —420 X 10^3 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

The World Health Organization has established an international standard for PAH's in drinking water of less than 0.2 ug/l. This recommendation is based upon the composite analysis of six PAH's in drinking water: fluoranthene, benzo(a)pyrene, benzo(g,h,i)perylene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)-pyrene. The selection of these six PAH's was not made on the basis of health effects but were selected as useful indicators of PAH pollution. The EPA estimated carcinogenic risk of 10^{-5} for a lifetime consumption of water with a concentration of total carcinogenic PAH's of 0.028 ug/l is not applicable in this study

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CUSTOMER P.O. NO. J-12290

DATE 2/23/88 MATERIAL SAFETY DATA SHEET

SECTION I -GENERAL INFORMATION

CATALOG NO 48510 (REORDER PRODUCT BY THIS NO.)
PRODUCT NAME 1,1,1-TRICHLOROETHANE 1G*
DATA SHEET NO R430110
1,1,1-TRICHLOROETHANE
FORMULA CH3CCl3 FORMULA WEIGHT 133
CAS 71-55-6 NRTECS KJ2975000
SYNONYM METHYLCHLOROFORM
MANUFACTURER SUPELCO INC. PHONE 814-359-3441
ADDRESS SUPELCO PARK, BELLEFONTE, PA 16823-0048

SECTION II - HAZARDOUS INGREDIENTS OF MIXTURES

MATERIALS - PERCENTAGE - CAS #
(FORMULA) - TLV(UNITS)
LD50 VALUE - CONDITIONS

N/A

SECTION III - PHYSICAL DATA

BOILING POINT 74 C MM MELTING POINT -35 C
VAPOR PRESSURE 104.40 25.0 C SPECIFIC GRAVITY 1.330 25.0 C (WATER=1
VAPOR DENSITY 4.54 C (AIR=1) PERCENT VOLATILE BY VOLUME 100
WATER SOLUBILITY .7 EVAPORATION RATE 0.35 (ETHER=1)
APPEARANCE CLEAR, COLORLESS LIQUID ETHER-LIKE ODOR

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT F FLAMMABLE LIMITS LEL 7.0 UEL 16.

EXTINGUISHING MEDIA

WATER
CO2
DRY CHEMICAL

SPECIAL FIRE FIGHTING PROCEDURES

WEAR SELF CONTAINED BREATHING APPARATUS WHEN FIGHTING A CHEMICAL FIRE.

UNUSUAL FIRE AND EXPLOSION HAZARDS

VAPORS FORM EXPLOSIVE MIXTURES WITH AIR.
THE FOLLOWING TOXIC VAPORS ARE FORMED WHEN THIS MATERIAL IS HEATED TO DECOMPOSITION.
HYDROGEN CHLORIDE & POSSIBLY TRACES OF PHOSGENE

SECTION V - HEALTH HAZARD DATA

LD50 10300 MG/KG ORAL RAT TLV 350 PPM

EMERGENCY AND FIRST AID PROCEDURES
EYES
FLUSH EYES WITH WATER FOR 15 MINUTES.
CONTACT A PHYSICIAN.

CATALOG NO 48510 (REORDER PRODUCT BY THIS NO.)
RODUCT NAME 1,1,1-TRICHLOROETHANE 1G
DATA SHEET NO R430110
1,1,1-TRICHLOROETHANE

SECTION V - HEALTH HAZARD DATA

* CONTINUED *

SKIN
PROMPTLY WASH SKIN WITH MILD SOAP AND LARGE VOLUMES OF WATER.
REMOVE CONTAMINATED CLOTHING.

INHALATION
IMMEDIATELY MOVE TO FRESH AIR.
GIVE OXYGEN IF BREATHING IS LABORED
IF BREATHING STOPS, GIVE ARTIFICIAL RESPIRATION
CONTACT A PHYSICIAN

INGESTION
NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON
NEVER TRY TO MAKE AN UNCONSCIOUS PERSON VOMIT
DO NOT INDUCE VOMITING.
GIVE LARGE AMOUNTS OF WATER
IMMEDIATELY CONTACT A PHYSICIAN.
NEVER ADMINISTER ADRENALIN FOLLOWING METHYLCHLOROFORM OVEREXPOSURE.
INCREASED SENSITIVITY OF THE HEART TO ADRENALIN MAY BE CAUSED BY OVER EXPOSURE TO METHYLCHLOROFORM.

EFFECTS OF OVEREXPOSURE

MAY IRRITATE EYES AND/OR SKIN
MAY BE FATAL IF INHALED
MAY BE FATAL IF SWALLOWED
BURNS EYES
DERMATITIS
IRRITATES NOSE AND THROAT
HEADACHE
NAUSEA
DIZZINESS
DEPRESSES CENTRAL NERVOUS SYSTEM
LIVER DAMAGE
KIDNEY DAMAGE
THERE IS NO DOCUMENTED EVIDENCE THAT METHYLCHLOROFORM CAUSES AN INCREASED CANCER INCIDENCE IN HUMANS.
DEPRESSION OF THE CIRCULATORY SYSTEM HAS BEEN REPORTED AS A RESULT OF OVEREXPOSURE TO METHYLCHLOROFORM. THE HEART MAY BE SENSITIZED BY METHYLCHLOROFORM, & VENTRICULAR ARRHYTHMIA MAY BE INDUCED.

SECTION VI - REACTIVITY DATA

STABILITY STABLE.

CONDITIONS TO AVOID

AVOID MIXING WITH CAUSTIC SODA, CAUSTIC POTASH OR OXIDIZING MATERIALS
SHOCK SENSITIVE EXPLOSIVES MAY FORM.

CATALOG NO 48510 (REORDER PRODUCT BY THIS NO.)
RODUCT NAME 1,1,1-TRICHLOROETHANE 1G
DATA SHEET NO R430110
1,1,1-TRICHLOROETHANE

SECTION VI - REACTIVITY DATA

* CONTINUED *

INCOMPATIBILITY

STRONG BASES
OXIDIZING AGENTS
AVOID USE WITH ALUMINUM AS SOLVENT MAY DECOMPOSE.

HAZARDOUS DECOMPOSITION PRODUCTS

HYDROGEN CHLORIDE & POSSIBLY TRACES OF PHOSGENE

HAZARDOUS POLYMERIZATION WILL NOT OCCUR.

CONDITIONS TO AVOID

N/A

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

TAKE UP WITH ABSORBENT MATERIAL.
VENTILATE AREA.
FLUSH AREA WITH WATER.

WASTE DISPOSAL METHOD

COMPLY WITH ALL APPLICABLE FEDERAL, STATE, OR LOCAL REGULATIONS

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFIC TYPE)

WEAR NIOSH/OSHA APPROVED RESPIRATORY PROTECTION.
WEAR SELF CONTAINED BREATHING APPARATUS.

PROTECTIVE GLOVES

WEAR NEOPRENE GLOVES.

EYE PROTECTION

WEAR PROTECTIVE GLASSES.

VENTILATION

USE ONLY IN WELL VENTILATED AREA.

CATALOG NO 48510 (REORDER PRODUCT BY THIS NO.)
PRODUCT NAME 1,1,1-TRICHLOROETHANE 1G
DATA SHEET NO R430110
1,1,1-TRICHLOROETHANE

SECTION VIII - SPECIAL PROTECTION INFORMATION

* CONTINUED *

SPECIAL

N/A

OTHER PROTECTIVE EQUIPMENT

N/A

SECTION IX PRECAUTIONS

STORAGE AND HANDLING

STORE IN DRY, WELL VENTILATED AREA.

OTHER PRECAUTIONS

AVOID EYE OR SKIN CONTACT.
AVOID BREATHING VAPORS.

WHILE THE INFORMATION AND RECOMMENDATIONS SET FORTH HEREIN ARE BELIEVED TO BE ACCURATE AS OF THE DATE HEREOF, SUPELCO, INC. MAKES NO WARRANTY WITH RESPECT THERETO AND DISCLAIMS ALL LIABILITY FROM RELIANCE THEREON.

LAST REVISED 11/20/86

TETRACHLOROETHYLENE

TTE

Common Synonyms	Watery liquid	Colorless	Sweet odor
Tetracap Perclene Perchloroethylene Perk	Sinks in water. Irritating vapor is produced.		

Stop discharge if possible.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
Poisonous gases are produced when heated.

Exposure

CALL FOR MEDICAL AID.

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

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $Cl_2C{=}CCl_2$
3.3 IMO/UN Designation: 6.0/1897
3.4 DOT ID No.: 1897
3.5 CAS Registry No.: 127-18-4

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Ethereal; like chloroform; mildly sweet

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: For high vapor concentrations use approved canister or air-supplied mask; chemical goggles or face shield; plastic gloves.
5.2 Symptoms Following Exposure: Vapor can affect central nervous system and cause anesthesia. Liquid may irritate skin after prolonged contact. May irritate eyes but causes no injury.
5.3 Treatment of Exposure: INHALATION: If illness occurs, remove patient to fresh air, keep him warm and quiet, and get medical attention. INGESTION: Induce vomiting only on physician's recommendation. EYES AND SKIN: flush with plenty of water and get medical attention if irritation or injury occurs.
5.4 Threshold Limit Value: 50 ppm
5.5 Short Term Inhalation Limits: 100 ppm for 60 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or throat if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 5 ppm
5.11 IDLH Value: 500 ppm

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic, irritating gases may be generated in fires.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Dry cleaning and industrial grades: 95+%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-X

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	0
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	1

11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 165.83
12.3 Boiling Point at 1 atm: 250°F = 121°C = 394°K
12.4 Freezing Point: −8.3°F = −22.4°C = 250.8°K
12.5 Critical Temperature: 657°F = 347°C = 620°K
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.63 at 20°C (liquid)
12.8 Liquid Surface Tension: 31.3 dynes/cm = 0.0313 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 44.4 dynes/cm = 0.0444 N/m at 25°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.116
12.12 Latent Heat of Vaporization: 90.2 Btu/lb = 50.1 cal/g = 2.10×10^5 J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

TETRAETHYL LEAD

TEL

Common Synonyms	Oily liquid	Colorless, but generally dyed red	Fruity odor
TEL Lead tetraethyl	Sinks in water. Poisonous, flammable vapor is produced.		

AVOID CONTACT WITH LIQUID AND VAPOR. Keep people away.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Stop discharge if possible.
Call fire department.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
POISONOUS GASES ARE PRODUCED IN FIRE.
Containers may explode in fire.
Vapor may explode if ignited in an enclosed area.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Combat fires from behind barrier or protected location.
Flood discharge area with water.
Extinguish with water, dry chemical, foam, or carbon dioxide.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
POISONOUS IF INHALED OR IF SKIN IS EXPOSED.
Irritating to eyes.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED.
Will burn eyes.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-poison, water contaminant
Restrict access
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Poison
2.2 Class: 6

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: $Pb(C_2H_5)_4$
3.3 IMO/UN Designation: 6.1/1649
3.4 DOT ID No.: 1649
3.5 CAS Registry No.: 78-00-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Dyed red or other distinctive color.
4.3 Odor: Sweet

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Organic vapor type canister face mask for short periods; air line type for longer periods; neoprene-coated, liquid-proof gloves; protective goggles or face shield; white or light-colored clothing; rubber shoes or boots.
5.2 Symptoms Following Exposure: Increased urinary output of lead. If a large degree of absorption from inhalation or skin contact, may cause insomnia, excitability, delirium, coma and death. Do not confuse with inorganic lead.
5.3 Treatment of Exposure: Remove victim from contaminated area and consult physician immediately. INGESTION: Induce vomiting. SKIN: wash immediately with kerosene or similar petroleum distillate followed by soap and water.
5.4 Threshold Limit Value: 0.1 mg/m^3
5.5 Short Term Inhalation Limits: 0.15 mg Pb/m^3 for 30 min.
5.6 Toxicity by Ingestion: Oral rat LD_{50} = 17 mg/kg
5.7 Late Toxicity: Lead poisoning
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: 40 mg/m^3

6. FIRE HAZARDS

6.1 Flash Point: 200°F C.C.; 185°F O.C.
6.2 Flammable Limits in Air: Data not available
6.3 Fire Extinguishing Agents: Water, foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic gases are generated in fires.
6.6 Behavior in Fire: May explode in fires.
6.7 Ignition Temperature: Decomposes above 230°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Data not available
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: Rust and some metals cause decomposition.
7.3 Stability During Transport: Stable below 230°F. At higher temperatures, may detonate or explode when confined.
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: 0.20 mg/l/96 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X-Y

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Poison, B
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	2
Reactivity (Yellow)	3

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 323.44
12.3 Boiling Point at 1 atm: Decomposes
12.4 Freezing Point: —215°F = —137°C = 136°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.653 at 20°C (liquid)
12.8 Liquid Surface Tension: 28.5 dynes/cm = 0.0285 N/m at (est.) 25°C
12.9 Liquid Water Interfacial Tension: (est.) 40 dynes/cm = 0.04 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: (est.) —7,870 Btu/lb = —4,380 cal/g = —183 X 10^3 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

TOLUENE

TOL

Common Synonyms	Watery liquid	Colorless	Pleasant odor
Toluol Methylbenzene Methylbenzol	Floats on water. Flammable, Irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: $C_6H_5CH_3$
3.3 IMO/UN Designation: 3.2/1294
3.4 DOT ID No.: 1294
3.5 CAS Registry No.: 108-88-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Pungent; aromatic, benzene-like; distinct, pleasant

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Air-supplied mask; goggles or face shield; plastic gloves.
5.2 Symptoms Following Exposure: Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration.
5.3 Treatment of Exposure: INHALATION: remove to fresh air, give artificial respiration and oxygen if needed; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 600 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: Kidney and liver damage may follow ingestion.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.17 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 40°F C.C.; 55°F O.C.
6.2 Flammable Limits in Air: 1.27%-7%
6.3 Fire Extinguishing Agents: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires.
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 997°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.7 mm/min.
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 1180 mg/l/96 hr/sunfish/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0%, 5 days; 38% (theor), 8 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research, reagent, nitration-all 99.8 + %; industrial: contains 94 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 90/120: less pure than industrial.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 92.14
12.3 Boiling Point at 1 atm: 231.1°F = 110.6°C = 383.8°K
12.4 Freezing Point: —139°F = —95.0°C = 178.2°K
12.5 Critical Temperature: 605.4°F = 318.6°C = 591.8°K
12.6 Critical Pressure: 596.1 psia = 40.55 atm = 4.108 MN/m^2
12.7 Specific Gravity: 0.867 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.0 dynes/cm = 0.0290 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 25°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.089
12.12 Latent Heat of Vaporization: 155 Btu/lb = 86.1 cal/g = 3.61×10^5 J/kg
12.13 Heat of Combustion: —17,430 Btu/lb = —9686 cal/g = -405.5×10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 17.17 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 1.1 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

TRICHLOROETHANE

TCE

Common Synonyms

1,1,1-Trichloroethane
Methylchloroform
Aerothene
Chlorothene

Watery liquid — Colorless — Sweet odor

Sinks in water. Irritating vapor is produced.

Stop discharge if possible. Keep people away.
Avoid contact with liquid and vapor.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
POISONOUS GASES ARE PRODUCED IN FIRE.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, carbon dioxide, or foam.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, may produce nausea.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated hydrocarbon
3.2 Formula: CH_3CCl_3
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: 2831
3.5 CAS Registry No.: 71-55-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Chloroform-like; sweetish

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Organic vapor-acid gas canister; self-contained breathing apparatus for emergencies; neoprene or polyvinyl-alcohol-type gloves; chemical safety goggles and face shield; neoprene safety shoes (or leather safety shoes plus neoprene footwear); neoprene or polyvinyl alcohol suit or apron for splash protection.
5.2 Symptoms Following Exposure: INHALATION: symptoms range from loss of equilibrium and incoordination to loss of consciousness; high concentration can be fatal due to simple asphyxiation combined with loss of consciousness. INGESTION: produces effects similar to inhalation and may cause some feeling of nausea. EYES: slightly irritating and lachrymatory. SKIN: defatting action may cause dermatitis.
5.3 Treatment of Exposure: Get medical attention for all eye exposures and any other serious overexposures. Do NOT administer adrenalin or epinephrine; otherwise, treatment is symptomatic. INHALATION: remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. INGESTION: have victim drink water and induce vomiting. EYES: flush thoroughly with water. SKIN: remove contaminated clothing and wash exposed area thoroughly with soap and warm water.
5.4 Threshold Limit Value: 350 ppm
5.5 Short Term Inhalation Limits: 1,000 ppm for 60 min. in man
5.6 Toxicity by Ingestion: Grade 1; LD_{50} = 5 to 15 g/kg (rat, mouse, rabbit, guinea pig)
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 100 ppm
5.11 IDLH Value: 1,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: Data not available
6.2 Flammable Limits in Air: 7%-16%
6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic and irritating gases are generated in fires.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 932°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: (est.) 2.9 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Reacts slowly, releasing corrosive hydrochloric acid.
7.2 Reactivity with Common Materials: Corrodes aluminum, but reaction is not hazardous.
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 36

8. WATER POLLUTION

8.1 Aquatic Toxicity: 75-150 ppm/*/pinfish/TL_m/salt water
*Time period not specified.
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Uninhibited; inhibited; industrial inhibited; white room; cold cleaning
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X-Y

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	1
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	1
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 133.41
12.3 Boiling Point at 1 atm: 165°F = 74°C = 347°K
12.4 Freezing Point: <—38°F = <—39°C = <234°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.31 at 20°C (liquid)
12.8 Liquid Surface Tension: 25.4 dynes/cm = 0.0254 N/m at 20°C
12.9 Liquid Water Interfacial Tension: (est.) 45 dynes/cm = 0.045 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 4.6
12.11 Ratio of Specific Heats of Vapor (Gas): 1.104
12.12 Latent Heat of Vaporization: 100 Btu/lb = 58 cal/g = 2.4 X 10^5 J/kg
12.13 Heat of Combustion: (est.) 4700 Btu/lb = 2600 cal/g = 110 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 4.0 psia

NOTES

TRICHLOROETHYLENE

TCL

Common Synonyms	Watery liquid	Colorless	Sweet odor
Trichloroethylene Trolene; Algylen Chlorylen Gemalgene Trethylene Trichloran; Trilene	Sinks in water. Irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Avoid contact with liquid and vapor.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
POISONOUS GASES ARE PRODUCED IN FIRE.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, carbon dioxide, or foam.

Exposure

CALL FOR MEDICAL AID.

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

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, difficult breathing, or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated hydrocarbon
3.2 Formula: $CHCl=CCl_2$
3.3 IMO/UN Designation: 9.0/1710
3.4 DOT ID No.: 1710
3.5 CAS Registry No.: 79-01-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Chloroform-like; ethereal

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Organic, vapor-acid gas canister; self-contained breathing apparatus for emergencies; neoprene or vinyl gloves; chemical safety goggles; face-shield; neoprene safety shoes; neoprene suit or apron for splash protection.
5.2 Symptoms Following Exposure: INHALATION: symptoms range from irritation of the nose and throat to nausea, an attitude of irresponsibility, blurred vision, and finally disturbance of central nervous system resulting in cardiac failure. Chronic exposure may cause organic injury. INGESTION: symptoms similar to inhalation. SKIN: defatting action can cause dermatitis. EYES: slightly irritating sensation and lachrymation.
5.3 Treatment of Exposure: Do NOT administer adrenalin or epinephrine; get medical attention for all cases of overexposure. INHALATION: remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. INGESTION: have victim drink water and induce vomiting; repeat three times; then give 1 tablespoon epsom salts in water. EYES: flush thoroughly with water. SKIN: wash thoroughly with soap and warm water.
5.4 Threshold Limit Value: 50 ppm
5.5 Short Term Inhalation Limits: 200 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 50 ppm
5.11 IDLH Value: 1,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 90°F C.C.; practically nonflammable
6.2 Flammable Limits in Air: 8.0%-10.5%
6.3 Fire Extinguishing Agents: Water fog
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic and irritating gases are produced in fire situations.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 770°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 36

8. WATER POLLUTION

8.1 Aquatic Toxicity: 660 mg/l/40 hr/daphnia/kill/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical; dry cleaning; degreasing; extraction
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-X-Y

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	1
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	1

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	1
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 131.39
12.3 Boiling Point at 1 atm: 189°F = 87°C = 360°K
12.4 Freezing Point: —123.5°F = —86.4°C = 186.8°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.46 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.3 dynes/cm = 0.0293 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 34.5 dynes/cm = 0.0345 N/m at 24°C
12.10 Vapor (Gas) Specific Gravity: 4.5
12.11 Ratio of Specific Heats of Vapor (Gas): 1.116
12.12 Latent Heat of Vaporization: 103 Btu/lb = 57.2 cal/g = 2.4×10^5 J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 2.5 psia

NOTES

m-XYLENE

XLM

Common Synonyms	Watery liquid	Colorless	Sweet odor
3-Dimethylbenzene Xylol	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

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

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: m-$C_6H_4(CH_3)_2$
3.3 IMO/UN Designation: 3.2/1307
3.4 DOT ID No.: 1307
3.5 CAS Registry No.: 108-38-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Like benzene; characteristic aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma; can be fatal. Kidney and liver damage can occur.
5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 300 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 g/kg
5.7 Late Toxicity: Kidney and liver damage.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.05 ppm
5.11 IDLH Value: 10,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 84°F C.C.
6.2 Flammable Limits in Air: 1.1%-6.4%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 966°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.8 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 22 ppm/96 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 0% (theor.), 5 days
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research: 99.99%; Pure: 99.9%; Technical: 99.2%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.16
12.3 Boiling Point at 1 atm: 269.4°F = 131.9°C = 405.1°K
12.4 Freezing Point: −54.2°F = −47.9°C = 225.3°K
12.5 Critical Temperature: 650.8°F = 343.8°C = 617.0°K
12.6 Critical Pressure: 513.8 atm = 34.95 psia = 3.540 MN/m^2
12.7 Specific Gravity: 0.864 at 20°C (liquid)
12.8 Liquid Surface Tension: 28.6 dynes/cm = 0.0286 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.4 dynes/cm = 0.0364 N/m at 30°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.071
12.12 Latent Heat of Vaporization: 147 Btu/lb = 81.9 cal/g = 3.43 X 10^5 J/kg
12.13 Heat of Combustion: −17,554 Btu/lb = −9752.4 cal/g = −408.31 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 26.01 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.34 psia

NOTES

o-XYLENE

XLO

Common Synonyms	Watery liquid	Colorless	Sweet odor
2-Dimethylbenzene Xylol	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

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

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: o-$C_6H_4(CH_3)_2$
3.3 IMO/UN Designation: 3.2/1307
3.4 DOT ID No.: 1307
3.5 CAS Registry No.: 95-47-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Benzene-like; characteristic aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma. Can be fatal. Kidney and liver damage can occur.
5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 300 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Kidney and liver damage.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.05 ppm
5.11 IDLH Value: 10,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 63°F C.C.; 75°F O.C.
6.2 Flammable Limits in Air: 1.1%-7.0%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 869°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.8 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: >100 mg/l/96 hr/D. magna/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 2.5% (theor.), 8 days
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research: 99.99%; Pure: 99.7%; Commercial: 95+%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No reaction
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.16
12.3 Boiling Point at 1 atm: 291.9°F = 144.4°C = 417.5°K
12.4 Freezing Point: −13.3°F = −25.2°C = 248.0°K
12.5 Critical Temperature: 674.8°F = 357.1°C = 630.3°K
12.6 Critical Pressure: 541.5 atm = 36.84 psia = 3.732 MN/m^2
12.7 Specific Gravity: 0.880 at 20°C (liquid)
12.8 Liquid Surface Tension: 30.53 dynes/cm = 0.03053 N/m at 15.5°C
12.9 Liquid Water Interfacial Tension: 36.06 dynes/cm = 0.03606 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.068
12.12 Latent Heat of Vaporization: 149 Btu/lb = 82.9 cal/g = 3.47×10^4 J/kg
12.13 Heat of Combustion: −17,558 Btu/lb = −9754.7 cal/g = -406.41×10^4 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 30.64 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.28 psia

NOTES

p-XYLENE

XLP

Common Synonyms	Watery liquid	Colorless	Sweet odor
1, 4-Dimethylbenzene Xylol	Floats on water. Flammable, irritating vapor is produced. Freezing point is 56°F.		

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

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

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: p-$C_6H_4(CH_3)_2$
3.3 IMO/UN Designation: 3.2/1307
3.4 DOT ID No.: 1307
3.5 CAS Registry No.: 106-42-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Like benzene; characteristic aromatic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 Symptoms Following Exposure: Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma. Can be fatal. Kidney and liver damage can occur.
5.3 Treatment of Exposure: INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 300 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Kidney and liver damage.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.05 ppm
5.11 IDLH Value: 10,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 81°F C.C.
6.2 Flammable Limits in Air: 1.1%-6.6%
6.3 Fire Extinguishing Agents: Foam, dry chemical, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective.
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 870°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.8 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 22 ppm/96 hr/bluegill/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0 lb/lb in 5 days
8.4 Food Chain Concentration Potential: Data not available

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research: 99.99%; Pure: 99.8%; Technical: 99.0%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 106.16
12.3 Boiling Point at 1 atm: 280.9°F = 138.3°C = 411.5°K
12.4 Freezing Point: 55.9°F = 13.3°C = 286.5°K
12.5 Critical Temperature: 649.4°F = 343.0°C = 616.2°K
12.6 Critical Pressure: 509.4 atm = 34.85 psia = 3.510 MN/m²
12.7 Specific Gravity: 0.861 at 20°C (liquid)
12.8 Liquid Surface Tension: 28.3 dynes/cm = 0.0283 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 37.8 dynes/cm = 0.0378 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.071
12.12 Latent Heat of Vaporization: 150 Btu/lb = 81 cal/g = 3.4 X 10⁴ J/kg
12.13 Heat of Combustion: −17,559 Btu/lb = −9754.7 cal/g = −408.41 X 10⁴ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 37.83 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.34 psia

NOTES

XYLENOL

XYL

Common Synonyms	Solid or liquid	Light yellowish brown	Sweet tarry odor
Dimethylphenol 2, 6-Xylenol Cresylic acid 2-Hydroxy-m-xylene	May float or sink in water.		

Stop discharge if possible. Keep people away.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
POISONOUS GASES ARE PRODUCED IN FIRE.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemicals, foam or carbon dioxide.
Water may be ineffective on fire.

Exposure

CALL FOR MEDICAL AID.

DUST
Irritating to eyes, nose and throat.
Harmful if inhaled.
Move victim to fresh air.
If in eyes, hold eyelids open and flush with plenty of water.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID OR SOLID
Irritating to skin and eyes.
If swallowed or skin is exposed will cause nausea and vomiting.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-water contaminant
Restrict access
Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: 2, 6-$(CH_3)_2C_6H_3OH$
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: 2261
3.5 CAS Registry No.: 1300-71-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid or liquid
4.2 Color: Light yellow-brown
4.3 Odor: Sweet tarry

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Organic canister mask; goggles or face shield; rubber gloves; other protective clothing to prevent contact with skin.

5.2 Symptoms Following Exposure: Vapor irritates eyes, nose, and throat and is readily absorbed through mucous membranes and lungs, producing general toxic symptoms (weakness, dizziness, headache, difficult breathing, twitching). Contact with skin causes temporary pricking and intense burning, then local anesthesia. Affected areas initially show white discoloration, wrinkling, and softening, then become red, then brown or black (signs of gangrene). Extensive burns may permit absorption of chemical to produce toxic symptoms described above. Ingestion causes irritation of mouth and stomach, nausea, abdominal pain, weakness, dizziness, headache, difficult breathing, and twitching.

5.3 Treatment of Exposure: Get medical attention at once following exposure to this compound. INHALATION: remove patient immediately to fresh air, irritation of nose or throat may be somewhat relieved by spraying or gargling with water until all odor is gone; 100% oxygen inhalation is indicated for cyanosis or respiratory distress; keep patient warm, but not hot. EYES: flood with running water for 15 min.; if physician is not immediately available, continue irrigation for another 15 min.; 2-3 drops of 0.5% pontocaine or equivalent may be instilled after first 15 min.; do not use oils or oily ointments unless ordered by physician. SKIN: wash affected areas with large quantities of water or soapy water until all odor is gone; then wash with alcohol or 20% glycerin solution and more water; keep patient warm, but not hot; cover chemical burns continously with compresses wet with saturated solution of sodium thiosulfate; apply no salves or ointments for 24 hrs after injury. INGESTION: give large quantities of liquid (salt water, weak sodium bicarbonate solution, milk, or gruel) followed by demulcent such as raw egg white or corn starch paste; if profuse vomiting does not follow immediately, give a mild emetic (such as 1 tbsp. mustard in glass of water), or tickle back of throat. Repeat procedure until vomitus is free of the odor. Some demulcent should be left in stomach after vomiting. Keep patient comfortably warm.

5.4 Threshold Limit Value: 45 ppm
5.5 Short Term Inhalation Limits: Data not available

(Continued)

6. FIRE HAZARDS

6.1 Flash Point: 186°F C.C.
6.2 Flammable Limits in Air: 1.4% (LFL)
6.3 Fire Extinguishing Agents: Water, dry chemical, foam, carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic vapors of unburned material may form in fire.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 1110°F
6.8 Electrical Hazard: Data not available
6.9 Burning Rate: Data not available
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
(2, 6 isomer)
7-9 ppm/*/trout/lethal/fresh water
*Time period not specified.
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 31% of theoretical in 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: 99% 2, 6-Xylenol. Other commercial Xylenols include 2, 3-; 2, 4-; 2, 5-; 3, 4-; 3, 5-; and various mixtures of these. Properties are similar to those of the 2, 6- compound.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-X-Y

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid or liquid
12.2 Molecular Weight: 122.2
12.3 Boiling Point at 1 atm: 413°F = 212°C = 485°K
12.4 Freezing Point: —40 to +106°F = —40 to +45°C = 233 to 318°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.01 at 20°C (liquid)
12.8 Liquid Surface Tension: (est.) 30 dynes/cm = 0.030 N/m at 30°C
12.9 Liquid Water Interfacial Tension: (est.) 25 dynes/cm = 0.025 N/m at 25°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: 212.74 Btu/lb = 118.19 cal/g = 4.9451 X 10^5 J/kg at 25°C
12.13 Heat of Combustion: —15,310 Btu/lb = —8,500 cal/g = —356 X 10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

5. HEALTH HAZARDS (Continued)

5.6 Toxicity by Ingestion: Grade 2; oral LD_{50} = 1,070 mg/kg (mouse)
5.7 Late Toxicity: Damage to heart muscle, and changes in liver, kidney, and spleen in rats
5.8 Vapor (Gas) Irritant Characteristics: Data not available
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

APPENDIX C

PERSONAL FORMS AND LOGS

PERSONAL HAZARDOUS WASTE EXPOSURE RECORD

NAME: _____

SITE: _____ DATE: _____

NUMBER OF HOURS ON SITE: _____

CONDITION OF SITE: _____

AMBIENT AIR/SOIL/WATER INDICATORS:

LABORATORY: G.C. _____ ON-SITE: G.C. _____

P.I. METER _____ P.I. METER _____

OTHER _____ OTHER _____

TYPE OF EXPOSURE (i.e. inhalation, soil/water contact): _____

_____

OPERATION PERFORMED (i.e. test pit inspection, sampling, drilling): _____

_____

CHEMICALS BURIED OR KNOWN PRESENT: _____

_____

PROTECTIVE EQUIPMENT WORN:

- ☐ SAFETY SHOES (STEEL TOE & SHANK)
- ☐ CHEMICAL RESISTANT BOOTS, TYPE: _____
- ☐ HALF-FACE RESPIRATOR
  TYPE OF CARTRIDGE: _____
- ☐ FULL-FACE RESPIRATOR
  TYPE OF CARTRIDGE: _____
- ☐ INNER LAB GLOVES
- ☐ OUTER CHEMICAL RESISTANT GLOVES
  TYPE: _____
- ☐ COVERALLS
  TYPE: _____
- ☐ _____

DECONTAMINATION MEASURES TAKEN:

- ☐ CHANGE OF CLOTHES
- ☐ SHOWER
- ☐ CHANGE OF PROTECTIVE EQUIPMENT
- ☐ _____
- ☐ _____
- ☐ _____

PERSONAL PROTECTIVE DECONTAMINATION PROCEDURES: _____

_____

_____

UNUSUAL SITE CONDITIONS/OCCURANCES: _____

_____

OBSERVED HEALTH EFFECTS: _____

_____

TES: _____

_____

_____

DAILY SAFETY LOG

PROJECT NAME: _____ DATE: _____

PROJECT NUMBER: _____ DAY NO: _____

E.C. JORDAN WORK PARTY: _____

_____

_____

SUBCONTRACTOR ( ): _____

_____

_____

VISITORS: _____

_____

WORK SITE LOCATION: _____

_____

_____

SUMMARY OF CONDITIONS ENCOUNTERED: _____

_____

_____

_____

_____

FIRST AID ADMINISTERED? _____

_____

_____

INFRACTIONS OBSERVED: _____

_____

BY: _____

APPENDIX D

MISCELLANEOUS REPORTS

SITE SAFETY FOLLOW-UP REPORT

(To be completed for each field change in plan.)

Was the HASP followed as presented? ___yes ___no

DESCRIBE IN DETAIL ANY CHANGES TO THE HASP:

REASON FOR CHANGES:

APPROVED BY SITE MANAGER: DATE:
SITE SAFETY OFFICER: DATE:

EVALUATION OF HEALTH AND SAFETY PLAN

Was the HASP adequate? ___yes ___no

WHAT CHANGES WOULD YOU RECOMMEND?

ACCIDENT REPORT

Site: _____ Project No.: _____
Location: _____
Location of Accident if different from above: _____
_____
Name and Address of Injured: _____
_____
SSN: _____ DOB: _____ Sex: _____
Years of Service: _____ Time on Present Job: _____ Department No.: _____
Title/Classification: _____
Date of Accident: _____ Time of Accident: _____
Name of Witness: _____ Telephone No.: _____

Accident Category: __ Motor Vehicle __ Property Damage __ Fire
__ Chemical Exposure __ Near Miss __ Other

Severity of Injury or Illness: __ Non-disabling __ Disabling
__ Medical Treatment __ Fatality

Amount of Damage: $_____ Property Damaged: _____

CLASSIFICATION OF INJURY

__ Fractures
__ Dislocations
__ Sprains
__ Abrasions
__ Lacerations
__ Punctures
__ Bites
__ Respiratory Allergy
__ Other (explain) _____

__ Heat Burns
__ Chemical Burns
__ Radiation Burns
__ Concussion
__ Toxic-Respiratory
__ Toxic-Ingestion
__ Toxic Dermal

__ Cold Exposure
__ Heat Stroke
__ Faint/Dizziness
__ Blisters
__ Bruises
__ Poison Ivy
__ Headache

Parts of Body Affected: _____

Degree of Disability: _____

Date Medical Care was Received: _____ Emergency Service? _____

Name and Address of Medical Facility: _____
_____

Follow-up Exam Required? _____ Estimated No. of Days Away From Job: _____

ACCIDENT LOCATION (use the back of sheet as required)

Causative agent most directly related to accident (object, substance, material, machinery, equipment, conditions):

Was weather a factor? How?

Unsafe mechanical/physical/environmental condition at time of accident (be specific):

Unsafe act by injured and/or others contributing to the accident (be specific, must be answered):

Personal factors (improper attitude, lack of knowledge or skill, slow reaction, fatigue, inattention, horseplay):

MODIFICATIONS

Level of personal protective equipment required in site safety plan: _____
Was injured using required equipment? _____
If not, how did actual equipment use differ from plan?

Was personal protective equipment required in site safety plan adequate for site conditions? _____

If no, what additional equipment was needed:

What can be done to prevent a reoccurrence of this type of accident? (modification of machine, mechanical guards, modification of work practices, training):

DETAILED NARRATIVE DESCRIPTION (how did accident occur, why; objects, equipment, tools used, circumstance assigned duties. Be specific.):

Signature of Preparer: _____ Date: _____

Signature of Site Manager: _____ Date: _____

SEND COPIES OF COMPLETED FORM TO HUMAN RESOURCES
AND THE HEALTH AND SAFETY SUPERVISOR.

APPENDIX E

HEAT STRESS CASUALTY PREVENTION PLAN

HEAT STRESS CASUALTY PREVENTION PLAN

Due to the increase in ambient air temperatures and the effects of protective outer wear decreasing body ventilation, there exists an increase in the potential for injury, specifically, heat casualties. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim and the prevention of heat stress casualties.

A. IDENTIFICATION AND TREATMENT

1. Heat Exhaustion

a) Symptoms: Usually begins with muscular weakness, dizziness, nausea, and a staggering gait. Vomiting is frequent. The bowels may move involuntarily. The victim is very pale, his skin is clammy, and he may perspire profusely. The pulse is weak and fast, breathing is shallow. The victim may faint unless he lies down. This may pass, but sometimes it persists and, while heat exhaustion is generally not considered life threatening, death could occur.

b) First Aid: Immediately remove the victim to the Decomtamination Reduction Zone in a shady or cool area with good air circulation. Remove all protective outer wear. Call a physician. Treat the victim for shock. (Make the victim lie down, raise feet 6-12 inches, maintain body temperature but loosen all clothing.) If the victim is conscious, it may be helpful to give sips of water. Transport victim to a medical facility.

2. Heat Stroke

a) Symptoms: This is the most serious of heat casualties due to the fact that the body excessively overheats. Body temperatures often are between 107°- 110°F. The victim will have a red face and will not be sweating. First there is often pain in the head, dizziness, nausea, oppression, and a dryness of the skin and mouth. Unconsciousness follows quickly and death is imminent if exposure continues. The attack will usually occur suddenly. Heat stroke is always serious.

b) First Aid: Immediately evacuate the victim to a cool and shady area in the Decontamination Reduction Zone. Remove all protective outer wear and all personal clothing. Lay the victim on his back with the head and shoulders slightly elevated. It is imperative that the body temperature be lowered immediately. This can be accomplished by applying cold wet towels, ice bags, etc., to the head and groin. Sponge off the bare skin with cool water or rubbing alcohol, if available, or even place in a tub of cool water. The main objective is to cool without chilling. Give no stimulants. Transport the victim to a medical facility as soon as possible.

B. PREVENTION OF HEAT STRESS

1) One of the major causes of heat casualties is the depletion of body fluids. Fluids should be maintained in the support zone. Personnel should replace water and salts loss from sweating. Salts can be replaced by either a 0.1% salt solution, more heavily salted foods, or commercial mixes such as Gatorade. The commercial mixes are advised for personnel on low sodium diets.

2) A work schedule will be established during warm weather so that the majority of the work day will be during the morning hours of the day before ambient air temperature levels reach their highs.

3) A work/rest schedule will be implemented for personnel required to wear Level B or C protection (i.e. impervious outer garment). A sufficient period will be allowed for personnel to "cool down". This may require shifts of workers during operations in addition to the breaks provided by required air tank changes (Level B). Maximum time between breaks at Level B or C shall be two hours regardless of temperature. At elevated temperatures, breaks should be scheduled as described below.

Ambient Temperatures	Maximum Time Between Cooldown Breaks
Above 90°F	1/4 hr.
85°-90°F	1/2 hr.
80°-85°F	1 hr
70°-80°F	1 1/2 hr.

4) Periodic breaks for "cooldown" and liquid replenishment should also be scheduled while wearing any chemical resistant outer wear.

C. HEAT STRESS MONITORING

For monitoring the body's recuperative ability to excess heat, one or more of the following techniques should be used as a screening mechanism. Monitoring of personnel wearing impervious clothing should commence when the ambient temperature is 70°F or above. Frequency of monitoring should increase as the ambient temperature increases or as slow recovery rates are indicated. When temperatures exceed 85°F, workers should be monitored for heat stress after every work period. The following are important considerations:

1. Heart rate (HR) should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats/minute. If the HR is higher, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. If the pulse rate is 100 beats/minute at the beginning of the next rest period, the following work cycle should be shortened by 33 percent.
2. Body temperature should be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature (OT) at the beginning of the rest period should not exceed 99°F. If it does, the next work period should be shortened by 10 minutes (or 33 percent), while

the length of the rest period stays the same. However, if the OT exceeds 99.7°F at the beginning of the next period, the following work cycle should be further shortened by 33 percent. OT should be measured again at the end of the rest period to make sure that it has dropped below 99°F.

3. Good hygienic standards must be maintained by frequent change of clothing and daily showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

E.C. JORDAN CO.
RESPIRATORY PROTECTION PROGRAM

I. INTRODUCTION

This program has been developed to govern the selection and use of respiratory protective devices by E.C. Jordan Co. (Jordan) personnel. The program is intended to comply with Occupational Safety and Health Administration (OSHA) requirements as set forth in 29 CFR 1910.134(b). The scope of this program is limited to activities related to field investigations of potentially hazardous waste disposal sites.

II. PERSONNEL REQUIREMENTS

All personnel assigned to field activities at hazardous or potentially hazardous locations are currently required by Jordan's Health and Safety policies to be enrolled in the corporate Health Monitoring Program. A portion of this program involves spirometry, a measure of the respiratory system status. No personnel may be assigned to the use of, or withdraw from stock, any respiratory protective device without physician certification that use of such a device will not be injurious to health. Psychological limitations, e.g. claustrophobia, are also considered in personnel assignments. Training in the use of the selected device and fit testing, as described herein, are also required.

No personnel will be assigned duties which require a respirator when facial hair, skullcaps or eye glasses will interfere with a proper fit. No contact lenses may be worn with any respiratory protective device. Eyeglass frames which fit inside the respirator facepiece are provided as necessary.

III. APPLICABLE EQUIPMENT

Jordan maintains the following respiratory protective equipment:

- full-face chemical/mechanical air purifying respirators
- self-contained breathing apparatus
- full-face air line-supplied breathing apparatus
- 5-minute escape air supply

This equipment is intended for use on an as needed basis, to be determined by an evaluation of on-site conditions. Respiratory protective equipment should not be used arbitrarily by any Jordan personnel.

Selection criteria are presented separately; training is required in the use of <u>each</u> type of equipment prior to drawing from stock.

IV. PERSONNEL TRAINING

Training of personnel in the proper use and care of respiratory protective equipment is considered essential to the success of the program. Training encompasses:

- respiratory protection principles
- selection of appropriate equipment
- use of equipment
- maintenance of equipment
- fit testing

Information regarding each topic is presented as standard respiratory protection procedures.

V. STANDARD RESPIRATORY PROTECTION PROCEDURES

The following information has been organized and presented by topic as Standard Respiratory Protection Procedures, to be used both in training and as reference material for field operations.

Standard Respiratory Protection Procedure No.	Topic
1	Respiratory Protection Principles
2	Selection of Respirators
3	Fit Testing
4	Inspection/Maintenance/Storage

These procedures are attached.

VI. PROGRAM ADMINISTRATION AND DOCUMENTATION

The administration of Jordan's Respiratory Protection Program is the responsibility of the Health and Safety Supervisor. Administration includes:

- respirator selection
- personnel training
- fit testing
- respirator maintenance
- documentation
- program evaluation and improvements
- personnel pulmonary testing and certification

Written HASPs for each site, and site hazard assessments result in respirator selection in accordance with the decision logic set forth in Standard Respiratory Protection Procedure No. 2.

Fit testing and respirator maintenance is performed by the equipment manager of Jordan's Sample Control and Staging Center under the administration of the HSS. Major maintenance is performed by manufacturer certified technicians

only. Personnel training in respiratory protection is one aspect of the HSS's ongoing personnel training programs. Program evaluation is a dynamic process, occurring each time a Project HASP is prepared.

Medical supervision of personnel occurs as part of Jordan's Health Monitoring Program, also administered by the HSS. Medical surveillance is required for all personnel assigned to hazardous or potentially hazardous site activities.

Documentation of the various elements of Jordan's Respiratory Protection Program is achieved through several media:

- Documentation of respirator selection is included in the hazard assessment of each site's HASP.

- Documentation of personnel training is maintained in both hard-copy and computerized files.

- Documentation of medical surveillance is achieved indirectly by maintaining a list of enrolled employees in the Health Monitoring Program and directly through physician certification of personnel allowed to be assigned respiratory protective devices.

- Documentation of fit-testing is maintained on file with the equipment manager of the Sample Control and Staging Center, utilizing the appropriate form. (Exhibit 1)

- Documentation of site surveillance is required both by this program and by the HASP for each site. Records of site surveillance are created by the HSO and maintained in project files.

- Respirator inspection and maintenance records are created and maintained for each respirator, SCBA, and escape respirator by the equipment manager. (Exhibit 2)

  Inspection and documentation occurs before each unit is removed from stock and when it is returned, or monthly.

Exhibit 1

Respirator Fit Test Worksheet

RESPIRATOR FIT TEST WORKSHEET

Applicant Name _____

Organization _____

Date of Test _____

Employee Number _____

Equipment Type _____

Manufacturer _____

Model/Size _____

Test Conducted by _____

TEST RESULTS

(1)	Negative Pressure Test	Pass ( )	Fail ( )	_____
(2)	Positive Pressure Test	Pass ( )	Fail ( )	_____
(3)	Isoamyl Acetate Vapor Test			
	Initial Odor Recognition	Yes ( )	No ( )	_____
	Odor Detected w/ Respirator On	Yes ( )	No ( )	_____
(4)	Irritant Smoke Test			
	Irritant Detected	Yes ( )	No ( )	_____

Employee briefed on fundamental principals of respiratory protection, use, inspection, cleaning, maintenance and storage of equipment
Yes ( ) No ( )

ADDITIONAL INFORMATION

Last Employee Physical Exam Conducted on _____
Stress Test Included Yes ( ) No ( )

At Medical Facility _____

Corrective Lenses Required for Normal Work Tasks Yes ( ) No ( )

Facial Characteristics: Clean Shaven ( ) Beard ( ) Other ( ) _____
Specify

Follow-up Physical Due _____

I hereby certify the subject employee has been fit tested according to procedures specified in RESPIRATORY PROTECTION PROCEDURE NO. 3.

_____ _____
Tester Name Date

Exhibit 2

Respirator Use & Maintenance Record

RESPIRATOR USE AND MAINTENANCE RECORD

Respirator

_____
ID Number

Respirator Type _____

Manufacturer _____

Model Number _____ Date Place In Service _____

Date	Assigned to Whom or Location of Storage	Inspection/Maintenance and Charging (SCBAs) Information	Serviced By

STANDARD RESPIRATORY PROTECTION PROCEDURE NO. 1
RESPIRATORY PROTECTION PRINCIPLES

1.1 INTRODUCTION

Since the lungs are not completely effective in protecting the body against respirable chemical hazards, they must be artificially protected from toxic gases, vapors, and particulates. In addition, the body must be supplied with enough oxygen to maintain a normal capacity to perform tasks.

1.2 ROUTES OF EXPOSURE

The volume of air inhaled during "normal" activities is approximately 6 /min. The volume of air inhaled during brisk activity or during periods of stress can go up to 75 /min (a 12-fold increase).

Air is inhaled through the nose and mouth and travels an extremely turbulent path to the lungs. This turbulency results in the air impinging on many sites, thus allowing the insoluble particulates to become impacted and soluble particulates, vapors, and gases to become absorbed.

The inhaled air passes through the pharynx, the common passageway for both food and air, and enters the trachea at the larynx. The trachea (or windpipe) divides into two bronchi, which lead to the two lungs. All of these organs are collectively called the conducting tubes, since they lead the air to the alveoli, the site of gaseous exchange with the pulmonary capillaries (i.e., the blood).

Toxic substances may be absorbed at any point in the respiratory tract. The conducting tubes are lined with mucus and cilia. Insoluble contaminants caught in the mucus are swept up to the esophagus by the cilia and swallowed, thus causing an ingestion problem.

1.3 OXYGEN DEFICIENCY

1.3.1 Oxygen and the Respiratory Process

The chemical composition of normal air is presented below as Table 1.

Table 1. Atmospheric Composition

Gas	Volume (%)	Partial Pressure (mm Hg at sea level)
Nitrogen	78.9	594
Oxygen	20.95	159
Argon	0.93	7
Carbon dioxide	0.04	0.03

It is not the percentage of oxygen in the air, but rather its partial pressure, that is important in respiration. As one increases in altitude, the percentage of oxygen stays constant, but its partial pressure drops. Additionally, as the percentage of oxygen in the air drops, so does its partial pressure.

The "anatomic dead space volume" of the respiratory tract is about 150 ml. The average breath draws in about 500 ml of air. This air is mixed with the air remaining in the dead space from the previous exhalation, which has been depleted in oxygen due to the normal respiratory process. The overall effect is a lower partial pressure of oxygen in the respiratory tract as compared with the ambient air. The average respirator adds about 100 ml of dead space to the respiratory system, which further lowers the partial pressure of oxygen in the respiratory system, causing a slight oxygen deficiency.

1.3.2 Oxygen Levels/Physiological Effect

The currently accepted National Institute for Occupational Safety and Health (NIOSH) standards specify that if an atmosphere contains less than 19.5 percent by volume oxygen at sea level, then an atmosphere-supplying device must be used.

Note that as altitude increases, the percentage of oxygen stays constant, but the partial pressure drops. There is currently no standard that accounts for the drop in partial pressure with altitude; the problem is currently under study by NIOSH.

The physiological effects of oxygen deficiency are indicated in Table 2.

1.4 PARTICULATE CONTAMINANTS - AEROSOLS

Aerosol is a term used to describe particulates in air without regard to their origin. Particulates are collected on the walls of the respiratory tract depending upon their size as follows:

1. Pharynx - 10-3 μm
2. Trachea - 10 μm
3. Bronchus - 5-10 μm
4. Alveoli - 0.1-1 μm

Particulates less than 0.5 μm may never be deposited in the respiratory tract and may simply be exhaled.

Particulates affect the human body as follows:

1. Nuisances - inert substances that cause no lung damage but inhibit proper functioning of the lungs.

2. Inert pulmonary reaction causing substances - substances that produce nonspecific pulmonary effects.

Table 2. Physiological Effects of Oxygen Deficiency

Oxygen Volume Percentage at Sea Level	Physiological Effect
16-12	Increased breathing volume. Accelerated heartbeat. Impaired attention and thinking. Impaired coordination.
14-10	Very faulty judgment. Very poor muscular coordination. Muscular exertion causes rapid fatigue that may cause permanent heart damage. Intermittent respiration.
10-6	Nausea. Vomiting. Inability to perform vigorous movement, or loss of all movement. Unconsciousness, followed by death.
Less than 6	Spasmatic breathing. Convulsive movements. Death in minutes.

3. Pulmonary fibrosis causing substances - substances that produce effects ranging from nodule production to serious diseases such as asbestosis.

4. Irritants - substances that irritate, inflame, or ulcerate lung tissues.

5. Systemic poisons - substances that cause injury to specific organs and body systems.

6. Allergens - substances that produce hypersensitivity.

1.5 GASEOUS CONTAMINANTS

Gaseous contaminants are "filtered" to a small degree by the respiratory tract before they reach the alveolar spaces. However, if the contaminants are soluble, they can be directly absorbed through the walls of the respiratory tract.

Gaseous contaminants affect the human body as follows:

1. Irritants - corrosive compounds that injure and inflame tissue.

2. Asphyxiants - substances that displace oxygen or prevent the use of oxygen by the body.

3. Anesthetics - substances that depress the central nervous system and cause intoxication or loss of sensation.

4. Systemic poisons - substances that cause diseases.

1.6 EXPRESSING AIR CONTAINMENT CONCENTRATIONS

Any substances that are not normal components of breathing air (oxygen, nitrogen, etc.) are considered to be contaminants. The respiratory threat posed by contaminants is a function of the actual contaminant and its concentration in the air. The concentration is expressed in a variety of ways, as listed below.

1. Particulates

   a. mppcf - millions of particulates per cubic foot.

   b. ppcc - particles per cubic centimeter.

   c. mg/m^3 - milligrams per cubic meter.

2. Gases and Vapors

   a. ppm - volumes per million volumes of air (parts per million).

   b. ppb - volumes per billion volumes of air (parts per billion).

   c. mg/m - milligrams of gas per cubic meter.

   d. Conversion of units. The following equation converts mg/m to ppm, at 24°C and 760 mm Hg.

$$\text{ppm} = \frac{24.45}{\text{molecular weight}} \, mg/m^3,$$

   This equation is extremely useful for determining respiratory protection requirements.

1.7 MEASURES OF RESPIRATORY HAZARDS

Every contaminant contained in breathing air has a limit, above which it becomes a threat to human health. These limits are determined either from animal studies or from epidemiological data. Unfortunately, animal studies can only approximate human response and may vary widely for individual chemicals. Epidemiological studies, although capable of providing a more precise forecast of human response, are limited by a lack of accurate records and a lack of controlled studies. Therefore, the "safe" limits of various chemicals must be viewed only as guidelines. Furthermore, these guidelines are primarily designed for the industrial situation where an individual is being exposed to one or two well-defined substances. These guidelines do not address the problems of synergism, potentiation, or allergic response.

The guidelines used in measuring respiratory hazards are listed below.

1. Threshold Limit Value. The threshold limit value (TLV) is recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) and is derived from consensus review. It is a time-weighted average concentration set for a particular substance that represents a level that almost all workers can be exposed to for an 8-hr day (40-hr week) without suffering adverse health effects. It is assumed that following each 8-hr. exposure there will be a 16-hr. recovery period and that after 5 days there will be a 48-hr. recovery period. The TLV lists are revised on a yearly basis.

2. Permissible Exposure Limits. The permissible exposure limits (PELs) are set forth in the Occupational Safety and Health Administration (OSHA) Standards 29 CFR 1910.1000, Tables Z-1, Z-2, and Z-3. These levels were promulgated initially from the ACGIH TLV lists (1968). As part of the law, they represent the legal maximum concentrations for personnel exposure. They are not updated on a yearly basis, as is the TLV list. Therefore, the most current ACGIH TLV is used in determining respiratory protection, rather than the PEL listing.

3. Immediately Dangerous to Life and Health. 30 CFR 11.3 defines conditions that are immediately dangerous to life and health (IDLH) as "conditions that pose an immediate threat to life or health or conditions that pose an immediate threat of severe exposure to contaminants such as radioactive materials, which are likely to have an adverse cumulative or delayed effect on health".

   OSHA adds these criteria:

   a. The worker must be able to escape without losing his life or suffering permanent health damage within 30 minutes.

   b. The worker must be able to escape without severe eye or respiratory irritation or other reactions.

4. Lower Flammable Limit. The lower flammable limit (LFL) is the lowest concentration by volume of a gas or vapor in air that will explode when there is an ignition source.

1.8 RESPIRATORY PROTECTION

When it has been determined that the ambient atmosphere is hazardous, it becomes necessary to protect the individual by:

1. avoiding and/or minimizing exposure;

2. applying engineering controls such as ventilation; and

3. using a respirator to either filter the air or supply air.

The legal requirements for respiratory protection are summarized below.

1. Williams and Steiger Occupational Safety and Health Act of 1970 established standards that state that "approved or accepted respirators shall be used when they are available".

2. 29 CFR 1910.134 gives legal requirements for the selection and use of respiratory equipment as promulgated by OSHA and based on American National Standards Institute (ANSI) Standard Z88.2, "American National Standards Practices for Respiratory Protection". Standard Z88.2 was originally a consensus standard, but now has been cited as a Federal regulation.

3. 30 CFR Part 11 describes tests for permissibility of respiratory protective apparatus and updates or deletes approvals. 30 CFR Part 11 also cites ANSI Z88.2 as the basis for respiratory protection.

STANDARD RESPIRATORY PROTECTION PROCEDURE NO. 2
SELECTION OF RESPIRATORS

2.1 INTRODUCTION

This text is based on "Joint NIOSH/OSHA Standards Completion Program - Respirator Decision Logic". The text is excerpted for the purpose of covering the major points of the respirator decision logic. For the complete text, see John S. Pritchard's, "A Guide to Industrial Respiratory Protection" (U.S. Department of Health, Education, and Welfare, U.S. Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, Cincinnati, Ohio, June 1976). It is not intended to be all-inclusive in content.

The purpose of the respirator decision logic is to provide technical accuracy and uniformity in the selection of respirators and to provide necessary criteria to support this selection. The decision logic is a step-by-step elimination of inappropriate respirators until only those that are acceptable remain. Judgment by persons knowledgeable of inhalation hazards and respiratory protection equipment is essential to ensure appropriate selection of respirators.

The primary technical criteria for what constitutes a permissible respirator are based on the technical requirements of 30 CFR 11. The health standards will allow only respirators approved under 30 CFR 11. Classes of respirators are only included when at least one device has been approved.

Protection factors are criteria used in determining what limiting concentrations are to be permitted for each respirator type that will afford adequate protection to the wearer. The referenced Subparts of 30 CFR 11 give technical descriptions concerning each type or class of respirators referenced in the decision logic; 30 CFR 11 should be used with the decision logic in order to properly understand the criteria for the specification of allowable respirators.

Throughout this text, reference is made to PELs. Prudent, accepted practice dictates the use of current ACGIH TLVs, which are updated each year, in the place of the PEL, which is only periodically updated.

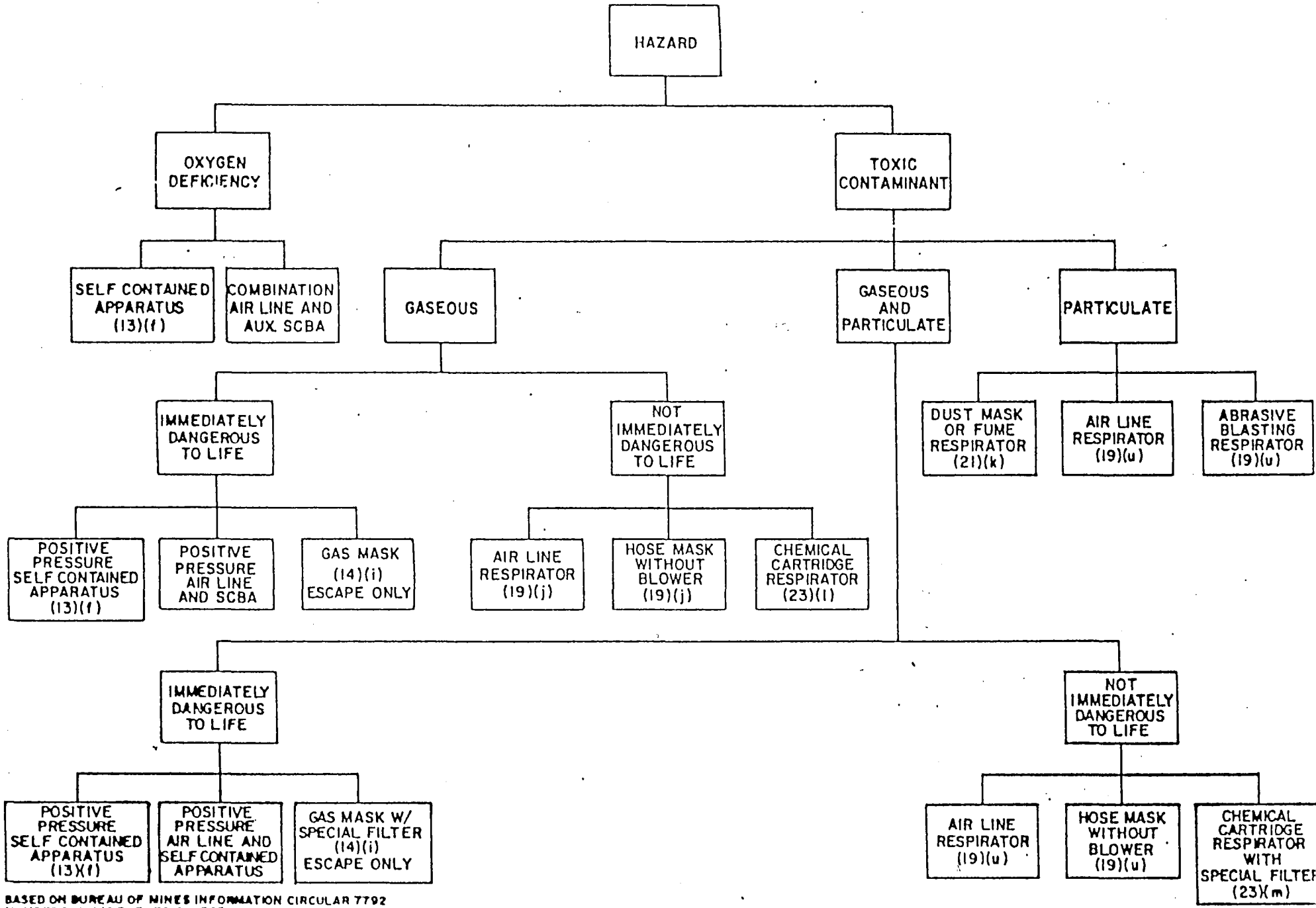
2.2 GENERAL DECISION LOGIC FLOWCHART

The following material used in concert with the decision logic chart (Figure 1) provides a formalized selection guide for respiratory protection.

1. Step 1 - Assemble Information on Substance. Assemble necessary toxicological, safety, and research information for the particular contaminant. The following are required:

    a. Permissible exposure limits specified in 29 CFR 1910.1000 (Tables Z-1, Z-2, and Z-3).

    b. Warning properties if the substance is a gas or a vapor.



BASED ON BUREAU OF MINES INFORMATION CIRCULAR 7792
NUMBERS IN PARENTHESIS REFER TO BUREAU OF MINES SCHEDULES
LETTERS IN PARENTHESIS REFER TO SUBPART OF NIOSH/MESA 30 CFR PART 11

FIGURE 1.
SELECTION OF RESPIRATORY EQUIPMENT (LUNDIN, A., 1979)

c. Eye irritation potential of the substance.

d. LFL for the substance.

e. IDLH concentration for the substance.

f. Any possibility of poor sorbent efficiency at IDLH concentration and below.

g. Any possibility of systemic injury of death resulting from absorbance of the substance (as a gas or vapor) through the skin.

h. Any possibility of severe skin irritation resulting from contact of the skin with corrosive gases, vapors, or particulates.

i. The vapor pressure of the substance (and equivalent ppm).

j. Any possibility of high heat of reaction with sorbent material in cartridge or canister.

2. Step 2 - Determine Physical State of Substance. Determine the physical state(s) of the substance as it is likely to be encountered in the occupational environment. It will be either (1) gas or vapor; (2) particulate (dust, fume or mist); or (3) combination of (1) and (2).

3. Step 3 - Assemble a Table of Permissible Respiratory Protection for Substance. This is done using the material from Step 1 and the appropriate specific decision logic chart from Section 2.3 below and respirator protection factors. Classes of respirators are only included where at least one device has been approved.

4. IF STEPS 1 THROUGH 3 CANNOT BE COMPLETED, THE ATMOSPHERE IS UNKNOWN AND MUST BE CLASSIFIED IDLH. ONLY POSITIVE PRESSURE SCBA MAY BE SELECTED.

2.3 SPECIFIC DECISION LOGIC CHARTS

A decision logic chart for respiratory protection against gases or vapors and against particulates is shown as Figure 1.

2.4 DECISION LOGIC CRITERIA

2.4.1 Skin Absorption and Irritation

Respirator selection criteria are based primarily on the inhalation hazard of the substance. A supplied-air suit may protect the skin from extremely toxic substances that may be absorbed through the skin or from substances which may cause severe skin irritation or injury.

Supplied-air suits are not covered in 30 CFR 11. Data are not available upon which to make recommendations for supplied-air suits for all types of exposures.

Where information is available indicating systemic injury or death resulting from absorbance of gas or vapor through the skin or where severe skin irritation or injury may occur from exposure to a gas, corrosive vapor, or particulate, the following statement is included as a footnote to the respirator tables, and both the employee and employer are cautioned in the appendices concerning their use:

> Use of supplied-air suit may be necessary to prevent skin contact and respiratory exposure from airborne concentrations of (specific substance). Supplied-air suits should be selected, used, and maintained under the immediate supervision of persons knowledgeable in the limitations and potential life-endangering characteristics of supplied-air suits. Where supplied-air suits are used above a concentration which may be IDLH (concentration), an auxiliary positive-pressure self-contained breathing apparatus must also be worn.

As a guideline for inclusion of the supplied air-suit statement for substances that are sorbed through the skin, a single skin penetration LD_{50} of 2 g/kg for any species is used.

2.4.2 Poor Warning Properties (Refer to Table 1)

It is important to realize that 30 CFR 11 approvals for air-purifying (organic vapor) devices prohibit use against organic vapors with poor warning properties.

Warning properties include odor, eye irritation, and respiratory irritation. Warning properties relying upon human senses are not foolproof. However, they provide some indication to the wearer of possible sorbent exhaustion or of poor facepiece fit or other respirator malfunction.

Adequate warning properties can be assumed when the substance odor, taste, or irritation effects are detectable and persistent at concentrations at or below the permissible exposure limit.

If the odor or irritation threshold of a substance is more than three times greater than the permissible exposure limit, this substance should be considered to have poor warning properties. If the substance odor or irritation threshold is somewhat above the permissible exposure limit (not in excess of three times the limit) and there is no ceiling limit, consideration is given to whether undetected exposure in this concentration range could cause serious or irreversible health effects. If not, the substance is considered to have adequate warning properties. Some substances have extremely low thresholds of odor and irritation in relation to the permissible exposure limit. Because of this, these substances can be detected by a worker within the facepiece of the respirator even when the respirator is functioning properly. These substances are, therefore, considered to have poor warning properties.

Though 30 CFR 11 does not specifically eliminate air-purifying respirators for pesticides with poor warning properties, prudent practice dictates that a respirator should not be used to protect against any substance with poor warning properties.

TABLE 1. COMPARISON OF ODOR THRESHOLDS AND TLVs FOR SELECTED CHEMICAL COMPOUNDS

Compounds	Odor Threshold (ppm)	TLV (ppm)
Group 1 - Odor Threshold Below or Approximately the Same as the TLV		
Acrolein	0.2	0.1
Carbon tetrachloride	10	5
Carbon disulfide	0.21	10
Cyclohexane	300	300
Cyclohexanol	100	50
Epichlorhydrin	10	2
Ethyl benzene	140	100
Ethylene diamine	11	10
Hydrogen chloride	10	5
Methyl acetate	200	200
Methylamine	10	10
Methyl chloride	25	50
Methyl chloroform	300	350
Nitrogen dioxide	5	3
Propyl alcohol	200	200
Turpentine	200	100
Group 2 - Odor Threshold from 2 to 10 Times the TLV		
Allyl alcohol	7	2
Arsine	0.21	0.05
Crotonaldehyde	7	2
1,2 Dichloroethylene	500	200
Dichloroethyl ether	35	5
Dimethyl acetamide	46	10
Dimethyl formamide	100	10
Hydrogen selenide	0.3	0.05
Isopropyl glycidyl ether (IGE)	300	50
Styrene monomer	200	50
Group 3 - Odor Threshold Equal to or Greater Than 10 Times TLV		
Acrylonitrile	21	2
Bromoform	530	0.5
Camphor (synthetic)	1.6-200	2
Chloroacetophenone	1	0.05
Chloroform	200	10
Chloropicrin	1	0.1
Diglycidyl ether (DGE)	5	0.1

TABLE 1. COMPARISON OF ODOR THRESHOLDS AND TLVs FOR SELECTED CHEMICAL COMPOUNDS (cont.)

Compounds	Odor Threshold (ppm)	TLV (ppm)
Group 3 - Odor Threshold Equal to or Greater Than 10 Times TLV (cont.)		
Ethylene oxide	500	1
Mercury vapor	(a)	0.05 mg/m³
Methyl bromide	(a)	5
Methyl formate	2000	100
Methanol	2000	200
Methyl cyclohexanol	500	50
Phosgene	1.0	0.1
Phosphine	(a)	0.3
Radioactive gases and vapors	(a)	
Toluene 2,4 diisocyanate (TDI)	2	0.005

(a) Information not Available

2.4.3 Sorbents

There are certain limitations involved with the use of sorbents in cartridge/canister sorbents. When the following conditions occur, a sorbent cartridge is not recommended:

1. Where supporting evidence exists of immediate (less than 3 min.) breakthrough time at the IDLH concentration and below for a cartridge or canister sorbent, air-purifying devices shall not be allowed for any use, escape or otherwise. See Table 2.

2. Where there is reason to suspect that commonly used sorbents (e.g., activated charcoal) do not provide adequate sorption efficiency against a specific contaminant, use of such sorbents shall not be allowed. However, where another sorbent material has been demonstrated to be effective against a specific contaminant, approved respirators using the effective sorbent material shall be allowed.

3. Where there is reason to suspect that a sorbent has a high heat of reaction with a substance, use of that sorbent is not allowed.

4. Where there is reason to suspect that a substance sorbed on a sorbent of a cartridge or canister is shock sensitive, use of air-purifying respirators is disallowed.

2.4.4 Eye Irritation

In addition to respiratory protection, it is important to consider a chemical's potential for producing eye irritation or damage. The following guidelines deal with eye protection:

TABLE 2. EFFECT OF SOLVENT VAPOR ON RESPIRATOR CARTRIDGE EFFICIENCY[a]

Solvent	Time to Reach 1 Percent Breakthrough (10 ppm) (Min)
Aromatics	
Benzene	73
Toluene	94
Ethyl benzene	84
m-Xylene	99
Cumene	81
Mesitylene	86
Alcohols	
Methanol	0.2
Ethanol	28
Isopropanol	54
Allyl alcohol	66
n-Propanol	70
Sec-Butanol	96
Butanol	115
2-Methoxyethanol	116
Isoamyl alcohol	97
4-Methyl-2-pentanol	75
2-Ethoxyethanol	77
Amyl alcohol	102
2-Ethyl-1-butanol	76.5
Monochlorides	
Methyl chloride	0.05
Vinyl chloride	3.8
Ethyl chloride	5.6
Allyl chloride	31
1-Chloropropane	25
1-Chlorobutane	72
Chlorocyclopentane	78
Chlorobenzene	107
1-Chlorohexane	77
o-Chlorotoluene	102
1-Chloroheptane	82
3-Chloromethyl heptane	63

TABLE 2. EFFECT OF SOLVENT VAPOR ON RESPIRATOR CARTRIDGE EFFICIENCY[a] (cont.)

Solvent	Time to Reach 1 Percent Breakthrough (10 ppm) (Min)
Dichlorides	
Dichloromethane	10
Trans-1,2-dichloroethylene	33
1,1-Dichloroethane	23
cis-1,2-Dichloroethylene	30
1,2-Dichloroethane	54
1,2-Dichloropropane	65
1,4-Dichlorobutane	108
o-Dichlorobenzene	109
Trichlorides	
Chloroform	33
Methyl chloroform	40
Trichloroethylene	55
1,1,2-Trichloroethane	72
1,2,3-Trichloropropane	111
Tetra- and Pentachlorides	
Carbon tetrachloride	77
Perchloroethylene	107
1,1,2,2-Tetrachloroethane	104
Pentachloroethane	93
Acetates	
Methyl acetate	33
Vinyl acetate	55
Ethyl acetate	67
Isopropyl acetate	65
Isopropenyl acetate	83
Propyl acetate	79
Allyl acetate	76
sec-Butyl acetate	83
Butyl acetate	77
Isopentyl acetate	71
2-Methoxyethyl acetate	93
1,3-Dimethylbutyl acetate	61
Amyl acetate	73
2-Ethoxylethyl acetate	80
Hexyl acetate	67

TABLE 2. EFFECT OF SOLVENT VAPOR ON RESPIRATOR CARTRIDGE EFFICIENCY[a] (cont.)

Solvent	Time to Reach 1 Percent Breakthrough (10 ppm) (Min)
Ketones	
Acetone	37
2-Butanone	82
2-Pentanone	104
3-Pentanone	94
4-Methyl-2-pentanone	96
Mesityl oxide	122
Cyclopentanone	141
3-Heptanone	91
2-Heptanone	101
Cyclohexanone	126
5-Methyl-3-heptanone	86
3-Methylcyclohexanone	101
Diisobutyl ketone	71
4-Methylcyclohexanone	111
Alkanes	
Pentane	61
Hexane	52
Methylcyclopentane	62
Cyclohexane	69
Cyclohexene	86
2,2,4-Trimethylpentane	68
Heptane	78
Methycyclohexane	69
5-Ethylidene-2-norbornene	87
Nonane	76
Decane	71
Amines	
Methyl amine	12
Ethyl amine	40
Isopropyl amine	66
Propyl amine	90
Diethyl amine	88
Butyl amine	110
Triethyl amine	81
Dipropyl amine	93
Diisopropyl amine	77
Cyclohexyl amine	112
Dibutyl amine	76

TABLE 2. EFFECT OF SOLVENT VAPOR ON RESPIRATOR CARTRIDGE EFFICIENCY[a] (cont.)

Solvent	Time to Reach 1 Percent Breakthrough (10 ppm) (Min)
Miscellaneous Materials	
Acrylonitrile	49
Pyridine	119
1-Nitropropane	143
Methyl iodide	12
Dibromomethane	82
1,2-Dibromoethane	141
Acetic anhydride	124
Bromobenzene	142

[a] The above cartridge pairs were tested at 1000 ppm, 50 percent relative humidity, 22°C, and 53.3 l/min. (equivalent to a moderately heavy work rate). The time to achieve a 1 percent breakthrough is noted for each cartridge pair. Cartridges were preconditioned at room temperature and 50 percent relative humidity for at least 24 hours prior to testing.

1. For routine work operations, any perceptible eye irritation is considered unacceptable. Therefore, only full facepiece respirators are permissible in contaminant concentrations that produce eye irritation. Protection may be required in certain concentrations of gases and vapors. For escape, some eye irritation is permissible if it is determined that such irritation would not inhibit escape and such irritation is reversible.

2. Where quantitative eye irritation data cannot be found in literature references, and theoretical considerations indicate that substance should not be an eye irritant, half-facepiece respirators are allowed.

3. Where a review of the literature indicates a substance causes eye irritation but no eye irritation threshold is specified, the data will be evaluated to determine whether quarter- or half-facepiece respirators can be used.

2.4.5 IDLH

The definition of IDLH provided in 30 CFR 11.3(t) is as follows:

> "Immediately dangerous to life or health" means conditions that pose an immediate threat to life or health or conditions that pose an immediate threat of severe exposure to contaminants, such as radioactive materials, which are likely to have adverse cumulative or delayed effects on health.

The purpose of establishing an IDLH exposure concentration is to ensure that the worker can escape without injury or irreversible health effects from an

The purpose of establishing an IDLH exposure concentration is to ensure that the worker can escape without injury or irreversible health effects from an IDLH concentration in the event of failure of the respiratory protective equipment. The IDLH is considered a maximum concentration above which only highly reliable breathing apparatus providing maximum worker protection is permitted. Since IDLH values are conservatively set, any approved respirator may be used up to its maximum use concentration below the IDLH.

In establishing the IDLH concentration the following factors are considered:

1. Escape without loss of life or irreversible health effects. Thirty minutes is considered the maximum permissible exposure time for escape.

2. Severe eye or respiratory irritation or other reactions that would prevent escape without injury.

IDLH should be determined from the following sources:

1. Specific IDLH provided in the literature, such as the AIHA Hygienic Guides.

2. Human exposure data.

3. Acute animal exposure data.

Where such data are lacking, acute toxicological data from analogous substances may be considered.

The following guidelines should be used to interpret toxicological data reported in the literature for animal species:

1. Where acute animal exposure data are available (30 min. to 4-hr. exposures), the lowest exposure concentration causing death or irreversible health effects in any species is determined to be the IDLH concentration.

2. Chronic exposure data may have no relevance to the acute effects and should be used in determining the IDLH concentration only upon competent toxicologic judgment.

3. Where there is no toxicologic evidence of an IDLH concentration, 500 times the permissible exposure limit shall determine the upper limit above which only highly reliable breathing apparatus providing maximum worker protection is used.

2.4.6 Lower Flammable Limit

In addition to toxic chemicals and irritants, it is necessary to consider flammable substances. In any atmosphere where there is a likelihood of a chemical fire, there is the risk of creating toxic vapors in the fire or of asphyxiation cause by reduction of the oxygen content by the products of combustion.

Contaminant concentrations in excess of the LFL are considered to be IDLH. At or above the LFL, the use of respirators is limited to those devices that

provide the maximum protection (i.e., positive pressure self-contained breathing apparatus (SCBA) and the combination positive pressure supplied-air respirators with auxiliary positive pressure SCBA).

2.4.7 Protection Factors

The protection factors of respiratory protection devices are a useful numerical tool to assist in the choice of a protective system. Protection factors are a measure of the overall effectiveness of a respirator. Filtering efficiency is a part of the protection factor and becomes a significant consideration for less efficient air-purifying respirators.

The protection factor of a given respirator for a specific user times the PEL (or TLV) for a given substance is the maximum allowable concentration for that substance for which the respirator may be used. For example, say the protection factor for a full-face mask respirator will provide protection up to 1000 ppm. Note that there is a difference between "quantitative" protection factors and "qualitative" protection factors. The correct protection factor must be used in determining the maximum allowable concentration.

2.4.8 Escape

Jordan provides and requires employees to carry an escape respirator where exposure may occur to extremely toxic substances. This escape respirator provides a 5-minute self-contained air supply. (An extremely toxic substance is defined as a gas or vapor having an LC_{50} of less than 10 ppm.)

STANDARD RESPIRATORY PROTECTION PROCEDURE NO. 3
RESPIRATOR FIT TESTING - QUALITATIVE

3.1 RESPIRATOR QUALITATIVE FITTING METHODS

Despite the care that goes into respirator design and manufacture to give maximum protection, efficiency will be lost if there is an improper match between the facepiece and the user, or other improper wearing practices. The problem is twofold. Since more than one brand of particular type of facepiece is available, the first problem is to determine which fits best. The second problem is whether the user knows when the respirator fits properly. Both problems can be solved by the use of a fitting test, which is in fact an OSHA requirement. A number of tests and fitting procedures can be performed easily, as outlined below.

Note: During any fitting test, the respirator head straps must be as comfortable as possible. Tightening the straps will sometimes reduce the facepiece leakage, but the user may be unable to tolerate the respirator for any length of time.

3.1.1 Test 1 - Negative Pressure Test

The user will perform this test alone in the field. It consists of merely closing off the inlets of the canister, cartridge(s), or filter(s) by covering with the palm(s) or replacing the seals over the canister or cartridge inlets, or by squeezing breathing tubes so that air cannot pass; inhaling gently so the facepiece collapses slightly; and holding the breath for ten seconds. If the facepiece remains slightly collapsed and no inward leakage is detected, the respirator is probably tight enough.

Although this test is simple, it has several major drawbacks, primarily that the user must handle the respirator after it has supposedly been positioned on the face. Handling can modify the facepiece-to-face seal. When the respirator is to be used in a relatively toxic atmosphere, this test should be used only as a very gross determination of fit. The user will perform this test just before entering any toxic atmosphere.

3.1.2 Test 2 - Positive Pressure Test

This test is very much like the negative pressure test; it has the same advantages and limitations. It is conducted by closing off the exhalation valve and exhaling gently into the facepiece. The fit is considered satisfactory if slight positive pressure can be built up inside the facepiece without any evidence of outward leakage. For some respirators, this method requires the user to remove the exhalation valve cover and then carefully replace it after the test, often a most difficult task which can disturb the respirator fit even more than does the negative pressure test. If removing and replacing the valve cover is required, this test should be used sparingly. For respirators whose valve covers have a single small port that can be covered by the palm or finger, this test is easy. Where applicable, this test will be performed just before entering any hazardous atmosphere.

3.1.3 Test 3 - Isoamyl Acetate Vapor (Banana Oil) Test

The chemical isoamyl acetate has a pleasant, easily detectable odor, so it is used widely in checking respirator fit.

The test gives the user the required opportunity to wear the respirator in a test atmosphere. Generally, it consists of creating an atmosphere containing banana oil around the user of an atmosphere-supplying or air-purifying respirator with an organic vapor removing cartridge(s) or canister. If the hazard is particulate matter or a non-organic vapor or gas, the organic vapor cartridge(s) or canister must be replaced with a particulate filter(s) or proper cartridge(s) or canister after this test. Thus, this test can be used for any facepiece that has the capability of accepting chemical cartridges and particulate filters. It must be emphasized, however, that the correct cartridge, canister or filter must be replaced on the facepiece before the user enters the specific exposure area.

The isoamyl acetate test is performed with single use capsules, or may be performed by saturating a piece of cotton or cloth with the liquid and passing it close to the respirator near the sealing surface, taking care to avoid skin contact.

In general, the isoamyl acetate fitting test will be performed as follows:

1. The user puts on the respirator in a normal manner in an area where he/she cannot smell banana oil and thus not be influenced by the odor while performing the fitting test. If it is an air-purifying device, it must be equipped with a cartridge(s) or canister specifically designed for protection against organic vapors.

2. The capsule or saturated cloth is passed close to the respirator sealing surfaces.

3. If the user smells banana oil, he readjusts the facepiece and/or adjusts the head straps without unduly tightening them.

4. The user repeats step 2. If banana oil is not smelled, there is assumed to be a satisfactory seal. If the wearer smells the vapor, an attempt should be made to find the leakage point. If the leak cannot be located, another respirator of the same type and brand should be tried. If this leaks, another brand of respirator with a facepiece of the same type but slightly different shape or size should be tried.

5. After a fit is obtained, if the respirator is an air-purifying device, it must be equipped with the correct filter(s), cartridge(s) or canister for the anticipated hazard.

During the test, the subject must make movements that approximate a normal workng situation. These will include, but not necessarily be limited to, the following:

1. Normal breathing.

2. Deep breathing like during a heavy exertion period: this should not be done long enough to cause hyper ventilation.

3. Slowly performing side-to-side and up-and-down head movements: these movements should be exaggerated, but should approximate those that take place on the job.

4. Talking: this is most easily accomplished by reading prepared text loudly enough to be understood by someone standing nearby.
5. Other exercises may be added depending upon the situation: for example, if users are going to spend a significant part of their time bent over at some task, it will include an exercise approximating this bending.

When the test is used in training workers and selecting the respirators that fit best, they will perform the complete set of exercises. However, the number of exercises may be reduced when the test is used as a quick field check before routine entry into a contaminated atmosphere.

3.1.4 Test 4 - Irritant Smoke Test

This test is similar to the isoamyl acetate test in concept. It involves exposing the respirator wearer to an irritating aerosol produced by stannic chloride or titanium tetrachloride smoke tubes normally used to check the quality of ventilation systems. (Note: Other types of smoke tubes such as acetic acid are available, but should not be used for respirator fitting.) When the tube ends are broken and air is passed through it, the material inside reacts with the moisture in the air to produce a dense, highly irritating smoke, consisting of hydrochloric acid absorbed in small solid particles. As a qualitative means of determining respirator fit, this test has a distinct advantage in that the user usually reacts involuntarily to leakage by coughing or sneezing. The likelihood of this giving a false indication of proper fit is reduced. On the other hand, the aerosol is very irritating and must be used carefully to avoid injury.

This test can be used for both air-purifying and atmosphere-supplying respirators, but air-purifying respirators must have a high-efficiency filter(s). After the test, it may be necessary to replace the high-efficiency filter(s) on the air-purifying respirator with another type of air-purifying element(s) depending upon the hazard to which the respirator user is to be exposed. This test can be used for worker training or respirator selection.

The irritant smoke test must be performed with proper safeguards because the aerosol is highly irritating. The procedure is as follows:

1. The user puts on the respirator normally, taking care not to tighten the headstrap uncomfortably and stands with his/her back to a source of exhaust ventilation.

2. The tester tells the user to close his/her eyes, even if wearing a full facepiece respirator, and to keep them closed until told to open them.

3. The tester lightly puffs smoke over the respirator, holding the smoke tube at least two feet from it. At this time, the test should keep the amount of smoke minimal and pause between puffs to note the user's reaction.

4. If the user detects no leakage, the tester will increase the smoke density and move the smoke tube progressively closer to the subject, still remaining alert to any reactions.
5. When the smoke tube has been brought to within about 6 inches of the respirator with no leakage detected, the tester will start to direct smoke specifically at potential sources of leakage, around the sealing surfaces and exhalation valve, while the subject's head is still.

6. At this point, if no leakage has been detected, the user may cautiously begin the head movements described in the isoamyl acetate test. The tester should remain especially alert and be prepared to stop producing smoke immediately.

7. If leakage is detected at any time, the tester should stop the smoke and let the user readjust the facepiece or head strap tension. The tester should then start the test at step 2.

STANDARD RESPIRATORY PROTECTION PROCEDURE NO. 4
INSPECTION/MAINTENANCE/STORAGE

4.1 INTRODUCTION

Respirator maintenance is an integral part of the overall respirator program. Wearing a poorly maintained or malfunctioning respirator is, in one sense, more dangerous than not wearing a respirator at all. Personnel wearing defective devices think they are protected when, in reality, they are not. Emergency escape and rescue devices are particularly vulnerable to poor maintenance as they generally are used infrequently, and then in the most hazardous and demanding circumstances. Serious injury or death can result from wearing a defective device during emergency escape or rescue.

This program includes:

1. Inspection for defects (including a leak check).
2. Cleaning and disinfecting.
3. Repair as required.
4. Proper and sanitary storage of equipment.

4.2 INSPECTION FOR DEFECTS

The most important part of a respirator maintenance program is continual inspection of the devices. If properly performed, inspections will identify damaged or malfunctioning respirators before they can be used. Two types of inspections will be performed.

1. While the respirator is in use.
2. While it is being cleaned.

Since the use and cleaning will, to a large extent, be performed by the same personnel, these inspections may become concurrent.

4.3 FREQUENCY OF INSPECTION

OSHA requires that "All respirators be inspected before and after each use" and that those not used routinely, i.e., emergency escape and rescue devices, "shall be inspected after each use and at least montly..." Obviously, emergency escape and rescue devices do not require inspection before each use. Records of inspections are kept on forms presented in Section VI-Program Administration and Documentation.

4.4 INSPECTION PROCEDURES

Respirator inspection shall include checking of:

1. Tightness of the connections.
2. Facepiece.
3. Valves.
4. Connecting tubes.

5. Canisters, filters, or cartridges.

In addition, the regulator and warning devices on a SCBA shall be checked for proper functions.

4.5 FIELD INSPECTION OF AIR-PURIFYING RESPIRATORS

Routinely used air-purifying respirators will be checked as follows before and after each use:

1. Examine the facepiece for:

   a. Excessive dirt.

   b. Cracks, tears, holes or physical distortion of shape from improper storage.

   c. Inflexibility of rubber facepiece (stretch and knead to restore flexibility).

   d. Cracked or badly scratched lenses in full facepieces.

   e. Incorrectly mounted full facepiece lenses, or broken or missing mounting clips.

   f. Cracked or broken air-purifying element holder(s), badly worn threads or missing gasket(s).

2. Examine the head straps or head harness for:

   a. Breaks.
   b. Loss of elasticity.
   c. Broken or malfunctioning buckles and attachments.
   d. Excessively worn serrations on head harness, which might permit slippage (full facepieces only).

3. Examine the exhalation valve for the following after removing its cover:

   a. Foreign material, such as detergent residue, dust particles or human hair under valve seat.

   b. Cracks, tears or distortion in the valve material.

   c. Improper insertion of the valve body in the facepiece.

   d. Cracks, breaks or chips in the valve body, particularly the sealing surface.

   e. Missing or defective valve cover.

   f. Improper installation of the valve in the valve body.

4. Examine the air-purifying element(s) for:

a. Incorrect cartridge, canister or filter for the hazard.

b. Incorrect installation, loose connections, missing or worn gasket or cross threading in the holder.

c. Expired shelf-life date on the cartridge or canister.

d. Cracks or dents in the outside case of the filter, cartridge or canister, indicated by the absence of sealing material, tape, foil, etc. over the inlet.

e. Identical cartridges if more than one are used.

4.6 CARE AND CLEANING OF SELF-CONTAINED BREATHING APPARATUS (SCBA)

The proper care of SCBAs involves:

1. Inspection for defects.
2. Cleaning and disinfecting.
3. Repair.
4. Storage.

The following checklist is to be used by personnel whenever they have to check out an SCBA. (Note: Any discrepancy found should be cause to set the unit aside until it can be repaired by a certified repair-person.)

1. Preliminary inspection. Check to ensure that:

   a. High-pressure hose connector is tight on cylinder fitting.
   b. Bypass valve is closed.
   c. Mainline valve is closed.
   d. There is no cover or obstruction on regulator outlet.
   e. Pressure in the tank is at least 1800 psi.

2. Backpack and harness assembly.

   a. Straps

      1. Visually inspect for complete set.
      2. Visually inspect for frayed or damaged straps that may break during use.

   b. Buckles

      1. Visually inspect for mating ends.
      2. Check locking function.

   c. Backplate and cylinder lock

      1. Visually inspect backplate for cracks and for missing rivets or screws.
      2. Visually inspect cylinder hold-down strap and physically check strap tightener and lock to ensure that it is fully engaged.

3. Cylinder and cylinder valve assembly

   a. Cylinder

      1. Physically check cylinder to ensure that it is tightly fastened to backplate.

      2. Check hydrostatic test date to ensure that it is current.[1]

      3. Visually inspect cylinder for large dents or gouges in metal.

   b. Head and valve assembly

      1. Visually inspect cylinder valve lock for presence.

      2. Visually inspect cylinder gauge for condition of face, needle, and lens.

      3. Open cylinder valve and listen or feel for leakage around packing. (If leakage is noted, do not use until repaired.). Note function of valve lock.

4. Regulator and high-pressure hose

   a. High-pressure hose and connector

      Listen or feel for leakage in hose or at hose-to-cylinder connector. (Bubble in outer hose covering may be caused by seepage of air through hose when stored under pressure. This does not necessarily mean a faulty hose.)

   b. Regulator and low-pressure alarm

      1. Cover outlet of regulator with palm of hand. Open mainline valve and read regulator gauge (must read at least 1800 psi and not more than rated cylinder pressure).

      2. Close cylinder valve and slowly move hand from regulator outlet to allow slow flow of air. Gauge should begin to show immediate loss of pressure as air flows. Low-pressure alarm should sound between 650 and 550 psi. Remove hand completely from outlet and close mainline valve.

      3. Place mouth onto or over regulator outlet and blow. A positive pressure should be created and maintained for 5 to 10 seconds without any loss of air. Next, establsih a slight negative pressure in regulator and hold for 5 to 10 sec. Vacuum should remain constant. This tests the integrity of the diaphragm. Any loss of pressure or vacuum during this test indicates a leak in the apparatus.

---

[1]Monthly inspection only.

4. Open cylinder valve.

5. Place hand over regulator outlet and open mainline valve. Remove hand from outlet and replace in rapid movement. Repeat twice. Air should escape when hand is removed each time, indicating a positive pressure in chamber. Close mainline valve and remove hand from outlet.

6. Ascertain that no obstruction is in or over the regulator outlet. Open and close the bypass valve momentarily to ensure flow of air through bypass system.

5. Facepiece and corrugated breathing tube.

a. Facepiece

1. Visually inspect head harness for damaged serrations and deteriorated rubber. Visually inspect rubber facepiece body for signs of deterioration or extreme distortion.

2. Visually inspect lens for proper seal in rubber facepiece, retaining clamp properly in place, and cracks or large scratches.

3. Visually inspect exhalation valve for visible deterioration or foreign materials buildup.

b. Breathing tube and connector

1. Stretch breathing tube and visually inspect for deterioration and holes.

(2) Visually inspect connector to ensure good condition of threads and for presence and proper condition of "O" ring or rubber gasket seal.

(3) Negative pressure test on facepiece.[2]

(a) Don backpack and facepiece.

(b) With facepiece held tightly to face or facepiece properly donned, stretch breathing tube to open corrugations and place thumb or hand over end of connector.

(c) Inhale. Negative pressure should be created inside mask, causing it to pull tightly to face. This negative pressure should be maintained for 5 to 10 sec. If negative pressure leaks down, the facepiece assembly is not adequate and should not be worn.

---

[2]For regular monthly inspection, only steps (b) and (c) of procedure are necessary.

6. Storage of units. Check that:

   a. Cylinder is refilled as necessary and unit is cleaned and inspected.

   b. Cylinder valve is closed.

   c. High-pressure hose connector is tight on cylinder.

   d. Pressure is bled off high-pressure hose and regulator.

   e. Bypass valve is closed.

   f. Mainline valve is closed.

   g. All straps are completely loosened and laid straight.

   h. Facepiece is properly stored to protect against dust, sunlight, heat, extreme cold, excess moisture, and damaging chemicals.

4.7 CLEANING AND SANITIZING

Any good detergent may be used followed by a disinfecting rinse or a combination disinfectant-detergent for a one step operation. Reliable, effective disinfectants may be made from readily available household solutions, including:

1. Hypochlorite solution (50 ppm of chlorine) made by adding approximately two milliliters of bleach (such as Clorox) to one liter of water, or two tablespoons of bleach per gallon of water. A two-minute immersion disinfects the respirators.

2. Aqueous solution of iodine (50 ppm of iodine) made by adding approximately 0.8 milliliters of tincture of iodine per liter of water, or one teaspoon of tincture of iodine per gallon of water. Again, a two-minute immersion is sufficient.

To prevent damaging the rubber and plastic in the respirator facepieces, the cleaning water should not exceed 140°F, but it should not be less than 120°F to ensure adequate cleaning.

4.8 RINSING

The cleaned and disinfected respirators should be rinsed thoroughly in water (140°F maximum) to remove all traces of detergent and disinfectant. This is very important for preventing dermatitis.

4.9 DRYING

The respirators may be allowed to dry in room air on a clean surface. They may also be hung from a horizontal wire, like drying clothes, but care must be taken not to damage or distort the facepieces.

4.10 REASSEMBLY AND INSPECTION

The clean, dry respirator facepieces should be reassembled and inspected in an area separate from the disassembly area to avoid contamination. The inspection procedures have been discussed; special emphasis should be given to inspecting the respirators for detergent or soap residue left by inadequate rinsing. This appears most often under the seat of the exhalation valve, and can cause valve leakage or sticking.

The respirator should be thoroughly inspected and all defects corrected. New or retested cartridges and canisters should be installed, and the completely reassembled respirator should be tested for leaks.

For SCBA devices, the facepiece should be combined with the tested regulator and the fully charged cylinder, and an operational check performed.

4.11 MAINTENANCE AND REPAIR

Replacement or repair shall be done only by trained, experienced persons with parts designed for the respirator. Besides being contrary to OSHA requirements, substitution of parts from a different brand or type of respirator invalidates approval of the device.

This restriction applies particularly to maintenance of the more complicated devices, especially SCBA, and more specifically, regulator valves and low pressure warning devices. These devices should be returned to the manufacturer or to a trained technician for adjustment or repair.

No problems are anticipated in repairing and maintaining most simple respirators, particularly the commonly used air-purifying type.

4.12 RESPIRATOR STORAGE

Respirators must be stored to protect against:

1. Dust.
2. Sunlight.
3. Heat.
4. Extreme cold.
5. Excessive moisture.
6. Damaging chemicals.
7. Mechanical damage.

Damage and contamination of respirators may take place if they are stored on a workbench, or in a tool cabinet or toolbox, among heavy tools, greases and dirt or in a vehicle.

Freshly cleaned respirators should be placed in reusable plastic bags until reissue. They should be stored in a clean, dry location away from direct sunlight. They should be placed in a single layer with the facepiece and exhalation valve in an undistorted position to prevent rubber or plastic from taking a permanent distorted "set".

APPENDIX G

VAPOR EMISSION RESPONSE PLAN

APPENDIX G
VAPOR EMISSION RESPONSE PLAN

The vapor emission response plan is divided into three sections, the minor and major emission responses and a borehole location evacuation plan.

Minor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 5 ppm above background in the breathing zone at the work zone perimeter (i.e., approximately 3-5 feet from and above borehole), the drilling activities will be halted and monitoring continued. If the organic level decreases below 5 ppm, then drilling activities can resume with increased monitoring.

Drilling activities can also resume (with appropriate personnel protection) if the organic level is above 5 ppm and below 50 ppm at the work zone perimeter, other parameters permitting (e.g., the LEL at the wellhead is below 20%, and the H_2S level is below 10 ppm). However, the organic level 200 feet downwind of the work zone must not exceed 5 ppm above background.

If the organic level is above 50 ppm, or the H_2S level is above 10 ppm at the work zone perimeter, then the Site Safety Officer must be notified and well drilling activities stopped.

If the LEL level exceeds 20% all drilling activities shall be stopped immediately and all engines (ignition sources) will be turned off. Drilling personnel will leave the area and notify the Site Safety Officer.

Major Emission Response Plan

If any of the following levels are identified approximately 200 feet downwind from the work zone perimeter, all drilling activities must stop:

1) organic levels greater than 5 ppm above background.

2) LEL greater than 20% or

3) H_2S levels greater than 10 ppm.

If any of the above levels persist after cessation of drilling activities then the following contingency plan shall be placed into effect.

1. The perimeter of the closest downwind residential or commercial property will be monitored. If organic vapor levels approach 5 ppm, or if H_2S levels approach 10 ppm above background, then the local police authorities will be immediately contacted by the Site Safety Officer.

2. The appropriate personnel listed on the Master Phone List are to be notified by the Site Safety Officer.

In the event of a significant gas release (sudden visual and/or audible release) or excessive volatile emissions (organic level greater than 5 ppm above background located 200 feet downwind) during the well drilling program, the response action described below will be carried out.

Response Action

The well drillers will immediately proceed as follows:

1) Break the drill rods at the nearest joint unless the rods can be removed from the hole in one lift.

2) As soon as possible, leave the Site and notify the Site Safety Officer. The well drillers shall not proceed with remedial efforts until instructed to do so by the Site Safety Officer.

The Site Safety Officer will determine if a Minor or Major Vapor Emission condition (as defined in the previous Section) exists and will activate the appropriate Vapor Emission Response Plan.

If a major emission response action is warranted, the drillers, wearing the proper level of protection, will then seal off the borehole using a bentonite slurry grout and abandon the hole.

APPENDIX H

OSHA JOB SAFETY AND HEALTH PROTECTION POSTER

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discrimination.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory penalties against employers of up to $1,000 for each serious violation and for optional penalties of up to $1,000 for each nonserious violation. Penalties of up to $1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to $10,000 for each such violation.

Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of not more than $10,000, or by imprisonment for not more than six months, or by both. Conviction of an employer after a first conviction doubles these maximum penalties.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

Such voluntary action should initially focus on the identification and elimination of hazards that could cause death, injury, or illness to employees and supervisors. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free consultative assistance, without citation or penalty, is available to employers, on request, through OSHA supported programs in most State departments of labor or health

AUGUSTA AREA OFFICE
FEDERAL BLDG. & P. O.
40 [illegible] ME. 121
AUGUSTA, [illegible]
TEL. (207) 622-8[illegible]

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, Georgia
Boston, Massachusetts
Chicago, Illinois
Dallas, Texas
Denver, Colorado
Kansas City, Missouri
New York, New York
Philadelphia, Pennsylvania
San Francisco, California
Seattle, Washington

Telephone numbers for these offices, and additional area office locations, are listed in the telephone directory under the United States Department of Labor in the United States Government listing.

Washington, D.C.
1985
OSHA 2203

William E. Brock, Secretary of Labor

U.S. Department of Labor
Occupational Safety and Health Administration

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or a facsimile) in a conspicuous place where notices to employees are customarily posted.

APPENDIX I

EMERGENCY INFORMATION

POST IN TRAILER

EMERGENCY TELEPHONE NUMBERS

(LOCAL) Police Department	911
(LOCAL) Rescue Service	911
South Baldwin Hospital	(205) 943-5051
Thomas Hospital	(205) 928-2375
(Local) Fire Department	911
Off-site Emergency Services	911
National Poison Control Center	(800) 492-2414
Florida Poison Control Center	(800) 282-3171
National USEPA Emergency Response	(800) 424-8802
Florida Emergency Response	(904) 488-0190
Chemical Manufacturers Association Chemical Referral Center	(800) 262-8200
Site HSO: Janet Burris	(904) 656-1293
Site Manager: R. Michael Nugent	(904) 656-1293
Regional HSS: Jack Davis	(904) 656-1293
C-E Environmental HSM: J.A. Reynolds	(201) 992-2323 x264

ROUTES TO EMERGENCY MEDICAL FACILITIES

Primary source of medical assistance for the OLF Barin:

South Baldwin Hospital
1613 North McKenzie Street
Foley, Alabama 36536
(205) 943-5051

Directions to primary source of medical assistance:

Drive 1 mile north from the main entrance on Enterprise Street to Highway 98, turn left. Travel 2.6 miles to Highway 59 (also N. McKenzie Street) turn right then drive 1 mile, the hospital will be on the left.

Alternate source of medical assistance:

Thomas Hospital
U.S. Highway 98 and Morphey Ave.
Fairhope, Alabama 36532
(205) 928-2375

Directions to alternate source of medical assistance:

Drive 1 mile north from the main entrance on Enterprise Street to Highway 98, turn left then travel 63 miles (approximately) to the town of Fairhope city limits. Travel 2 miles south on 98 to Morphey Avenue and the hospital will be on the left side of the road.

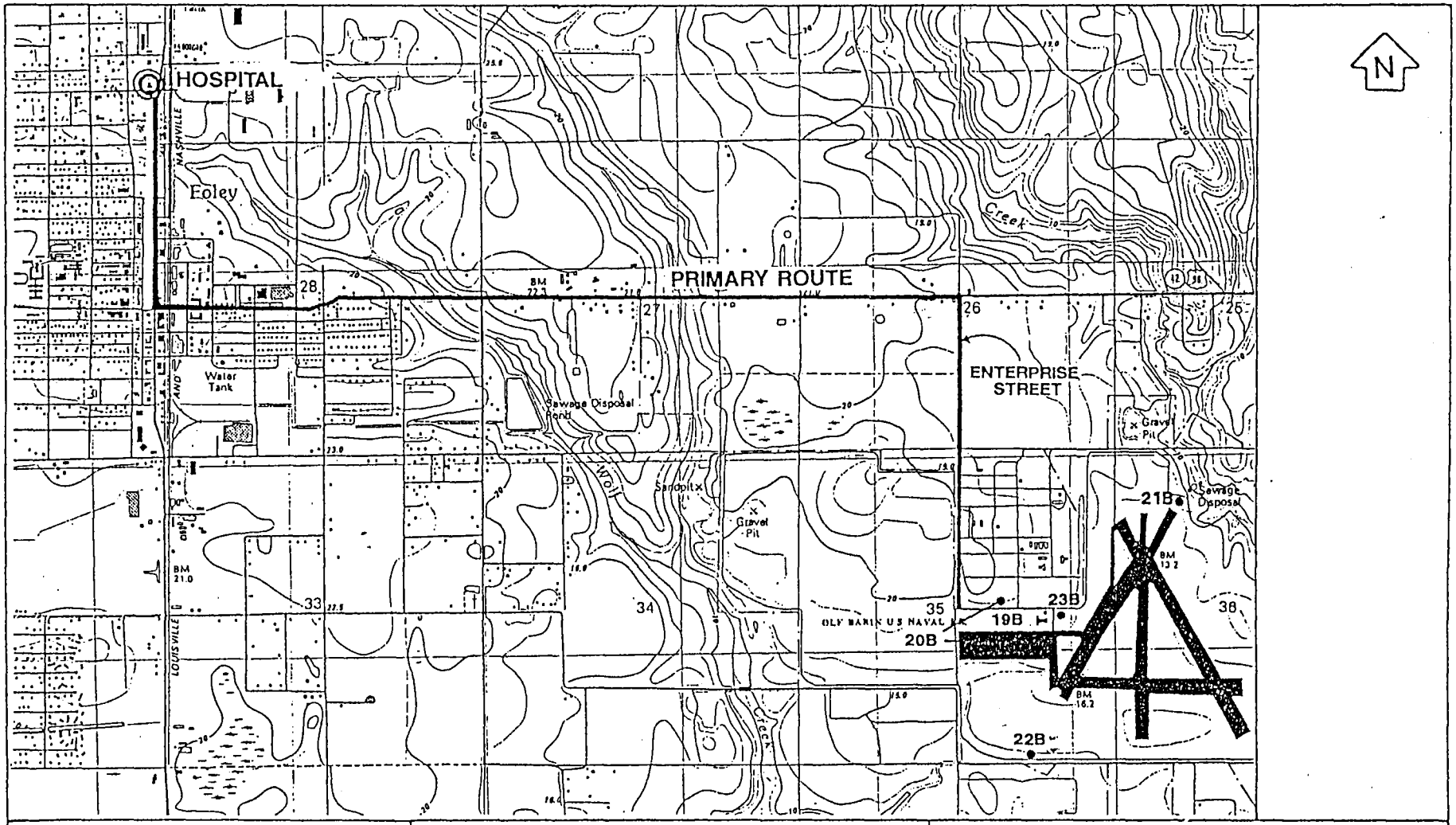
POST IN TRAILER

EMERGENCY SIGNALS

At OLF Barin portable radios are not anticipated to be used for communication. In the event they were used, a transmission that indicates it is of an emergency nature will take priority over all other transmissions. All other side radios will yield the frequency to the emergency transmissions

Where radio communication is not available, the following air horn signals shall be used:

HELP	three short blasts	(. . .)
EVACUATION	three long blasts	(_ _ _)
ALL CLEAR	alternating long and short blasts	(_._.)



SCALE IN MILES

0 .5 1

SOURCE: USGS QUADRANGLE
FOLEY, ALABAMA 1980

FIGURE A

APPENDIX I

HEALTH & SAFETY PLAN
SITE INSPECTION

OLF BARIN
FOLEY, ALABAMA