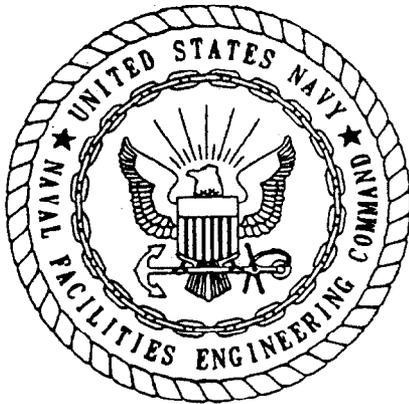


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SUPPLEMENTAL RESOURCE CONSERVATION AND RECOVERY ACT FACILITY  
INVESTIGATION FOR SITE 11 VOLUME III HEALTH AND SAFETY PLAN NSB KINGS BAY  
GA  
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ABB ENVIRONMENTAL



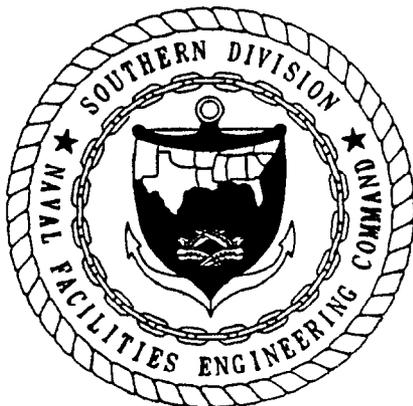
**SUPPLEMENTAL RESOURCE CONSERVATION  
AND RECOVERY ACT FACILITY INVESTIGATION  
FOR SITE 11**

**VOLUME III, HEALTH AND SAFETY PLAN**

**NAVAL SUBMARINE BASE  
KINGS BAY, GEORGIA**

**UNIT IDENTIFICATION CODE: N42237  
CLEAN, DISTRICT I  
CONTRACT NO. N62467-89-D-0317**

**AUGUST 1994**



**SOUTHERN DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND  
NORTH CHARLESTON, SOUTH CAROLINA  
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**Block No. 18, Subject Terms**

**Block No. 19, Abstract**

Three volumes comprise the planning documents for a Supplemental Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at Site 11, Old Camden County Landfill, at Naval Submarine Base, Kings Bay, Georgia. The Supplemental RFI was developed to investigate releases from the landfill that were identified during previous RFI investigative tasks. The Supplemental RFI was designed to support a Corrective Measures Study, Interim Corrective Measures, a Health and Environmental Assessment, and identification and characterization of contaminated media. Previous investigations had identified volatile organic compounds in groundwater that were attributed to releases from wastes disposed at the site.

Volume I, the Workplan, provides a record of site history, describes regional environmental factors, details previous investigative results, describes the Supplemental RFI tasks, describes site investigative methodology, and describes project organization and schedule. Appendix A of the workplan includes a preinvestigation evaluation of corrective measures technologies.

Volume II, the Sampling and Analysis Plan (SAP), focuses on the field investigation, analytical methods, and quality assurance and quality control (QA/QC) procedures. The SAP describes the project, site management, and field methods; details the technical approach and sampling plans; and describes QA/QC requirements for sample collection, sample analysis, data assessment, and reporting.

Volume III, the Health and Safety Plan (HASP), outlines health and safety procedures for field tasks. The HASP includes Material Safety Data Sheets for chemicals that may be encountered at the site and provides emergency information and telephone numbers.

**DISTRIBUTION**

Southern Division, Naval Facilities Engineering Command  
Naval Submarine Base, Kings Bay, Georgia

**Final**

3

15

**SUPPLEMENTAL RESOURCE CONSERVATION AND RECOVERY ACT  
FACILITY INVESTIGATION HEALTH AND  
SAFETY PLAN FOR SITE 11**

**VOLUME III, HEALTH AND SAFETY PLAN**

**NAVAL SUBMARINE BASE  
KINGS BAY, GEORGIA**

**Unit Identification Code No. N42237**

**Contract Task Order No. 094**

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**Prepared by:**

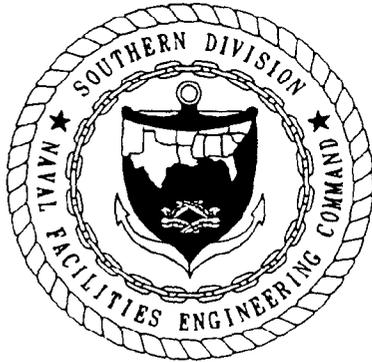
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**August 1994**



## FOREWORD

In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the 1986 Superfund Amendments and Reauthorization Act (SARA), the 1976 Resource Conservation and Recovery Act (RCRA) as augmented by the 1984 Hazardous and Solid Waste Amendments (HSWA), and as directed in Executive Order 12580 of January 1987, the Department of Defense (DOD) conducts an Installation Restoration (IR) program for evaluating and remediating problems related to releases and disposal of toxic and hazardous materials at DOD facilities.

The Naval Assessment and Control of Installation Pollutants (NACIP) program was developed by the Navy to implement the IR program for all naval and Marine Corps facilities. The NACIP program was originally conducted in three phases: (1) Phase I, Initial Assessment Study, (2) Phase II, Confirmation Study (including a Verification Step and a Characterization Step), and (3) Phase III, Planning and Implementation of Remedial Measures. The three-phase IR program was modified and updated to be congruent with the CERCLA, SARA, RCRA, and HSWA driven DOD IR program.

The updated nomenclature for the RCRA/SARA process is as follows:

- Preliminary Assessment and Site Inspection,
- Remedial Investigation,
- Feasibility Study, and
- planning and implementation of remedial design.

This Health and Safety Plan (HASP) has been developed to address field operations associated with the Supplemental RCRA Facility Investigation (RFI) and Interim Measure (IM) at Site 11 at Naval Submarine Base (NSB), Kings Bay, Georgia. This HASP is intended to meet the requirements of 29 Code of Federal Regulations 1910.120. This document outlines potential hazards, protective measures, monitoring requirements, and summarizes decontamination procedures for the project. Material safety data sheets are included for chemicals that may be encountered and emergency information is provided.

Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) has the responsibility for implementation of the Navy and Marine Corps IR program in the southeastern and midwestern United States. Questions regarding this report should be addressed to the Public Affairs Office, Naval Submarine Base, Kings Bay, Georgia, at (912) 673-4714.

## EXECUTIVE SUMMARY

This Health and Safety Plan (HASP) is Volume III of a three volume set of planning documents for the Supplemental Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) to be conducted at Site 11, Naval Submarine Base, Kings Bay, Georgia. Volumes I and II of the planning documents are the Workplan and Sampling and Analysis Plan, respectively.

This HASP addresses health and safety requirements associated with implementing the Supplemental RFI field program, as well as the IM field program. Compliance with this HASP is required for all ABB Environmental Services, Inc., personnel, contractor personnel, and third parties entering the site.

The HASP has been developed to address requirements of 29 Code of Federal Regulations 1910.120. The HASP describes responsibilities of project personnel and provides a brief history of the site and description of the work to be performed. Potential hazards are identified and protective measures are outlined for each task. Material safety data sheets are included for chemicals that may be encountered at the site. Emergency information is provided, such as directions to the hospital and emergency telephone numbers.

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### APPENDICES:

- Appendix A: CLEAN Generic HASP
- Appendix B: OSHA Poster

### REFERENCES:

The following chapters of the Comprehensive Long-term Environmental Action, Navy (CLEAN) Program District I Generic HASP are applicable for the work anticipated at the site.

- 2.0 AUTHORITY AND RESPONSIBILITY OF HEALTH AND SAFETY PERSONNEL
- 3.0 TRAINING PROGRAM
- 4.0 MEDICAL SURVEILLANCE PROGRAM
- 5.0 ENGINEERING CONTROLS
- 6.0 PERSONAL PROTECTIVE LEVEL DETERMINATION
- 7.0 MONITORING EQUIPMENT
- 8.0 ZONATION
- 9.0 WORK PRACTICES
- 10.0 CONFINED SPACE ENTRY PROCEDURES
- 11.0 EXCAVATION AND TRENCHING
- 12.0 TEMPERATURE EXTREMES
  - HEAT STRESS
  - COLD STRESS
- 13.0 DECONTAMINATION
- 14.0 EMERGENCY PLANNING

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- ✓ 15.0 HEALTH AND SAFETY FORMS AND DATA SHEETS
  - ✓ HEALTH AND SAFETY AUDIT FORM
  - ✓ ACCIDENT REPORT FORM
  - ✓ HEALTH AND SAFETY OFFICER (HSO) CHECKLIST FOR FIELD OPERATIONS
  - ✓ MATERIAL SAFETY DATA SHEETS
  - ✓ LIQUI-NOX
  - ETHYL ALCOHOL (denatured)
  - TRISODIUM PHOSPHATE
  - ✓ OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) POSTER
  - ✓ DAILY HEALTH AND SAFETY AUDIT FORM
  
- ✓ 16.0 RESPIRATORY PROTECTION PROGRAM
  
- ✓ 17.0 OTHER
  - ✓ ILLUMINATION
  - ✓ SANITATION
  - ✓ HEALTH AND SAFETY AUDIT PROCEDURES

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## GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
bls	below land surface
C	ceiling limit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
CLEAN	Comprehensive Long-term Environmental Action, Navy
CNS	central nervous system
CRZ	Contamination Reduction Zone
DOD	Department of Defense
GPR	ground-penetrating radar
HASP	Health and Safety Plan
HSO	Health and Safety Officer
HSM	Health and Safety Manager
HSS	Health and Safety Supervisor
HSWA	Hazardous and Solid Waste Amendments
IAS	Initial Assessment Study
IDW	Investigation-derived wastes
IM	Interim Measure
IR	Installation Restoration
LEL	lower explosion limit
mg/l	milligrams per liter
MOTKI	Military Ocean Terminal, Kings Bay
NACIP	Naval Assessment and Control of Installation Pollutants
NSB	Naval Submarine Base
OSHA	Occupational Safety and Health Administration
OVA	organic vapor analyzer
PORTA-FID	portable flame ionization detector
PPE	personal protective equipment
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
SARA	Superfund Amendments and Reauthorization Act
SOP	Standard Operating Procedure
SOUTHNAVFACENCOM	Southern Division, Naval Facilities Engineering Command
SVOC	semivolatile organic compound

GLOSSARY (Continued)

TAL	Target Analyte List
TCL	Target Compound List
TOM	Task Order Manager
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

## 1.0 GENERAL

1.1 SCOPE AND PURPOSE. This Health and Safety Plan (HASP) has been prepared in conformance with the ABB Environmental Services, Inc. (ABB-ES), generic HASP developed under the Comprehensive Long-Term Environmental Action, Navy (CLEAN) District I Contract (CLEAN HASP) and is intended to meet the requirements of 29 Code of Federal Regulations (CFR) 1910.120. As such, the HASP addresses those activities associated with field operations for this project. Compliance with this HASP is required for all ABB-ES personnel, contractor personnel, or third parties entering the site.

This HASP outlines project personnel and corporate health and safety policies; provides a brief site characterization and description of the scope of work; outlines potential hazards, protective measures, and monitoring for the site; and summarizes decontamination procedures. In addition, the HASP includes material safety data sheets for chemicals that may be encountered at the site and provides emergency information, such as a map to the hospital and emergency telephone numbers. The site-specific HASP references the CLEAN contract generic HASP where possible. The CLEAN generic HASP is included in Appendix A for onsite reference. Appendix B includes an Occupational Safety and Health Administration (OSHA) poster that must be displayed in a conspicuous place at the job site.

### 1.2 PROJECT PERSONNEL.

1.2.1 Task Order Manager The Task Order Manager (TOM) is the individual with overall project management responsibilities. Those responsibilities as they relate to health and safety include provision for the development of this site-specific HASP, the necessary resources to meet requirements of this HASP, the coordination of staff assignments to ensure that personnel assigned to the project meet medical and training requirements, and the means and materials necessary to resolve any health and safety issues that are identified or that develop on the project.

1.2.2 General Site Supervisor The General Site Supervisor has vested authority from the TOM to carry out day-to-day site operations.

1.2.3 Health and Safety Officer The Health and Safety Officer (HSO) will have at least an indirect line of reporting to the Health and Safety Manager (HSM) through the Health and Safety Supervisor (HSS) for the duration of his assignment as project HSO. The HSO is responsible for developing and implementing this site-specific HASP in accordance with the CLEAN HASP. The HSO will investigate all accidents, illnesses, and incidents occurring onsite. The HSO will also conduct safety briefings and site-specific training for onsite personnel. As necessary, the HSO will accompany all U.S. Environmental Protection Agency (USEPA), OSHA, or other governmental agency personnel visiting the Naval Submarine Base (NSB), Kings Bay, site in response to health and safety issues. The HSO, in consultation with the HSS or HSM, is responsible for updating and modifying this HASP as site or environmental conditions change.

1.3 TRAINING. Training is defined under the CLEAN HASP, and all personnel entering potentially contaminated areas at the NSB Kings Bay site must meet the

requirements of 29 CFR 1910.120. Personnel without the required training **will not be permitted** in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange). Refer to Chapter 3.0 of the CLEAN HASP for further information.

**1.4 MEDICAL SURVEILLANCE.** All personnel entering potentially contaminated areas of this site will be medically qualified for site assignment through a medical surveillance program outlined in the ABB-ES Generic HASP. Personnel who have not received medical clearance **will not be permitted** in any area with potential for exposure to toxic substances or harmful physical agents (i.e., downrange). Refer to Chapter 4.0 of the CLEAN HASP for further information.

## 2.0 SITE CHARACTERIZATION AND ANALYSIS

2.1 SITE NAME, LOCATION, AND SIZE. NSB Kings Bay is located in Camden County, in the southeastern corner of Georgia (Figure 2-1). The Base occupies an area of approximately 16,037 acres situated about 5 miles north of the city of St. Marys.

2.2 SITE HISTORY AND LAYOUT. The site was originally acquired by the U.S. Army in the early 1950's and was developed as Military Ocean Terminal, Kings Bay (MOTKI). It was constructed to meet Department of the Army requirements for east coast port facilities capable of shipping ammunition and other explosives in the event of a national emergency. Inasmuch as there was no immediate operational need for this installation, it was placed in an inactive status and remained in that status until its transference to the Navy. The Navy selected NSB Kings Bay as the east coast base for its Fleet Ballistic Missile Submarine Support Facility and ownership was transferred July 1, 1978. NSB Kings Bay was a terminal and not a storage dump or depot, as it was not designed to store ammunition or explosives for more than short periods of time. NSB Kings Bay had no assigned military personnel and was operated by 19 U.S. Government Civil Service employees, whose mission was to plan, program, and perform repair and utilities and fire prevention and protection functions for the terminal.

As prescribed by the Installation Restoration (IR) program at NSB Kings Bay, an Initial Assessment Study (IAS) was performed. The IAS report reviewed 16 potential sites and concluded that none of the sites needed additional investigation. The Georgia Environmental Protection Division issued a Hazardous Waste Permit (HW-014 [s][2]) in which they required four landfill sites to undergo additional investigation. Of the four sites (Sites 5, 11, 12, and 16), three were investigated during the initial Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI). The Site 12 investigation included a literature search only. Site 11, the Old Camden Landfill, will be the focus of this HASP, as the RFI continues and Interim Measures (IM) are planned at this site.

The Old Camden County Landfill is situated along the northwest boundary of the NSB. The width of the landfill ranges from approximately 140 feet at the southern end to approximately 760 feet at the northern end. The landfill is approximately 1,400 feet at its maximum length. The landfill operated as a trench and fill operation with trenches oriented in a southeast to northwest direction. Based on magnetic and ground-penetrating radar (GPR) surveys performed during previous investigations, the trenches range from 600 to 800 feet in length and 35 to 60 feet in width. GPR data also suggested that the spacing between trenches ranged between 3 and 5 feet and the depth to refuse ranged from 2 to 3 feet below land surface (bls).

The landfill was operated by Camden County from 1974 to 1981. On the average, approximately 12 truck loads per day of wastes were disposed at the site. Burning of wastes was allowed during the early years of landfill activity. This practice was prohibited in 1975. At the end of each day, the wastes (and ash) were compacted and covered with at least 6 inches of soil cover. The landfill ceased operations in October 1981 and was covered with 2 feet of fill. The

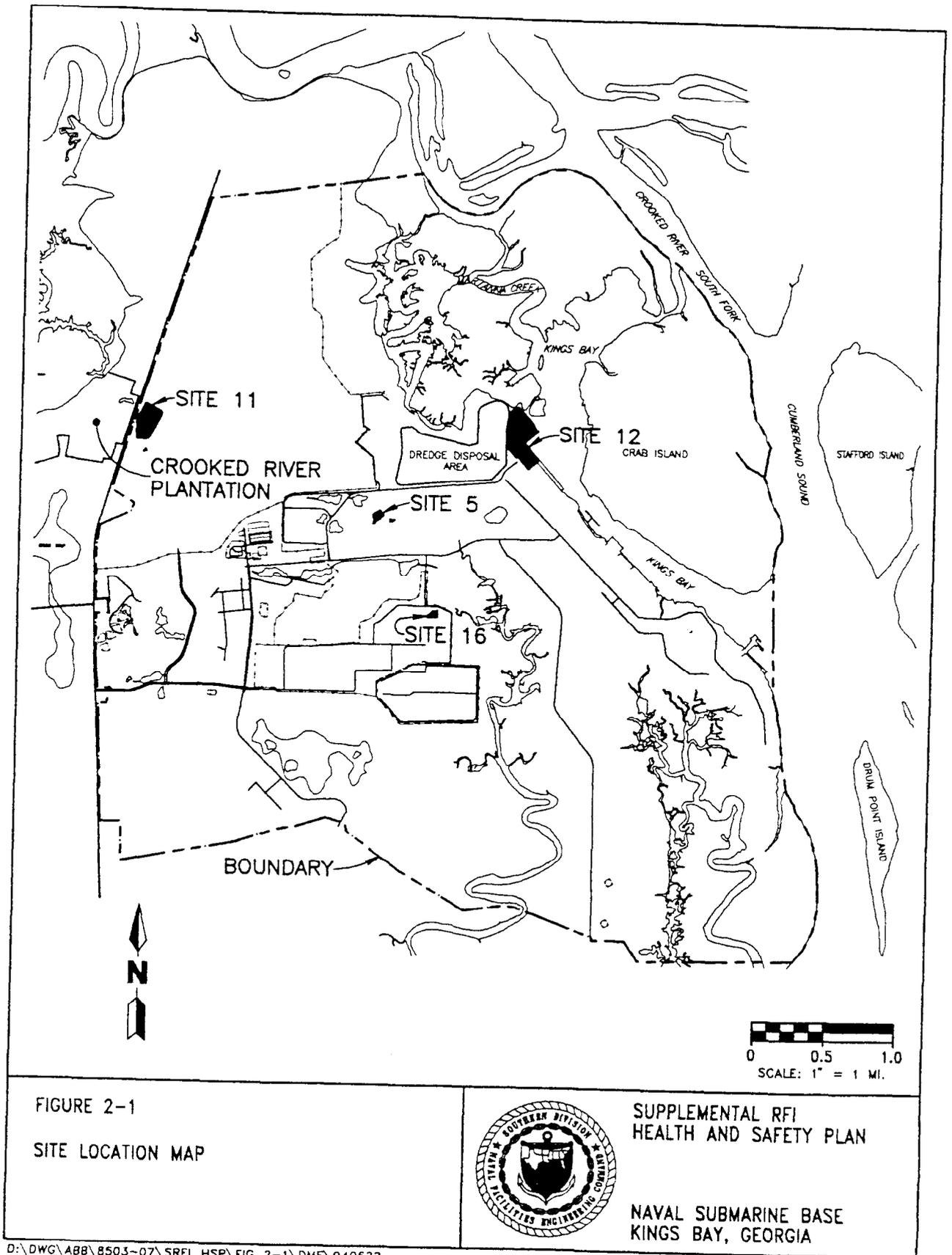


FIGURE 2-1  
SITE LOCATION MAP



SUPPLEMENTAL RFI  
HEALTH AND SAFETY PLAN

NAVAL SUBMARINE BASE  
KINGS BAY, GEORGIA

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landfill surface is currently vegetated with grasses, weeds, and pine saplings and has a flat undulating surface.

Approximately 500,000 cubic yards of waste were disposed at the landfill between 1974 and 1981. This reportedly consisted of general household waste, office waste, scrap paper and wood, and waste sludge and grit from the NSB sewage treatment plant. The landfill reportedly received no hazardous waste. Approximately 100 cubic yards of fire-fighting pit sludges from a proposed dredge spoils disposal area were assumed to be disposed in the landfill. This waste did not exceed Extraction Procedure toxicity as described 40 CFR Part 241.24 under Section 3001 of the RCRA, which was applicable for waste characterization in 1981.

Based on the results of RFI activities completed to date, chlorinated and non-chlorinated solvents and fuel-related volatile organic compounds (VOCs) have been identified as constituents of the waste at Site 11. Little semivolatile organic compound (SVOC) data currently exists. SVOCs detected during the first two bimonthly sampling events were limited to phthalates that could be attributed to laboratory or sampling artifacts. Chemical data and field observations indicated that contaminants are present as solute in groundwater. Concentrations of contaminants are generally less than 1 milligram per liter (mg/l), except for vinyl chloride and cis-1,2-dichloroethene that have been detected at concentrations exceeding 1 mg/l. Other contaminants found at the site at levels below 1 mg/l include acetone, tetrachloroethene, trichloroethene, trans-1,2-dichloroethene, 1,1-dichloroethane, 1,2-dichloroethane, 1,2-dichloropropane, benzene, toluene, ethylbenzene, xylenes, chlorobenzene, 1,4-dichlorobenzene, 2-methylphenol, 4-methylphenol, and 2,4-dimethylphenol.

2.3 SCOPE OF WORK (WORKPLAN). The field investigation at the Old Camden County Landfill (Site 11) will consist of the following:

- surface water and sediment sampling and ecological survey at Porcupine lake,
- air sampling,
- subsurface soil sampling,
- surface soil sampling,
- monitoring well installation,
- groundwater sampling,
- test pitting,
- aquifer testing, and
- Interim Measures.

### 3.0 HAZARD ANALYSIS

#### 3.1 TASK ONE, SURFACE WATER AND SEDIMENT SAMPLING AND ECOLOGICAL SURVEY.

Surface water and sediment samples will be taken at five locations in Porcupine Lake. The sampling will be conducted concurrently with the ecological survey and, if contamination is identified, the results will be used to assess contaminant exposures for aquatic receptors.

3.1.1 Hazardous Substances The contaminants of concern that may be present are listed in Table 3-1.

3.1.2 Site Risks The following are the health hazards and safety hazards that are expected to be encountered.

3.1.2.1 Health Hazards Health hazards at Porcupine Lake consist primarily of potential exposure to contaminated matrices. VOCs were not detected during prior onsite VOC analysis; however, 2-butanone and acetone were detected in low concentrations in one surface water sample analyzed offsite.

3.1.2.2 Safety Hazards Safety hazards include those hazards that 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, slips, trips and falls, sampling from a boat, and snake, spider, and tick bites. During hot days, personnel should take time to drink fluids and cool off to avoid overheating and symptoms related to heat stress (see Chapter 12 of the CLEAN Generic HASP [Appendix A]).

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, and black widow spiders. Life jackets will be worn by all personnel sampling from the boat.

3.1.2.3 Conclusions and Risk Assessment Based on all of the available information (nature of the work, potential onsite chemicals and their properties, exposure limits, etc.), hazards associated with conducting the described field work are considered to be low, assuming appropriate health and safety practices are maintained.

3.1.3 Protective Measures The following are the protective measures that will be used at the site.

3.1.3.1 Engineering Controls None anticipated.

3.1.3.2 Levels of Protection. As only very low level contamination was found during prior surface water and sediment sampling, level D protective equipment will be used initially. Level D protection should only be used when the atmosphere contains no known hazard, all potential airborne contaminants can be monitored for, and work functions preclude splash, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.

**Table 3-1  
Contaminants of Concern at Site 11**

**Supplemental Resource Conservation and Recovery  
Act Facility Investigation for Site 11  
Volume III, Health and Safety Plan  
Naval Submarine Base  
Kings Bay, Georgia**

Chemical	Approximate Odor Threshold (ppm)	Permissible Exposure Limits (ppm)	Threshold Limit Value (ppm)	Physical Characteristics	Dermal Toxicity	Remarks
Acetone	62	750	750	Colorless liquid, fragrant mint-like odor.	Moderate skin irritant.	Vapor irritating to eyes and mucous membranes.
Benzene	61	1	10, A2	Colorless liquid, pleasant aromatic odor.	Moderate skin irritant.	Inhalation of large amounts attacks central nervous system (CNS); chronic poisoning causes leukemia.
Chlorobenzene	1.3	75	10	Colorless liquid, sweet almond odor.	Moderate skin irritant.	Chronic inhalation may result in damage to lungs, liver, and kidney.
Chloroform	192	2	10, A2	Colorless, watery liquid, sweet odor.	Moderate skin irritant.	Headaches, nausea, dizziness, drunkenness, and narcosis.
1,2-Dichlorobenzene	0.7	C50	25	Colorless liquid, pleasant odor.	Moderate skin irritant.	Chronic inhalation may result in damage to lungs, liver, and kidney.
1,4-Dichlorobenzene	0.7	75	10, A3	White to clear solid crystals, mothball odor.	Moderate skin irritant.	Irritation of upper respiratory tract and eyes. Depression and injury to liver and kidney.
1,1-Dichloroethane	200	100	100	Colorless, oily liquid, chloroform-like odor.	Slight burn.	Irritation of respiratory tract, and eyes. Lacrimation. Salivation, sneezing, coughing, dizziness, nausea, and vomiting.
1,2-Dichloroethane	26	1	10	Colorless liquid, sweet odor.	May produce burn.	Nausea, drunkenness, depression. Eye contact may produce corneal injury.
1,2-Dichloroethene	500	200	200	Colorless liquid, sweet pleasant odor.	Moderate skin irritant.	Nausea, vomiting, weakness, tremor, cramps, CNS depression.
1,2-Dichloropropane	0.26	75	75	Colorless, watery liquid, sweet odor.	Moderate skin irritant.	May cause skin and eye irritation.
2,4-Dimethylphenol	---					
Ethylbenzene	0.6	100	100	Colorless liquid, aromatic odor.	Liquid blisters skin.	Dizziness, depression.
2-Methylphenol (o-Cresol)	0.0006	5	5	Colorless to yellow solid crystals or liquid.	Absorbs through intact skin. Corrosive.	CNS depression, muscular weakness, gastroenteric disturbances, convulsions, and death.
See notes at end of table.						

**Table 3-1 (Continued)  
Contaminants of Concern at Site 11**

**Supplemental Resource Conservation and Recovery  
Act Facility Investigation for Site 11  
Volume III, Health and Safety Plan  
Naval Submarine Base  
Kings Bay, Georgia**

Chemical	Approximate Odor Threshold (ppm)	Permissible Exposure Limits (ppm)	Threshold Limit Value (ppm)	Physical Characteristics	Dermal Toxicity	Remarks
4-Methylphenol (p-Cresol)	0.00028	5	5	Colorless solid, tar-like odor.	Absorbs through skin, discoloration, intense burning, loss of feeling.	Irritation of nose or throat, may damage eyes. Can cause gangrene. Muscular weakness, gastroenteric disturbance, severe depression, and collapse.
Naphthalene	0.038	10	10	Colorless to brown solid with an odor of mothballs.	Moderate skin irritant.	Inhalation causes headache and confusion; vapors irritate eyes.
Tetrachloroethylene	47	25	25	Colorless liquid with an odor like chloroform.	Moderate skin irritant.	Inhalation may irritate eyes and nose and cause CNS damage.
Toluene	16	100	50	Colorless liquid, pleasant aromatic odor.	Mild skin irritant.	Ingestion or aspiration can cause pulmonary edema, depressed respiration.
Trichloroethene	82	50	50	Colorless liquid, sweet odor.	Can cause dermatitis.	Eye and nose irritation, blurred vision, nausea, CNS damage.
Vinyl chloride	20	1	5,A1	Colorless gas, sweet odor.	May cause frostbite.	Dizziness, anesthesia, lung irritation.
Xylene	5.4	100	100	Colorless watery liquid, sweet odor.	Moderate skin irritant.	Headaches, dizziness, severe coughing, distress, pulmonary edema, nausea, vomiting, cramps, coma. Can be fatal.
<p>Sources: American Industrial Hygienists Association, 1989. U.S. Department of Transportation and U.S. Coast Guard, 1991. National Institute of Occupational Safety and Health, 1990. American Conference of Governmental and Industrial Hygienists. Occupational Safety and Health Administration, 1989.</p> <p>Notes: ppm = parts per million. A1 = Known Human Carcinogen. A2 = Suspected Human Carcinogen. A3 = Animal Carcinogen, Not Likely a Human Carcinogen. C = ceiling limit.</p>						

3.1.4 Monitoring It is intended that real time monitoring instrumentation will be used to monitor the work environment to ensure the appropriate level of protection for the site team.

**3.1.4.1 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 used at the site and may be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment will be used at the site:

1. PORTA-FID (portable flame ionization detector) organic vapor analyzer (OVA) and
2. Draeger pump with vinyl chloride 0.5/a and benzene 0.5/c tubes.

Refer to Chapter 7.0 of the CLEAN HASP for information on the calibration and maintenance of the equipment.

If the OVA detects a steady measurable quantity of organic vapors greater than background at the source (e.g., borehole or sample), upgrade to modified level D. If the OVA reads steadily above background in the breathing zone, begin monitoring with vinyl chloride and benzene Draeger tubes. If vinyl chloride levels reach or exceed 0.5 parts per million (ppm) in the breathing zone, upgrade to level B. If vinyl chloride levels are below 0.5 ppm, but benzene levels are greater than 0.5 ppm, upgrade to level C. Otherwise continue working at modified level D until the OVA reads 5 ppm above background in the breathing zone at which time upgrade to level C. Upgrade to level B if OVA readings reach or exceed 50 ppm.

The above action limits are summarized below.

Level B personal protective equipment (PPE) required if:

Vinyl chloride Draeger tube  $\geq$  0.5 ppm; or  
OVA  $\geq$  50 ppm.

Level C PPE required if:

Vinyl chloride Draeger tube  $<$  0.5 ppm;  
Benzene Draeger tube  $\geq$  0.5 ppm; and  
OVA  $\geq$  5 ppm but  $<$  50 ppm.

Modified Level D PPE required if:

Vinyl chloride Draeger tube  $<$  0.5 ppm;  
Benzene Draeger tube  $<$  0.5 ppm; and  
OVA  $>$  background at the source but  $<$  5 ppm.

Level D PPE acceptable if:

OVA levels at the source are at background.

3.1.4.2 **Personal Monitoring** All ABB-ES personnel onsite will wear a thermoluminescent dosimetry body badge to measure possible exposure to radiation.

**3.2 TASK TWO, AIR SAMPLING.** Air sampling for baseline characterization will be conducted prior to soil-intrusive activities and again during site investigation. Three sampling events will be conducted to evaluate levels of Target Compound List (TCL) VOCs using USEPA Method TO-14. Sampling locations will be selected with the aid of a portable meteorological station that will be set up onsite. VOC concentrations during site activities will be compared to levels measured during the baseline evaluation to determine the impact of test pitting, etc., on the site's air quality.

**3.2.1 Hazardous Substances** The contaminants of concern that may be present are listed in Table 3-1.

**3.2.2 Site Risks** The following are the health hazards and safety hazards that are expected to be encountered.

**3.2.2.1 Health Hazards** Health hazards consist primarily of potential exposure to contaminated matrices.

**3.2.2.2 Safety Hazards** Safety hazards include those hazards that 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, slips, trips, and falls, as well as snake, spider, and tick 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 Chapter 12 of the CLEAN Generic HASP).

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. Take care when walking over the landfill or uneven terrain, especially where vegetation may cover the hazard. During all site activities, personnel should be aware of the possibility of an encounter with poisonous snakes, particularly rattlesnakes, and black widow spiders.

**3.2.2.3 Conclusions and Risk Assessment** Based on all of the available information (nature of the work, potential onsite chemicals and their properties, exposure limits, etc.), hazards associated with conducting the described field work are considered to be low, assuming appropriate health and safety practices are maintained.

**3.2.3 Protective Measures** The following are the protective measures that will be used at the site.

**3.2.3.1 Engineering Controls** None anticipated.

**3.2.3.2 Levels of Protection** As only very low level contamination was found in the groundwater and soil, level D protective equipment will be used initially. Level D protection should only be used when the atmosphere contains no known hazard, all potential airborne contaminants can be monitored for, and work

functions preclude splash, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.

3.2.4 Monitoring It is intended that real time monitoring instrumentation will be used to monitor the work environment to ensure the appropriate level of protection for the site team.

3.2.4.1 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 used at the site and may be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment will be used at the site:

1. PORTA-FID OVA,
2. Draeger pump with vinyl chloride 0.5/a and benzene 0.5/c tubes, and
3. low explosion limit (LEL)/oxygen meter.

Refer to Chapter 7.0 of the CLEAN HASP for information on the calibration and maintenance of the equipment.

If OVA reads steadily above background in the breathing zone, begin monitoring with vinyl chloride and benzene Draeger tubes. If vinyl chloride levels reach or exceed 0.5 ppm in the breathing zone, upgrade to level B. If vinyl chloride levels are below 0.5 ppm, but benzene levels are greater than 0.5 ppm, upgrade to level C. Otherwise continue working at modified level D until OVA reads 5 ppm above background in the breathing zone at which time upgrade to Level C. Upgrade to level B if OVA readings reach or exceed 50 ppm.

The above action limits are summarized below.

Level B PPE required if:

Vinyl chloride Draeger tube  $\geq$  0.5 ppm; or  
OVA  $\geq$  50 ppm.

Level C PPE required if:

Vinyl chloride Draeger tube  $<$  0.5 ppm;  
Benzene Draeger tube  $\geq$  0.5 ppm; and  
OVA  $\geq$  5 ppm but  $<$  50 ppm.

Level D PPE required if:

Vinyl chloride Draeger tube  $<$  0.5 ppm;  
Benzene Draeger tube  $<$  0.5 ppm; and  
OVA  $<$  5 ppm.

LEL/Oxygen Meter:

Oxygen  $\geq$ 19.5 percent - see above;  
Oxygen <19.5 percent - backoff as Level B PPE required;  
LEL >10 percent at source - continue, only using proper precautions; and  
LEL >20 percent at source - backoff.

3.2.4.2 **Personal Monitoring** All personnel on the site will be enrolled in the ABB-ES medical surveillance program. In addition, all ABB-ES personnel on the site will wear a thermoluminescent dosimetry body badge to measure possible exposure to radiation.

3.3 TASK THREE, SOIL SAMPLING. Fifteen soil borings (Figure 3-1) will be advanced for the purposes of collecting subsurface soil samples for lithologic characterization or physical and chemical analyses. Two of the borings are within the landfill. Split-spoon samples will be collected from all borings at 5-foot intervals. Seven soil samples will be collected from borings assumed to be in areas outside the contaminated plume for fate and transport analysis. Three background samples and five samples from within the contaminant plume will be collected for chemical analyses, including TCL VOCs, TCL SVOCs, TCL pesticides and polychlorinated biphenyl compounds, Target Analyte List (TAL) inorganics (full TCL/TAL), cyanide, and sulfide. Four soil samples will be collected from within the plume for analysis of TCL VOCs, TCL SVOCs, TAL inorganics, cyanide, and sulfide. In addition, four soil samples will be collected (two within the plume and two outside the plume) to aid the evaluation of bioremediation as a potential corrective measure.

Recovery wells will be drilled as part of the IM. Subsurface soil samples will be collected at 5-foot intervals.

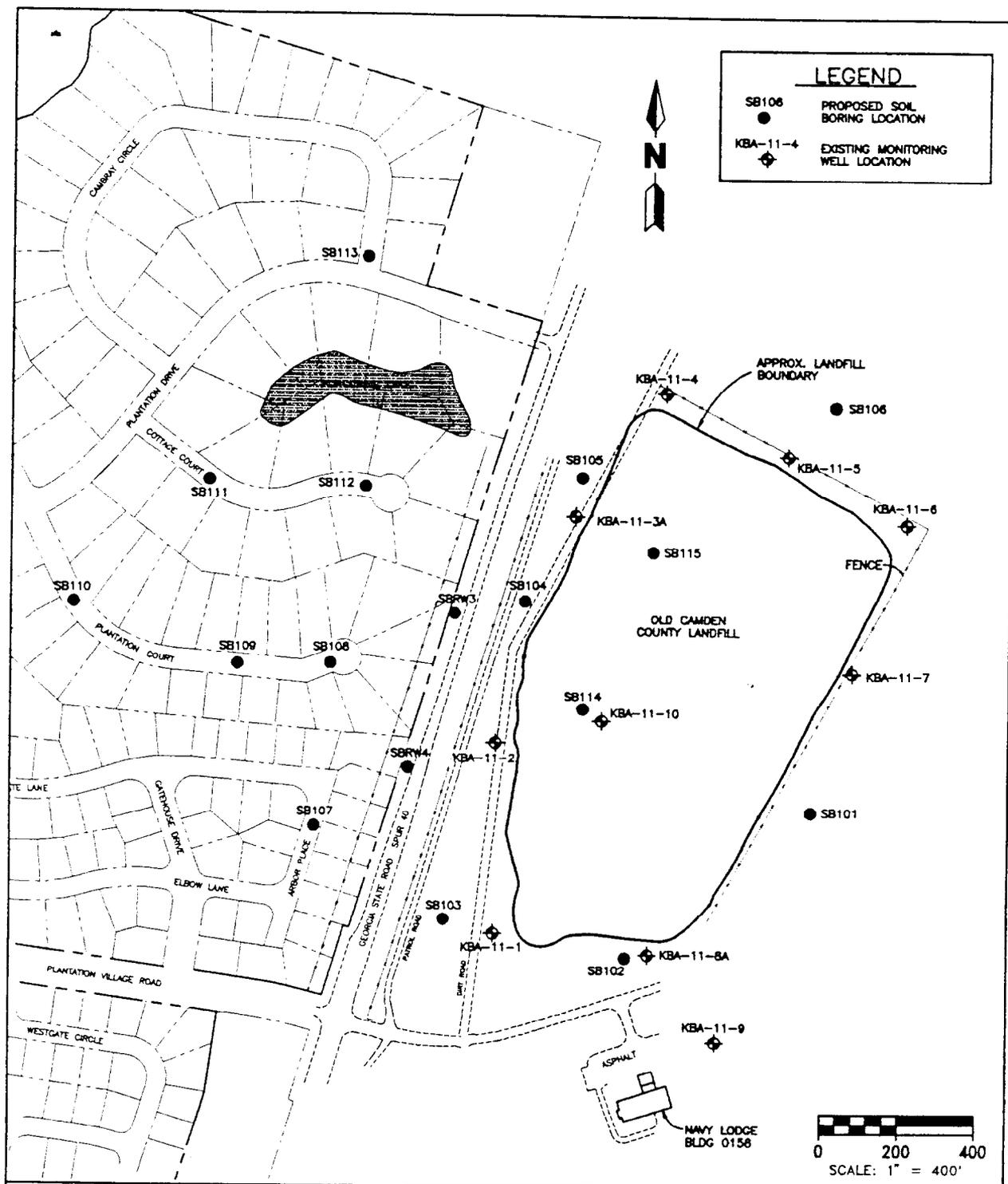
Five composite surface and near surface soil samples will be collected from locations within the landfill and two additional surface soil samples will be collected from locations east of the landfill (background samples). Additional surface and near surface soil samples may need to be collected from the subdivision to complete the risk assessment for the site. The need to collect these additional samples will be evaluated after the groundwater contamination has been further characterized.

3.3.1 Hazardous Substances The contaminants of concern that may be present are listed in Table 3-1.

3.3.2 Site Risks The following are the health hazards and safety hazards that are expected to be encountered.

3.3.2.1 **Health Hazards** Health hazards consist primarily of potential exposure to contaminated matrices.

3.3.2.2 **Safety Hazards** Safety hazards include those hazards that 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, slips, trips, and falls, as well as snake, spider, and tick bites. Extreme caution should be exhibited by all personnel while conducting work around drill rigs, backhoes, and other heavy equipment. During



**FIGURE 3-1**  
**PROPOSED SOIL BORING LOCATIONS**



**SUPPLEMENTAL RFI  
 HEALTH AND SAFETY PLAN**

**NAVAL SUBMARINE BASE  
 KINGS BAY, GEORGIA**

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hot days, personnel should take time to drink fluids and cool off to avoid overheating and symptoms related to heat stress (see Chapter 12 of the CLEAN Generic HASP).

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. Take care when walking over the landfill or uneven terrain, especially where vegetation may cover the hazard. During all site activities, personnel should be aware of the possibility of an encounter with poisonous snakes, particularly rattlesnakes, and black widow spiders.

**3.3.2.3 Conclusions and Risk Assessment** Based on all of the available information (nature of the work, potential onsite chemicals and their properties, exposure limits, etc.), hazards associated with conducting the described field work are considered to be low, assuming appropriate health and safety practices are maintained.

**3.3.3 Protective Measures** The following are the protective measures that will be used at the site.

**3.3.3.1 Engineering Controls** None anticipated.

**3.3.3.2 Levels of Protection** Low level contamination was found from prior sampling. Level D protection will be worn if heat stress is a factor and the atmosphere contains no known hazard, all potential airborne contaminants can be monitored for, and work functions preclude splash, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.

**3.3.4 Monitoring** It is intended that real time monitoring instrumentation will be used to monitor the work environment to ensure the appropriate level of protection for the site team.

**3.3.4.1 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 used at the site and may be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment will be used at the site:

1. PORTA-F1D OVA,
2. Draeger pump with vinyl chloride 0.5/a and benzene 0.5/c tubes, and
3. LEL/oxygen meter.

Refer to Chapter 7.0 of the CLEAN HASP for information on the calibration and maintenance of the equipment.

If the OVA detects a steady measurable quantity of organic vapors greater than background at the source (e.g., borehole, sample), upgrade to modified level D. If OVA reads steadily above background in the breathing zone, begin monitoring with vinyl chloride and benzene Draeger tubes. If vinyl chloride levels reach or exceed 0.5 ppm in the breathing zone, upgrade to level B. If vinyl chloride levels are below 0.5 ppm, but benzene levels are greater than 0.5 ppm, upgrade

to level C. Otherwise continue working at modified level D until OVA reads 5 ppm above background in the breathing zone at which time upgrade to level C. Upgrade to level B if OVA readings reach or exceed 50 ppm.

The above action limits are summarized below.

Level B PPE required if:

Vinyl chloride Draeger tube  $\geq 0.5$  ppm; or  
OVA  $\geq 50$  ppm.

Level C PPE required if:

Vinyl chloride Draeger tube  $< 0.5$  ppm;  
Benzene Draeger tube  $\geq 0.5$  ppm; and  
OVA  $\geq 5$  ppm but  $< 50$  ppm.

Modified Level D PPE required if:

Vinyl chloride Draeger tube  $< 0.5$  ppm;  
Benzene Draeger tube  $< 0.5$  ppm; and  
OVA  $>$  background at the source but  $< 5$  ppm.

Level D PPE acceptable if:

OVA levels at the source are at background.

LEL/Oxygen Meter:

Oxygen  $\geq 19.5$  percent - see above;  
Oxygen  $< 19.5$  percent - backoff as Level B PPE required;  
LEL  $> 10$  percent at source - continue only using proper precautions; and  
LEL  $> 20$  percent at source - backoff.

**3.3.4.2 Personal Monitoring** All personnel on the site will be enrolled in the ABB-ES medical surveillance program. In addition, all ABB-ES personnel on the site will wear a thermoluminescent dosimetry body badge to measure possible exposure to radiation.

**3.4 TASK FOUR, MONITORING WELL INSTALLATION AND GROUNDWATER SAMPLING.** Twenty-five new monitoring wells will be installed in and around the landfill and in Crooked River Plantation Subdivision (Figure 3-2). Groundwater samples will be collected from the estimated 35 new and existing monitoring wells. Two monitoring events have been scheduled. In the event that contaminants are identified that were not previously identified, a plan to sample private irrigation wells will be developed.

**3.4.1 Hazardous Substances** The contaminants of concern that may be present are listed in Table 3-1.

**3.4.2 Site Risks** The following are the health hazards and safety hazards that are expected to be encountered.

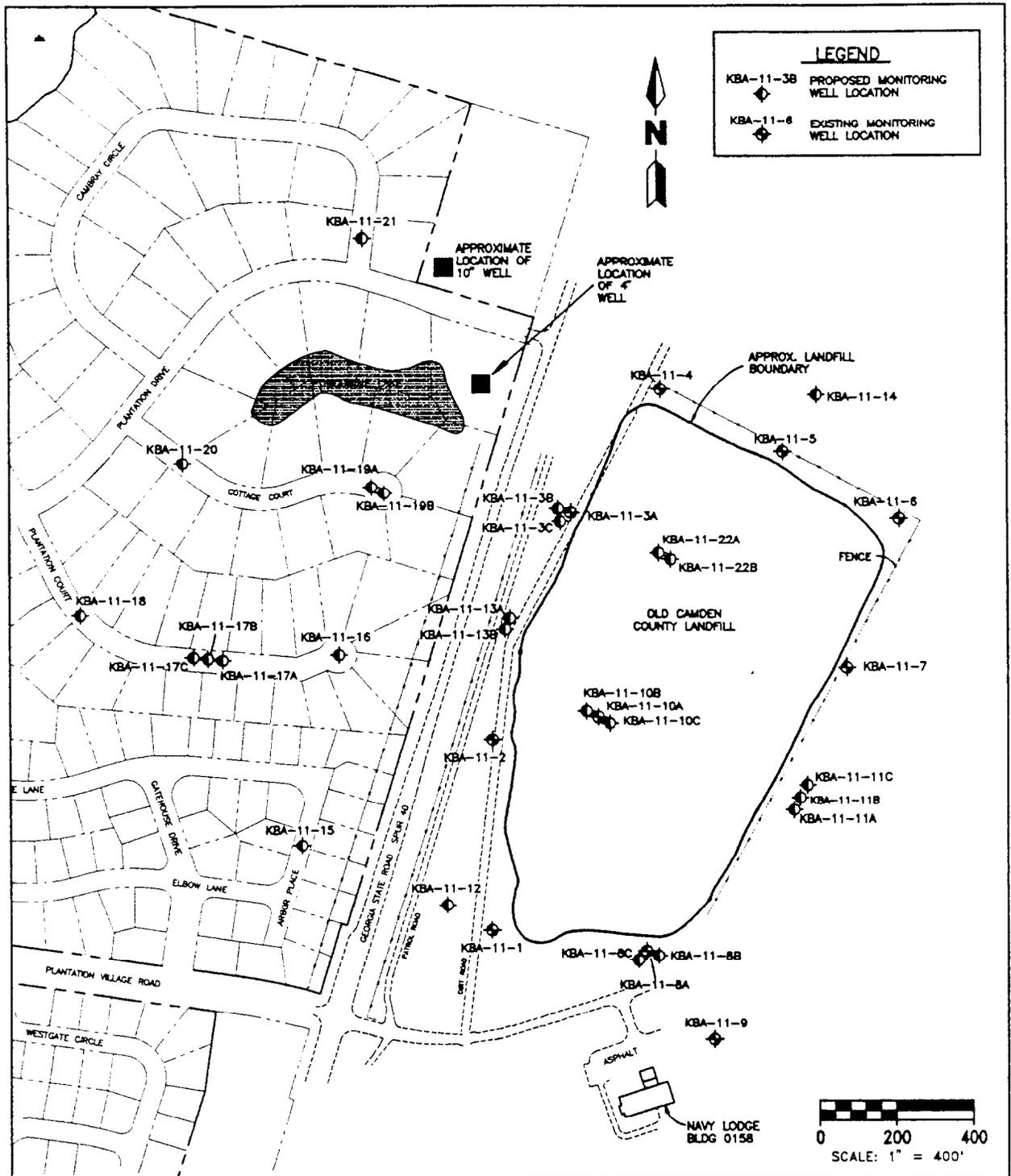


FIGURE 3-2  
EXISTING AND PROPOSED  
MONITORING WELL LOCATIONS



SUPPLEMENTAL RFI  
HEALTH AND SAFETY PLAN

NAVAL SUBMARINE BASE  
KINGS BAY, GEORGIA

D:\DWG\ABB\8503-07\SRFI\_HSP\FIG\_3-2\DMF\940623

**3.4.2.1 Health Hazards** Health hazards consist primarily of potential exposure to contaminated matrices.

**3.4.2.2 Safety Hazards** Safety hazards include those hazards that 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, slips, trips, and falls, as well as snake, spider, and tick 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 Chapter 12 of the CLEAN Generic HASP).

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. Take care when walking over the landfill or uneven terrain, especially where vegetation may cover the hazard. During all site activities, personnel should be aware of the possibility of an encounter with poisonous snakes, particularly rattlesnakes, and black widow spiders.

**3.4.2.3 Conclusions and Risk Assessment** Based on all of the available information (nature of the work, potential onsite chemicals and their properties, exposure limits, etc.), hazards associated with conducting the described field work are considered to be low, assuming appropriate health and safety practices are maintained.

**3.4.3 Protective Measures** The following are the protective measures that will be used at the site.

**3.4.3.1 Engineering Controls** None anticipated.

**3.4.3.2 Levels of Protection** Low level contamination was found from prior sampling. Level D protection will be worn if heat stress is a factor and the atmosphere contains no known hazard, all potential airborne contaminants can be monitored for, and work functions preclude splash, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.

**3.4.4 Monitoring** It is intended that real time monitoring instrumentation will be used to monitor the work environment to ensure the appropriate level of protection for the site team.

**3.4.4.1 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 utilized at the site and may be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment will be used at the site:

1. PORTA-FID OVA,
2. Draeger pump with vinyl chloride 0.5/a and benzene 0.5/c tubes, and
3. LEL/oxygen meter.

Refer to Chapter 7.0 of the CLEAN HASP for information on the calibration and maintenance of the equipment.

If the OVA detects a steady measurable quantity of organic vapors greater than background at the source (e.g., borehole, sample), upgrade to modified level D. If OVA reads steadily above background in the breathing zone, begin monitoring with vinyl chloride and benzene Draeger tubes. If vinyl chloride levels reach or exceed 0.5 ppm in the breathing zone, upgrade to level B. If vinyl chloride levels are below 0.5 ppm, but benzene levels are greater than 0.5 ppm, upgrade to level C. Otherwise continue working at modified level D until OVA reads 5 ppm above background in the breathing zone at which time upgrade to level C. Upgrade to level B if OVA readings reach or exceed 50 ppm.

The above action limits are summarized below:

Level B PPE required if:

Vinyl chloride Draeger tube  $\geq$  0.5 ppm; or  
OVA  $\geq$  50 ppm.

Level C PPE required if:

Vinyl chloride Draeger tube  $<$  0.5 ppm;  
Benzene Draeger tube  $\geq$  0.5 ppm; and  
OVA  $\geq$  5 ppm but  $<$  50 ppm.

Modified Level D PPE required if:

Vinyl chloride Draeger tube  $<$  0.5 ppm;  
Benzene Draeger tube  $<$  0.5 ppm; and  
OVA  $>$  background at the source but  $<$  5 ppm.

Level D PPE acceptable if:

OVA levels at the source are at background.

LEL/Oxygen Meter:

Oxygen  $\geq$  19.5 percent in breathing zone, see above;  
Oxygen  $<$  19.5 percent in breathing zone, backoff as Level B PPE required;  
LEL  $>$  10 percent at source - continue only using proper precautions; and  
LEL  $>$  20 percent at source - backoff.

**3.4.4.2 Personal Monitoring** All personnel on the site will be enrolled in the ABB-ES medical surveillance program. In addition, all ABB-ES personnel on the site will wear a thermoluminescent dosimetry body badge to measure possible exposure to radiation.

**3.5 TASK FIVE, TEST TRENCHES.** Ten test trenches (Figure 3-3) will be excavated in the landfill to a depth of approximately 10 to 12 feet bls or until groundwater is encountered to allow visual examination and possible sampling of the waste material. The test pits will be excavated in areas where magnetic

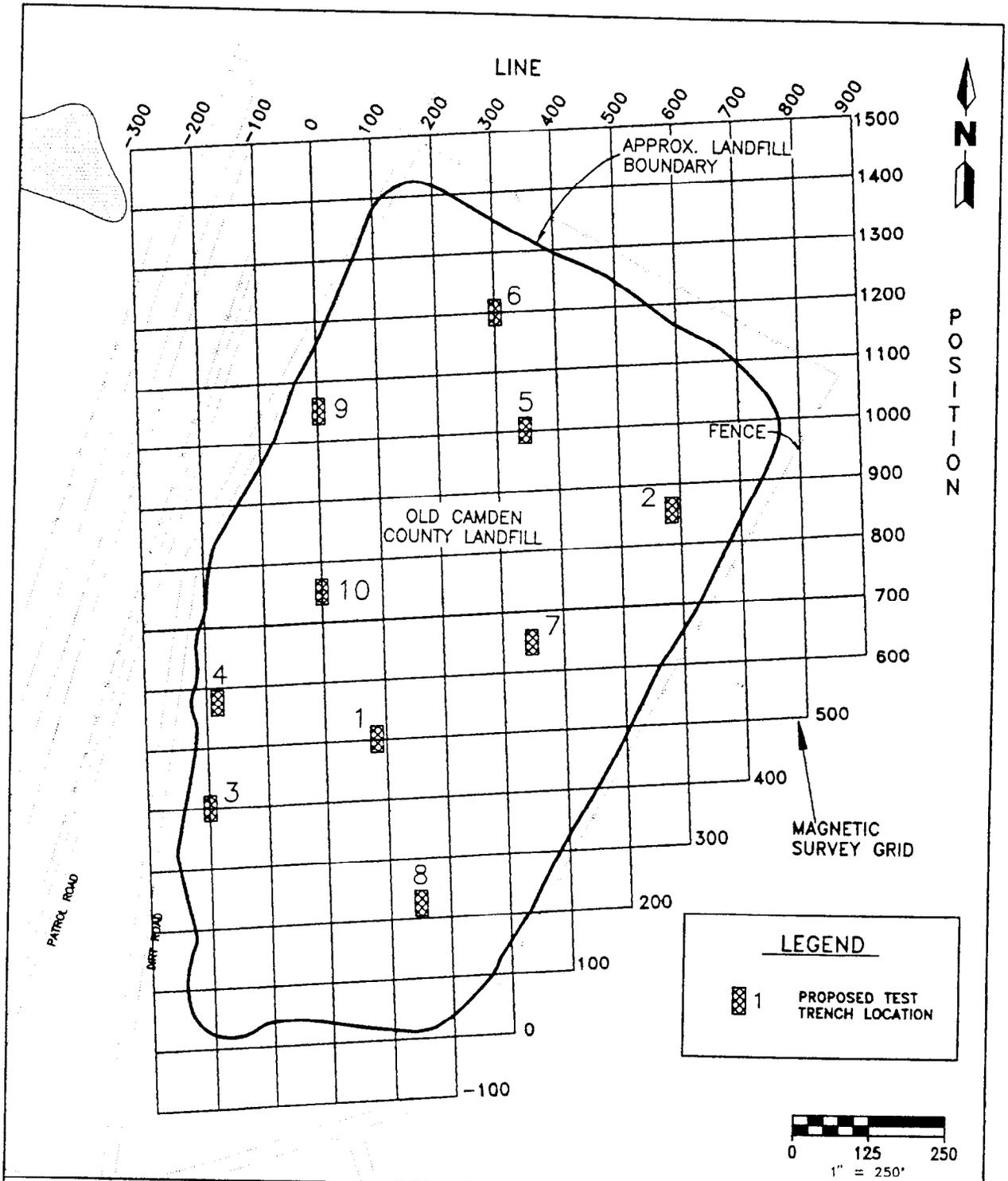


FIGURE 3-3  
PROPOSED TEST TRENCH LOCATIONS



SUPPLEMENTAL RFI  
HEALTH AND SAFETY PLAN

NAVAL SUBMARINE BASE  
KINGS BAY, GEORGIA

D:\DWG\ABB\8503-07\SRFI\_HSP\FIG\_3-3\DMF\940622

anomalies were observed and in areas suspected to be "hot spots" of the contamination plume.

3.5.1 Hazardous Substances The contaminants of concern that may be present are listed in Table 3-1.

3.5.2 Site Risks The following are the health hazards and safety hazards that are expected to be encountered.

**3.5.2.1 Health Hazards** Health hazards consist primarily of potential exposure to contaminated matrices.

**3.5.2.2 Safety Hazards** Safety hazards include those hazards that 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, slips, trips, and falls, as well as snake, spider, and tick 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.

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. Take care when walking over the landfill or uneven terrain, especially where vegetation may cover the hazard. During all site activities, personnel should be aware of the possibility of an encounter with poisonous snakes, particularly rattlesnakes, and black widow spiders.

Personnel are not expected to enter the trenches. Any personnel needing to enter the trenches will be trained in confined space entry. Trenches will be shored prior to personnel entering the trenches.

**3.5.2.3 Conclusions and Risk Assessment** As the test pits will be excavated in areas where magnetic anomalies were observed, there is a potential for unknowns and high concentrations of contamination.

3.5.3 Protective Measures The following are the protective measures that will be used at the site.

**3.5.3.1 Engineering Controls** None anticipated.

**3.5.3.2 Levels of Protection** As unknowns and high concentrations of contamination are a potential, level B PPE will be worn by all workers in the exclusion zone. Downgrading of PPE is not expected to be a potential while doing this task.

3.5.4 Monitoring It is intended that real time monitoring instrumentation will be used to monitor the work environment in order to ensure the appropriate level of protection for the site team.

**3.5.4.1 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 used at the site, and may be used as the basis for upgrading or

downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment will be used at the site:

1. PORTA-FID OVA and
2. LEL/oxygen meter.

Refer to Chapter 7.0 of the CLEAN HASP for information on the calibration and maintenance of the equipment.

Level B PPE will be worn initially while doing test pitting. As there is a potential for unknowns or high concentrations of contaminants, downgrading of PPE is not expected. Monitoring with an LEL/oxygen meter will be conducted. Action limits are as follows:

LEL/Oxygen Meter:

LEL >10 percent at source - continue only using proper precautions; and  
LEL >20 percent at source - backoff.

**3.5.4.2 Personal Monitoring** All personnel on the site will be enrolled in the ABB-ES medical surveillance program. In addition, all ABB-ES personnel on the site will wear a thermoluminescent dosimetry body badge to measure possible exposure to radiation.

**3.6 TASK SIX, AQUIFER CHARACTERIZATION.** Aquifer characterization tests are being conducted as part of the IM. These tests include a 25-hour pumping test on one of the recovery wells, step-drawdown tests at each recovery well installed, and long-term (7 to 10 days) pumping tests at a selected recovery well. Other long-term tests will be performed by pumping simultaneously from two recovery wells and then from all six recovery wells to delineate the groundwater extraction system's capture zone.

**3.6.1 Hazardous Substances** The contaminants of concern that may be present are listed in Table 3-1.

**3.6.2 Site Risks** The following are the health hazards and safety hazards that are expected to be encountered.

**3.6.2.1 Health Hazards** Health hazards consist primarily of potential exposure to contaminated matrices.

**3.6.2.2 Safety Hazards** Safety hazards include those hazards that 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, slips, trips, and falls, as well as snake, spider, and tick 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 Chapter 12 of the CLEAN Generic HASP).

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. Take care when walking over the landfill or uneven terrain, especially where vegetation may cover the hazard. During all site activities, personnel should be aware of the possibility of an encounter with poisonous snakes, particularly rattlesnakes, and black widow spiders.

**3.6.2.3 Conclusions and Risk Assessment** Based on all of the available information (nature of the work, potential onsite chemicals and their properties, exposure limits, etc.), hazards associated with conducting the described field work are considered to be low, assuming appropriate health and safety practices are maintained.

**3.6.3 Protective Measures** The following are the protective measures that will be used at the site.

**3.6.3.1 Engineering Controls** None anticipated.

**3.6.3.2 Levels of Protection** As only very low level contamination was found during prior sampling, Level D protective equipment will be used initially. Level D protection should only be used when the atmosphere contains no known hazard, all potential airborne contaminants can be monitored for, and work functions preclude splash, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.

**3.6.4 Monitoring** It is intended that real time monitoring instrumentation will be used to monitor the work environment in order to ensure the appropriate level of protection for the site team.

**3.6.4.1 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 utilized to ensure the adequacy of the levels of protection being used at the site and may be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment will be used at the site:

1. PORTA-FID OVA,
2. Draeger pump with vinyl chloride 0.5/a and benzene 0.5/c tubes, and
3. LEL/oxygen meter.

Refer to Chapter 7.0 of the CLEAN HASP for information on the calibration and maintenance of the equipment.

If the OVA detects a steady measurable quantity of organic vapors greater than background at the source (e.g., borehole, sample), upgrade to modified level D. If OVA reads steadily above background in the breathing zone, begin monitoring with vinyl chloride and benzene Draeger tubes. If vinyl chloride levels reach or exceed 0.5 ppm in the breathing zone, upgrade to level B. If vinyl chloride levels are below 0.5 ppm, but benzene levels are greater than 0.5 ppm, upgrade to level C. Otherwise continue working at modified level D until OVA reads 5 ppm above background in the breathing zone at which time upgrade to level C. Upgrade to level B if OVA readings reach or exceed 50 ppm.

The above action limits are summarized below.

Level B PPE required if:

Vinyl chloride Draeger tube  $\geq$  0.5 ppm; or  
OVA  $\geq$  50 ppm.

Level C PPE required if:

Vinyl chloride Draeger tube  $<$  0.5 ppm;  
Benzene Draeger tube  $\geq$  0.5 ppm; and  
OVA  $\geq$  5 ppm but  $<$  50 ppm.

Modified Level D PPE required if:

Vinyl chloride Draeger tube  $<$  0.5 ppm;  
Benzene Draeger tube  $<$  0.5 ppm; and  
OVA  $>$  background at the source but  $<$  5 ppm.

Level D PPE acceptable if:

OVA levels at the source are at background.

LEL/Oxygen Meter:

Oxygen  $\geq$  19.5 percent - see above;  
Oxygen  $<$  19.5 percent - backoff as Level B PPE required;  
LEL  $>$  10 percent at source - continue only using proper precautions; and  
LEL  $>$  20 percent at source - backoff.

3.6.4.2 **Personal Monitoring** All personnel on the site will be enrolled in the ABB-ES medical surveillance program. In addition, all ABB-ES personnel on the site will wear a thermoluminescent dosimetry body badge to measure possible exposure to radiation.

3.7 TASK SEVEN, INTERIM MEASURES. Four to six recovery wells are to be installed at four locations in the area found to contain the highest concentrations of VOC contaminants (Figure 3-4). A submersible pump will be installed in the wells and the groundwater will be discharged to the pretreatment tank located on the treatment pad. The groundwater treatment system includes collection of extracted groundwater; pretreatment for removal of heavy metals, iron and carbonate; and air stripping for removal of volatile organics. The pretreatment will include an 1,800-gallon equalization tank for collection of groundwater from recovery wells. This tank also may be used for monitoring or chemical addition, if needed. The pretreatment process(es) may include aeration, chemical addition, precipitation, sedimentation, filtration, and dewatering. The layout of the treatment compound is shown in Figure 3-5.

3.7.1 Hazardous Substances The contaminants of concern that may be present are listed in Table 3-1.

3.7.2 Site Risks The following are the health hazards and safety hazards that are expected to be encountered.

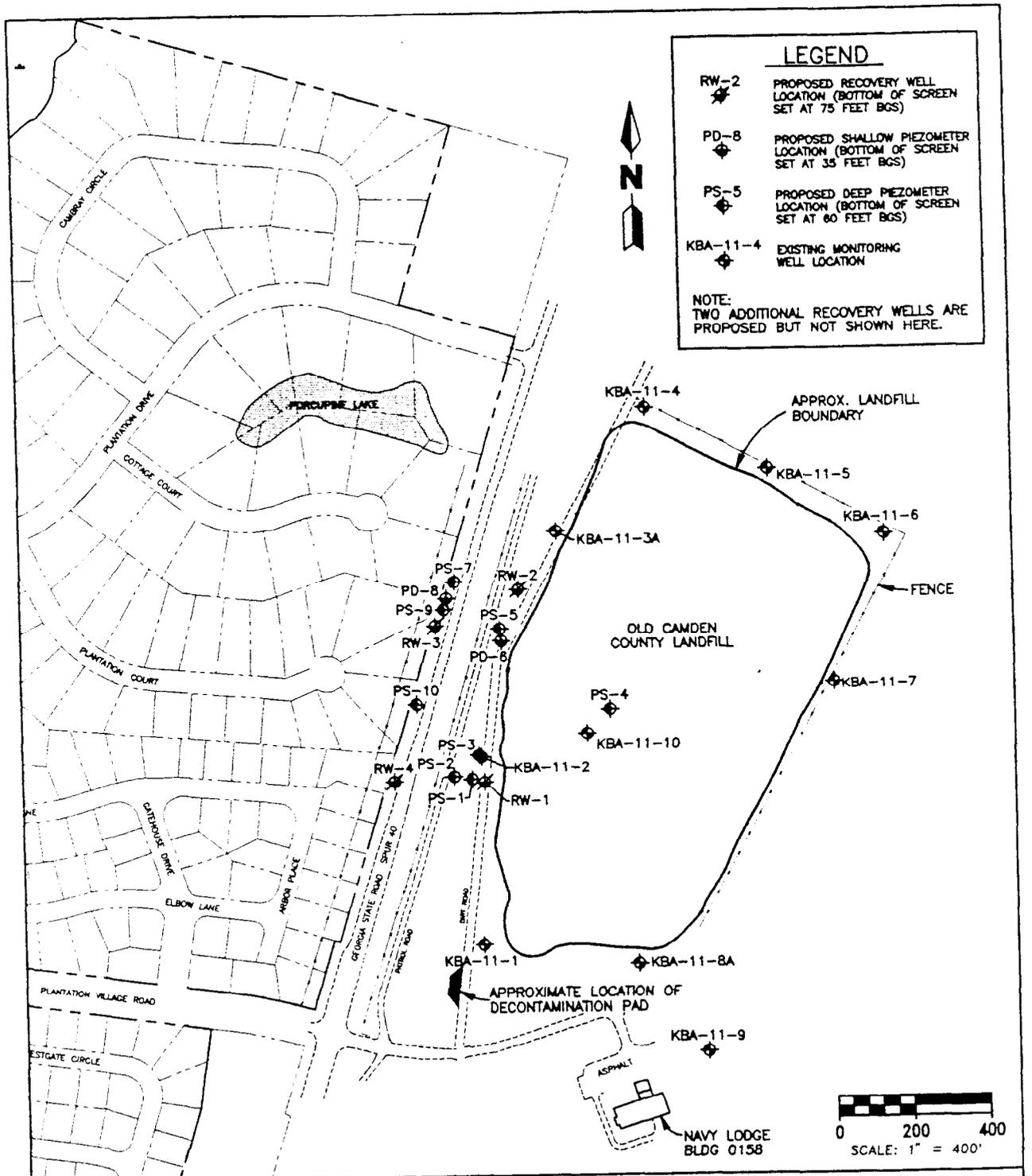


FIGURE 3-4  
PROPOSED RECOVERY WELL LOCATIONS



SUPPLEMENTAL RFI  
HEALTH AND SAFETY PLAN

NAVAL SUBMARINE BASE  
KINGS BAY, GEORGIA

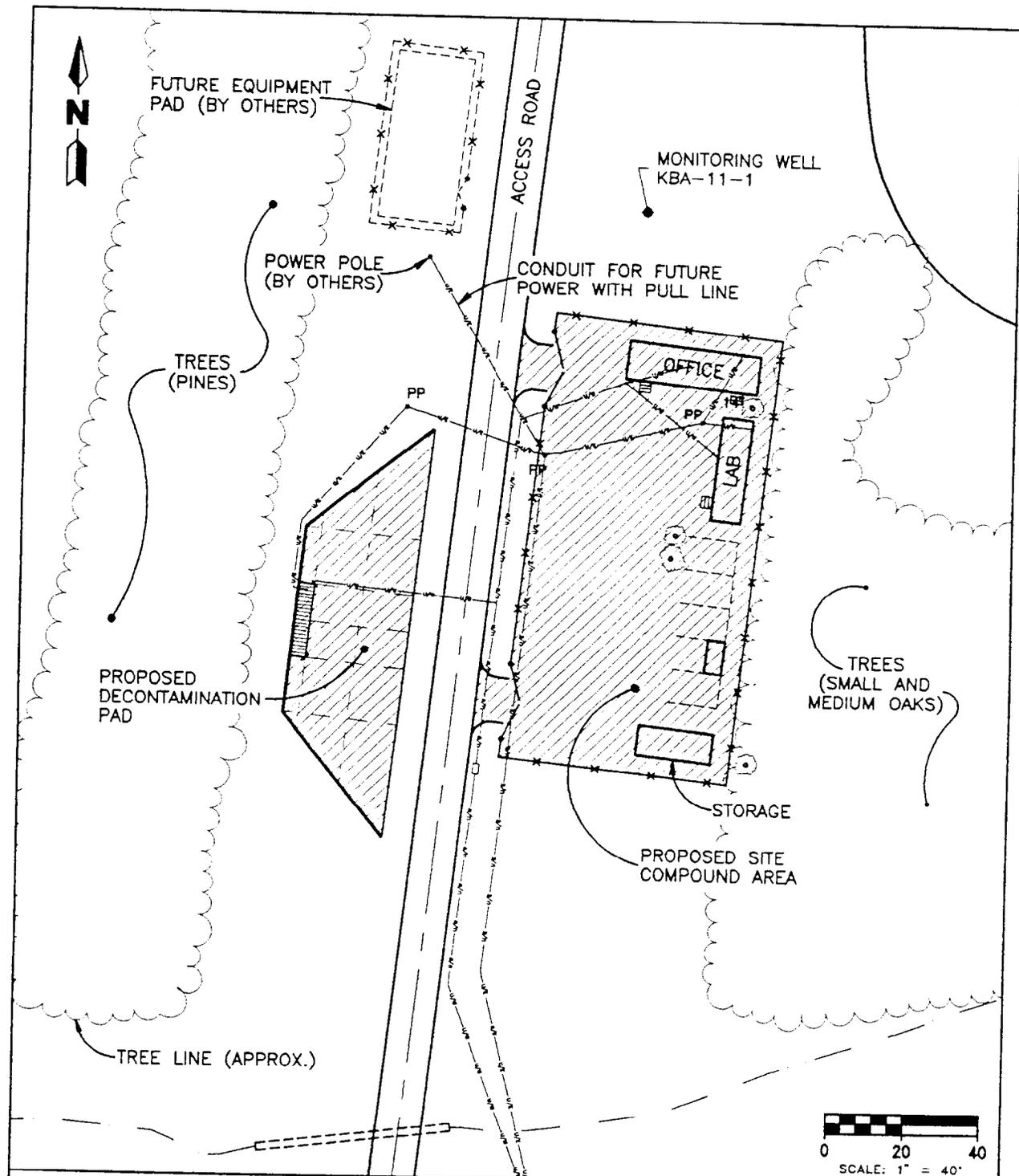


FIGURE 3-5  
 PROPOSED SITE COMPOUND AREA



SUPPLEMENTAL RFI  
 HEALTH AND SAFETY PLAN

NAVAL SUBMARINE BASE  
 KINGS BAY, GEORGIA

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3.7.2.1 **Health Hazards** Health hazards consist primarily of potential exposure to contaminated matrices.

3.7.2.2 **Safety Hazards** Safety hazards include those hazards that 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, slips, trips, and falls, as well as snake, spider, and tick 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 Chapter 12 of the CLEAN Generic HASP).

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. Take care when walking over the landfill or uneven terrain, especially where vegetation may cover the hazard. During all site activities, personnel should be aware of the possibility of an encounter with poisonous snakes, particularly rattlesnakes, and black widow spiders.

3.7.2.3 **Conclusions and Risk Assessment** Based on all of the available information (nature of the work, potential onsite chemicals and their properties, exposure limits, etc.), hazards associated with conducting the described field work are considered to be low, assuming appropriate health and safety practices are maintained.

3.7.3 Protective Measures The following are the protective measures that will be used at the site.

3.7.3.1 **Engineering Controls** None anticipated.

3.7.3.2 **Levels of Protection** Low level contamination was found from prior sampling. Level D protection will be worn if heat stress is a factor and the atmosphere contains no known hazard, all potential airborne contaminants can be monitored for, and work functions preclude splash, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.

3.7.4 Monitoring It is intended that real time monitoring instrumentation will be used to monitor the work environment to ensure the appropriate level of protection for the site team.

3.7.4.1 **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 used at the site, and may be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment will be used at the site:

1. PORTA-FID OVA,
2. Draeger pump with vinyl chloride 0.5/a and benzene 0.5/c tubes, and
3. LEL/oxygen meter.

Refer to Chapter 7.0 of the CLEAN HASP for information on the calibration and maintenance of the equipment.

If the OVA detects a steady measurable quantity of organic vapors greater than background at the source (e.g., borehole, sample), upgrade to modified level D. If the OVA reads steadily above background in the breathing zone, begin monitoring with vinyl chloride and benzene Draeger tubes. If vinyl chloride levels reach or exceed 0.5 ppm in the breathing zone, upgrade to level B. If vinyl chloride levels are below 0.5 ppm, but benzene levels are greater than 0.5 ppm, upgrade to level C. Otherwise continue working at modified level D until OVA reads 5 ppm above background in the breathing zone at which time upgrade to level C. Upgrade to level B if OVA readings reach or exceed 50 ppm.

The above action limits are summarized below.

Level B PPE required if:

Vinyl chloride Draeger tube  $\geq$  0.5 ppm; or  
OVA  $\geq$  50 ppm.

Level C PPE required if:

Vinyl chloride Draeger tube  $<$  0.5 ppm;  
Benzene Draeger tube  $\geq$  0.5 ppm; and  
OVA  $\geq$  5 ppm but  $<$  50 ppm.

Modified Level D PPE required if:

Vinyl chloride Draeger tube  $<$  0.5 ppm;  
Benzene Draeger tube  $<$  0.5 ppm; and  
OVA  $>$  background at the source but  $<$  5 ppm.

Level D PPE acceptable if:

OVA levels at the source are at background.

LEL/Oxygen Meter:

Oxygen  $\geq$  19.5 percent - see above;  
Oxygen  $<$  19.5 percent - backoff as Level B PPE required;  
LEL  $>$  10 percent at source - continue only using proper precautions; and  
LEL  $>$  20 percent at source - backoff.

**3.7.4.2 Personal Monitoring** All ABB-ES personnel on the site will wear a thermoluminescent dosimetry body badge to measure possible exposure to radiation.

## 4.0 MATERIAL SAFETY DATA SHEETS

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# ACETONE

ACT

<p><b>Common Synonyms</b> Dimethyl ketone Propanone 2-Propanone</p>	<p>Watery liquid      Colorless      Sweet odor</p> <p>Floats and mixes with water. Flammable, irritating vapor is produced.</p>
<p>Stay upwind and use water spray to "knock down" vapor. Shut off ignition sources and call fire department. Keep people away. Stop discharge if possible. Isolate and remove discharged material. Avoid contact with liquid and vapor. Notify local health and pollution control agencies.</p>	
<b>Fire</b>	<p><b>FLAMMABLE.</b> Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Extinguish with dry chemical, alcohol foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.</p>
<b>Exposure</b>	<p><b>CALL FOR MEDICAL AID.</b></p> <p><b>VAPOR</b> Irritating to eyes, nose and throat. If inhaled, may cause difficult breathing or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p><b>LIQUID</b> Irritating to eyes. Not irritating to skin. <b>IF IN EYES,</b> hold eyelids open and flush with plenty of water.</p>
<b>Water Pollution</b>	<p>Dangerous to aquatic life in high concentrations. May be dangerous if it enters water intakes. Notify local health and pollution control officials. Notify operators of nearby water intakes.</p>
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Disperse and flush</p>	<p><b>2. LABEL</b></p> <p>2.1 Category: Flammable liquid 2.2 Class: 3</p>
<p><b>3. CHEMICAL DESIGNATIONS</b></p> <p>3.1 CG Compatibility Class: Ketone 3.2 Formula: CH<sub>3</sub>COCH<sub>3</sub> 3.3 IMO/UN Designation: 3 1/1090 3.4 DOT ID No.: 1090 3.5 CAS Registry No.: 67-64-1</p>	<p><b>4. OBSERVABLE CHARACTERISTICS</b></p> <p>4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Sweetish; pleasant, resembling that of mint or fruit; pungent, sharp, penetrating residual, ketonic, pleasant, non-residual</p>
<p style="text-align: center;"><b>5. HEALTH HAZARDS</b></p> <p>5.1 Personal Protective Equipment: Organic vapor canister or air-supplied mask; synthetic rubber gloves, chemical safety goggles or face splash shield.</p> <p>5.2 Symptoms Following Exposure: <b>INHALATION:</b> vapor irritating to eyes and mucous membranes, acts as an anesthetic in very high concentrations. <b>INGESTION:</b> low order of toxicity but very irritating to mucous membranes. <b>SKIN:</b> prolonged excessive contact causes defatting of the skin, possibly leading to dermatitis.</p> <p>5.3 Treatment of Exposure: <b>INHALATION:</b> if victim is overcome, remove to fresh air and call a physician; administer artificial respiration if breathing is irregular or stopped. <b>INGESTION:</b> if victim has swallowed large amounts and is conscious and not having convulsions, induce vomiting and get medical help promptly; no specific antidote known. <b>SKIN:</b> wash well with water. <b>EYES:</b> flush with water immediately for at least 15 min. Consult a physician.</p> <p>5.4 Threshold Limit Value: 750 ppm 5.5 Short Term Inhalation Limits: 1000 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 1, LD<sub>50</sub> 5 to 15 g/kg (dog) 5.7 Late Toxicity: Not pertinent 5.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors cause moderate irritation of the eyes or respiratory system. Effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: No appreciable hazard. Practically harmless to the skin because it is very volatile and evaporates quickly from the skin. 5.10 Odor Threshold: 100 ppm 5.11 IDLH Value: 20000 ppm</p>	

<p style="text-align: center;"><b>6. FIRE HAZARDS</b></p> <p>6.1 Flash Point: 4°F O.C.; 0°F C.C. 6.2 Flammable Limits in Air: 2.6%-12.8% 6.3 Fire Extinguishing Agents: Alcohol foam, dry chemical, carbon dioxide 6.4 Fire Extinguishing Agents Not to be Used: Water in straight hose stream will scatter and spread fire and should not be used. 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fires: Not pertinent 6.7 Ignition Temperature: 860°F 6.8 Electrical Hazard: Class I, Group D 6.9 Burning Rate: 3.9 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</p> <p style="text-align: center;"><b>7. CHEMICAL REACTIVITY</b></p> <p>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: 18</p> <p style="text-align: center;"><b>8. WATER POLLUTION</b></p> <p>8.1 Aquatic Toxicity: 14,250 ppm/24 hr/sunfish/tulled/lap water 13,000 ppm/48 hr/mosquito fish/TL<sub>50</sub>/ turbot water 8.2 Waterfowl Toxicity: Not pertinent 8.3 Biological Oxygen Demand (BOD): (Theor) 122%, 5 days 8.4 Food Chain Concentration Potential: None noted</p> <p style="text-align: center;"><b>9. SHIPPING INFORMATION</b></p> <p>9.1 Grades of Purity: Technical: 99.5% plus 0.5% water Reagent: 99.5% plus 0.5% water 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open (flame arrester) or pressure-vacuum</p>	<p style="text-align: center;"><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-P-Q-R-S</p> <p style="text-align: center;"><b>11. HAZARD CLASSIFICATIONS</b></p> <p>11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: left;">Rating</th> </tr> </thead> <tbody> <tr> <td>Fire .....</td> <td>3</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant .....</td> <td>1</td> </tr> <tr> <td>Liquid or Solid Irritant .....</td> <td>0</td> </tr> <tr> <td>Poisons .....</td> <td>0</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity .....</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity .....</td> <td>1</td> </tr> <tr> <td>Aesthetic Effect .....</td> <td>1</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals .....</td> <td>1</td> </tr> <tr> <td>Water .....</td> <td>2</td> </tr> <tr> <td>Self Reaction .....</td> <td>0</td> </tr> <tr> <td>11.3 NFPA Hazard Classification:</td> <td></td> </tr> <tr> <td>Category</td> <td>Classification</td> </tr> <tr> <td>Health Hazard (Blue) .....</td> <td>1</td> </tr> <tr> <td>Flammability (Red) .....</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow) .....</td> <td>0</td> </tr> </tbody> </table> <p style="text-align: center;"><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b></p> <p>12.1 Physical State at 15 C and 1 atm: Liquid 12.2 Molecular Weight: 58.08 12.3 Boiling Point at 1 atm: 133°F 56.1 C 329.3 K 12.4 Freezing Point: -138°F -94.7 C 178.5 K 12.5 Critical Temperature: 455°F 235 C 508 K 12.6 Critical Pressure: 582 psia 46.4 atm 4.70 MN/m<sup>2</sup> 12.7 Specific Gravity: 0.791 at 20 C (liquid) 12.8 Liquid Surface Tension: Not pertinent 12.9 Liquid Water Interfacial Tension: Not pertinent 12.10 Vapor (Gas) Specific Gravity: 2.0 12.11 Ratio of Specific Heats of Vapor (Gas): 1.127 12.12 Latent Heat of Vaporization: 220 Btu/lb 122 cal/g 5.11 X 10<sup>4</sup> J/kg 12.13 Heat of Combustion: -12,250 Btu/lb -6808 cal/g -285.0 X 10<sup>4</sup> 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: 23.42 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 7.25 psia</p> <p style="text-align: center;">NOTES</p>	Category	Rating	Fire .....	3	Health		Vapor Irritant .....	1	Liquid or Solid Irritant .....	0	Poisons .....	0	Water Pollution		Human Toxicity .....	1	Aquatic Toxicity .....	1	Aesthetic Effect .....	1	Reactivity		Other Chemicals .....	1	Water .....	2	Self Reaction .....	0	11.3 NFPA Hazard Classification:		Category	Classification	Health Hazard (Blue) .....	1	Flammability (Red) .....	3	Reactivity (Yellow) .....	0
Category	Rating																																						
Fire .....	3																																						
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Health Hazard (Blue) .....	1																																						
Flammability (Red) .....	3																																						
Reactivity (Yellow) .....	0																																						

# BENZENE

BNZ

Common Synonyms Benzol Benzole		Watery liquid	Colorless	Gasoline-like odor
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.				
<b>Fire</b>		<p><b>FLAMMABLE.</b> 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.</p>		
<b>Exposure</b>		<p><b>CALL FOR MEDICAL AID.</b></p> <p><b>VAPOR</b> 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.</p> <p><b>LIQUID</b> 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.</p>		
<b>Water Pollution</b>		<p>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.</p>		
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Restrict access</p>		<p><b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3</p>		
<p><b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: C<sub>6</sub>H<sub>6</sub> 3.3 IMO/UN Designation: 3.2/1114 3.4 DOT ID No.: 1114 3.5 CAS Registry No.: 71-43-2</p>		<p><b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic; rather pleasant aromatic odor; characteristic odor</p>		
<p><b>5. HEALTH HAZARDS</b></p> <p>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.</p> <p>5.2 Symptoms Following Exposure: Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possible death.</p> <p>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.</p> <p>5.4 Threshold Limit Value: 10 ppm</p> <p>5.5 Short Term Inhalation Limits: 75 ppm for 30 min.</p> <p>5.6 Toxicity by Ingestion: Grade 3; LD<sub>50</sub> = 50 to 500 mg/kg</p> <p>5.7 Late Toxicity: Leukemia</p> <p>5.8 Vapor (Gas) Irritant Characteristics: If present in high concentrations, vapors may cause irritation of eyes or respiratory system. The effect is temporary.</p> <p>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.</p> <p>5.10 Odor Threshold: 4.68 ppm</p> <p>5.11 IDLH Value: 2,000 ppm</p>				

**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<sub>50</sub>/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+ %  
Theophene-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 MAS 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/m<sup>2</sup>  
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 10<sup>3</sup> J/kg  
12.13 Heat of Combustion: -17,460 Btu/lb = -9698 cal/g = -406.0 X 10<sup>3</sup> 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

# CHLOROBENZENE

CRB

<p><b>Common Synonyms</b></p> <p>Monochlorobenzene Phenyl chloride Benzene chloride MCB</p>		<p>Watery liquid</p> <p>Colorless</p> <p>Sweet, almond odor</p>
<p>Sinks in water. Flammable vapor is produced.</p>		
<p>Avoid contact with liquid and vapor. Keep people away. 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.</p>		
<p><b>Fire</b></p>	<p><b>FLAMMABLE</b></p> <p>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.</p>	
<p><b>Exposure</b></p>	<p><b>CALL FOR MEDICAL AID.</b></p> <p><b>VAPOR</b> If inhaled, will cause coughing or dizziness. Not irritating to eyes, nose and throat. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p><b>LIQUID</b> 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.</p>	
<p><b>Water Pollution</b></p>	<p>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.</p>	
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Should be removed Chemical and physical treatment</p>		<p><b>2. LABEL</b></p> <p>2.1 Category: Flammable liquid 2.2 Class: 3</p>
<p><b>3. CHEMICAL DESIGNATIONS</b></p> <p>3.1 CG Compatibility Class: Halogenated hydrocarbon 3.2 Formula: C<sub>6</sub>H<sub>5</sub>Cl 3.3 IMO/UN Designation: 3.3/1134 3.4 DOT ID No.: 1134 3.5 CAS Registry No.: 108-90-7</p>		<p><b>4. OBSERVABLE CHARACTERISTICS</b></p> <p>4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Mild amine odor; sweet, almond-like; aromatic</p>
<p><b>5. HEALTH HAZARDS</b></p> <p>5.1 Personal Protective Equipment: Organic vapor-acid gas respirator where appropriate; neoprene or vinyl gloves; chemical safety spectacles, plus face shield where appropriate; rubber footwear; apron or impervious clothing for splash protection; hard hat.</p> <p>5.2 Symptoms Following Exposure: Irritating to skin, eyes and mucous membranes. Repeated exposure of skin may cause dermatitis due to defatting action. Chronic inhalation of vapors or mist may result in damage to lungs, liver, and kidneys. Acute vapor exposures can cause symptoms ranging from coughing to transient anesthesia and central nervous system depression.</p> <p>5.3 Treatment of Exposure: Get medical attention for all eye exposures and any serious over-exposures. Treat the symptoms. INHALATION: remove to clean air; administer oxygen as needed. INGESTION: dilute by drinking water; if vomiting occurs, administer more water. Administer saline laxative. EYES: flush thoroughly with water. SKIN: remove contaminated clothing, wash exposed area with soap and water.</p> <p>5.4 Threshold Limit Value: 75 ppm 5.5 Short Term Inhalation Limit: Data not available 5.6 Toxicity by Ingestion: Grade 2; LD<sub>50</sub> = 0.5 to 5 g/kg (rat, rabbit) 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: 0.21 ppm 5.11 IDLH Value: 2,400 ppm</p>		

<p><b>6. FIRE HAZARDS</b></p> <p>6.1 Flash Point: 84°F C.C.; 97°F O.C. 6.2 Flammable Limits in Air: 1.3%-7.1% 6.3 Fire Extinguishing Agents: Carbon dioxide, dry chemical, foam or water spray 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Products: Burning in open flame can form toxic phosgene and hydrogen chloride gases. 6.6 Behavior in Fire: Heavy vapor can travel a considerable distance to a source of ignition and flash back. 6.7 Ignition Temperature: 1184°F 6.8 Electrical Hazard: Data not available 6.9 Burning Rate: (est.) 4.8 mm/min. 6.10 Adiabatic Flame Temperature: Data not available</p> <p style="text-align: right;">(Continued)</p>	<p><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-T-X</p>																																				
<p><b>7. CHEMICAL REACTIVITY</b></p> <p>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</p>	<p><b>11. HAZARD CLASSIFICATIONS</b></p> <p>11.1 Code of Federal Regulations: Flammable liquid 11.2 NAB Hazard Rating for Bulk Water Transportation:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire.....</td> <td>3</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant.....</td> <td>0</td> </tr> <tr> <td>Liquid or Solid Irritant.....</td> <td>1</td> </tr> <tr> <td>Poisons.....</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity.....</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity.....</td> <td>3</td> </tr> <tr> <td>Aesthetic Effect.....</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals.....</td> <td>1</td> </tr> <tr> <td>Water.....</td> <td>0</td> </tr> <tr> <td>Salt Reaction.....</td> <td>0</td> </tr> </tbody> </table> <p>11.3 NFPA Hazard Classification:</p> <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue).....</td> <td>2</td> </tr> <tr> <td>Flammability (Red).....</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow).....</td> <td>0</td> </tr> </tbody> </table>	Category	Rating	Fire.....	3	Health		Vapor Irritant.....	0	Liquid or Solid Irritant.....	1	Poisons.....	2	Water Pollution		Human Toxicity.....	1	Aquatic Toxicity.....	3	Aesthetic Effect.....	2	Reactivity		Other Chemicals.....	1	Water.....	0	Salt Reaction.....	0	Category	Classification	Health Hazard (Blue).....	2	Flammability (Red).....	3	Reactivity (Yellow).....	0
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<p><b>8. WATER POLLUTION</b></p> <p>8.1 Aquatic Toxicity: 20 ppm/96 hr/bluegill/TL<sub>50</sub>/fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 0.3 lb/lb, 5 days 8.4 Food Chain Concentration Potential: Data not available</p>	<p><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b></p> <p>12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 112.56 12.3 Boiling Point at 1 atm: 270°F = 132°C = 405°K 12.4 Freezing Point: -50.1°F = -45.6°C = 227.6°K 12.5 Critical Temperature: 678°F = 359°C = 632°K 12.6 Critical Pressure: 656 psia = 44.6 atm = 4.52 MN/m<sup>2</sup> 12.7 Specific Gravity: 1.11 at 20°C (liquid) 12.8 Liquid Surface Tension: 33 dynes/cm = 0.033 N/m at 25°C 12.9 Liquid Water Interfacial Tension: 37.41 dynes/cm = 0.03741 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: Not pertinent 12.11 Ratio of Specific Heats of Vapor (Gas): 1.094 12.12 Latent Heat of Vaporization: 135 Btu/lb = 75 cal/g = 3.140 X 10<sup>3</sup> J/kg 12.13 Heat of Combustion: (est.) 12,000 Btu/lb = 6700 cal/g = 280 X 10<sup>3</sup> 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: 20.40 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 0.5 psia</p>																																				
<p><b>9. SHIPPING INFORMATION</b></p> <p>9.1 Grades of Purity: 99.5%; technical 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum</p>	<p><b>6. FIRE HAZARDS (Continued)</b></p> <p>6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>																																				

# CHLOROFORM

CRF

<b>Common Synonyms</b> Trichloromethane	Watery liquid      Colorless      Sweet odor  Sinks in water. Irritating vapor is produced.
Avoid contact with liquid and vapor. Stay upwind. Wear goggles and self-contained breathing apparatus. Stop discharge if possible. Keep people away. Notify local health and pollution control agencies.	
<b>Fire</b>	Not flammable. <b>POISONOUS AND IRRITATING GASES ARE PRODUCED WHEN HEATED.</b> Wear goggles and self-contained breathing apparatus.
<b>Exposure</b>	CALL FOR MEDICAL AID  <b>VAPOR</b> Irritating to eyes, nose and throat. If inhaled, will cause headache, nausea, dizziness, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.  <b>LIQUID</b> Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing. 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 AND HAVING CONVULSIONS, do nothing except keep victim warm.
<b>Water Pollution</b>	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.
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-air contaminant Restrict access Should be removed	<b>2. LABEL</b> 2.1 Category: None 2.2 Class: Not pertinent
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Halogenated hydrocarbon 3.2 Formula: CHCl <sub>3</sub> 3.3 IMO/UN Designation: 9.0/1888 3.4 DOT ID No.: 1888 3.5 CAS Registry No.: 67-66-3	<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Pleasant, sweet; ethereal
<b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: Chemical goggles, 50 ppm to 2%; suitable full-face gas mask. Above 2%; suitable self-contained system. 5.2 Symptoms Following Exposure: Headache, nausea, dizziness, drunkenness, narcosis. 5.3 Treatment of Exposure: <b>INHALATION:</b> If ill effects develop, get victim to fresh air, keep him warm and quiet, and get medical attention. If breathing stops, start artificial respiration. <b>INGESTION:</b> induce vomiting and get medical attention. No known antidote; treat symptoms. <b>EYES:</b> flush with plenty of water for at least 15 minutes and get medical attention. <b>SKIN:</b> wash with soap and water, remove contaminated clothing and free of chemical. 5.4 Threshold Limit Value: 10 ppm 5.5 Short Term Inhalation Limits: 50 ppm for 10 min. 5.6 Toxicity by Ingestion: Grade 2; LD <sub>50</sub> = 0.5 to 5 g/kg 5.7 Late Toxicity: None 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: 205-307 ppm 5.11 IDLH Value: 1,000 ppm	

<b>6. FIRE HAZARDS</b> 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: Poisonous and irritating gases are produced when heated. 6.6 Behavior in Fire: Decomposes, producing toxic gases 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	<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook)  A-X																																				
<b>7. CHEMICAL REACTIVITY</b> 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	<b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: ORM-A 11.2 NAS Hazard Rating for Bulk Water Transportation: <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: left;">Rating</th> </tr> </thead> <tbody> <tr> <td>Fire.....</td> <td>1</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant.....</td> <td>2</td> </tr> <tr> <td>Liquid or Solid Irritant.....</td> <td>1</td> </tr> <tr> <td>Poisons.....</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity.....</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity.....</td> <td>2</td> </tr> <tr> <td>Aesthetic Effect.....</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals.....</td> <td>1</td> </tr> <tr> <td>Water.....</td> <td>0</td> </tr> <tr> <td>Salt Reaction.....</td> <td>0</td> </tr> </tbody> </table> 11.3 NFPA Hazard Classification: <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: left;">Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue).....</td> <td>2</td> </tr> <tr> <td>Flammability (Red).....</td> <td>0</td> </tr> <tr> <td>Reactivity (Yellow).....</td> <td>0</td> </tr> </tbody> </table>	Category	Rating	Fire.....	1	Health		Vapor Irritant.....	2	Liquid or Solid Irritant.....	1	Poisons.....	2	Water Pollution		Human Toxicity.....	1	Aquatic Toxicity.....	2	Aesthetic Effect.....	2	Reactivity		Other Chemicals.....	1	Water.....	0	Salt Reaction.....	0	Category	Classification	Health Hazard (Blue).....	2	Flammability (Red).....	0	Reactivity (Yellow).....	0
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<b>8. WATER POLLUTION</b> 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	<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 119.39 12.3 Boiling Point at 1 atm: 142°F = 61.2°C = 334.4°K 12.4 Freezing Point: -82.3°F = -63.5°C = 209.7°K 12.5 Critical Temperature: 506°F = 263.2°C = 536.4°K 12.6 Critical Pressure: 790 psia = 54 atm = 5.5 MN/m <sup>2</sup> 12.7 Specific Gravity: 1.49 at 20°C (liquid) 12.8 Liquid Surface Tension: 27.1 dynes/cm = 0.0271 N/m at 20°C 12.9 Liquid Water Interfacial Tension: 32.8 dynes/cm = 0.0328 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: 4.1 12.11 Ratio of Specific Heats of Vapor (Gas): 1.146 12.12 Latent Heat of Vaporization: 106.7 Btu/lb = 59.3 cal/g = 2.483 X 10 <sup>5</sup> 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: 17.62 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 6.39 psia																																				
NOTES																																					

# o-CRESOL

CRO

<b>Common Synonyms</b> o-Hydroxytoluene 2-Methylphenol o-Toluid 2-Cresol	Solid crystals or liquid. Colorless to yellow. Sweet tarry odor.  Sinks and mixes slowly with water.
Avoid contact with liquid or solid. Keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Stop discharge if possible. Call fire department. Notify local health and pollution control agencies. Isolate and remove discharged material.	
<b>Fire</b>	<b>COMBUSTIBLE</b> <b>POISONOUS GASES MAY BE PRODUCED IN FIRE.</b> Wear goggles and self-contained breathing apparatus. Extinguish with water fog, dry chemical, foam or carbon dioxide. Cool exposed containers with water.
<b>Exposure</b>	<b>CALL FOR MEDICAL AID</b> <b>LIQUID OR SOLID</b> Will burn skin and eyes. Poisonous if swallowed, inhaled or if skin is exposed. 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.
<b>Water Pollution</b>	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.
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning water contaminant, poison. Restrict access. Should be removed. Chemical and physical treatment.	<b>2. LABEL</b> 2.1 Category: Corrosive 2.2 Class: 8
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Phenols, cresols 3.2 Formula: C <sub>7</sub> H <sub>8</sub> O 3.3 IMO/UN Designation: 6.1/2076 3.4 DOT ID No.: 2076 3.5 CAS Registry No.: 95-48-7	<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Solid or liquid 4.2 Color: Colorless to yellow. 4.3 Odor: Phenolic, tarry
<b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: Chemical goggles or face shields, full protective clothing including boots and gloves, and respiratory protective apparatus. 5.2 Symptoms Following Exposure: INHALATION, INGESTION OR SKIN ABSORPTION: Central nervous system depression, muscular weakness, gastroenteric disturbances, convulsions and death. EYES: can cause burns. SKIN: Corrosive action may produce severe burns. 5.3 Treatment of Exposure: Call a doctor. INHALATION: Move to fresh air. Oxygen inhalation for respiratory distress. If needed, give artificial respiration. EYES: Irrigate with copious quantities of running water for 15 min. Hold eyelids open. If physician not available irrigate for an additional 15 min. SKIN: Remove all contaminated clothing. Wash with soap and water until all odor is gone. Then wash contaminated areas with alcohol or glycerin. Then use more water. INGESTION: Drink 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. Induce vomiting, if not spontaneous. Keep up until vomitus is free of Cresol odor. 5.4 Threshold Limit Value: 5 ppm. Skin absorption can contribute to exposure. 5.5 Short Term Inhalation Limits: 10 ppm. 5.6 Toxicity by Ingestion: Grade 3; LD <sub>50</sub> = 50 - 500 mg/kg. 5.7 Late Toxicity: May produce neoplasms or act as tumor promoters. Central nervous system damage. Chronic gastritis, possible liver and kidney damage, and lesions of heart and brain. Dermatitis may result. 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: Fairly severe skin irritant. May cause pain and second-degree burns after a few minutes contact. 5.10 Odor Threshold: 0.65 ppm detection in water 0.26 ppm recognition in air. 5.11 IDLH Value: 250 ppm	

<b>6. FIRE HAZARDS</b> 6.1 Flash Point: 178°F C.C. 6.2 Flammable Limits in Air: 1.35% 6.3 Fire Extinguishing Agents: Water may be used to blanket fire. CO <sub>2</sub> , dry chemical, foam, water spray. 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Products: Emits highly toxic fumes. 6.6 Behavior in Fire: Vapors form explosive mixtures with air. 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	<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) <p style="text-align: center;">SS</p>								
<b>7. CHEMICAL REACTIVITY</b> 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. 7.6 Inhibitor of Polymerization: Not pertinent 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 21	<b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Corrosive material 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: <table style="width: 100%; border: none;"> <tr> <td style="text-align: right;">Category</td> <td style="text-align: right;">Classification</td> </tr> <tr> <td style="text-align: right;">Health Hazard (Blue)</td> <td style="text-align: right;">3</td> </tr> <tr> <td style="text-align: right;">Flammability (Red)</td> <td style="text-align: right;">2</td> </tr> <tr> <td style="text-align: right;">Reactivity (Yellow)</td> <td style="text-align: right;">0</td> </tr> </table>	Category	Classification	Health Hazard (Blue)	3	Flammability (Red)	2	Reactivity (Yellow)	0
Category	Classification								
Health Hazard (Blue)	3								
Flammability (Red)	2								
Reactivity (Yellow)	0								
<b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 49.1-19 ppm/24-96 hr/goldfish/TL <sub>50</sub> /soft water 22.2-20.8 ppm/24-96 hr/bluegill/TL <sub>50</sub> /soft water 18-13.4 ppm/24-96 hr/fathead minnow/TL <sub>50</sub> /hard water 18-50 ppm/24-96 hr/guppy/TL <sub>50</sub> /hard water 8.2 Waterfowl Toxicity: Chronic water fowl toxic limit is 25 ppm. 8.3 Biological Oxygen Demand (BOD): 1.64 lb/lb, 5 days. 8.4 Food Chain Concentration Potential: None	<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Solid 12.2 Molecular Weight: 108.134 12.3 Boiling Point at 1 atm: 376°F - 191°C = 464.2°K 12.4 Freezing Point: 88°F - 31°C = 304.2°K 12.5 Critical Temperature: 795.9°F = 424.4°C = 697.6°K 12.6 Critical Pressure: 726.0 psia = 49.4 atm = 5.00 MN/m <sup>2</sup> 12.7 Specific Gravity: 1.05 at 20°C. 12.8 Liquid Surface Tension: 40.3 dynes/cm = 0.0403 N/m at 20°C. 12.9 Liquid Water Interfacial Tension: 32.7 dynes/cm = 0.0327 N/m at 20°C. 12.10 Vapor (Gas) Specific Gravity: 3.72. 12.11 Ratio of Specific Heats of Vapor (Gas): > 1. 12.12 Latent Heat of Vaporization: 178.4 Btu/lb = 99.12 cal/g 4.15 X 10 <sup>3</sup> J/kg 12.13 Heat of Combustion: -13994 Btu/lb = -7774 cal/g = -325 X 10 <sup>3</sup> 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								
<b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: 80-98% containing 2-20% phenol, 99.2% with 0.2% phenol and 0.6% meta and para isomers. 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open									
<b>NOTES</b>									

# p-CRESOL

CSO

<b>Common Synonyms</b> p-Methylphenol 4-Hydroxytoluene p-Toluol p-Methylhydroxybenzene	<b>Solid</b>  Sinks and mixes slowly with water.	<b>Colorless</b>	<b>Tarlike odor</b>
Avoid contact with liquid. Keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves). Stop discharge if possible. Call fire department. Isolate and remove discharged material. Notify local health and pollution control agencies.			
<b>Fire</b>	Combustible <b>POISONOUS GASES MAY BE PRODUCED IN FIRE.</b> Wear goggles and self-contained breathing apparatus. Extinguish with water, dry chemical, foam or carbon dioxide. Cool exposed containers with water.		
<b>Exposure</b>	CALL FOR MEDICAL AID.  <b>LIQUID</b> Will burn skin and eyes. Poisonous 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, and have victim induce vomiting.		
<b>Water Pollution</b>	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.		
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning - Water contaminant, poison. Restrict access. Should be removed. Chemical and physical treatment.		<b>2. LABEL</b> 2.1 Category: Corrosive 2.2 Class: 8	
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Phenols, cresols 3.2 Formula: C <sub>7</sub> H <sub>8</sub> O 3.3 IMO/UN Designation: 6.1/2076 3.4 DOT ID No.: 2076 3.5 CAS Registry No.: 106-44-5		<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid or solid 4.2 Color: Colorless 4.3 Odor: Phenolic	
<b>5. HEALTH HAZARDS</b>			
5.1 <b>Personal Protective Equipment:</b> Chemical goggles, full protective clothing including boots and gloves, self-contained breathing apparatus. 5.2 <b>Symptoms Following Exposure:</b> INHALATION: Irritation of nose or throat. EYES: Intense irritation and pain, swelling of conjunctiva and corneal damage may occur. SKIN: Intense burning, loss of feeling, white discoloration and softening. Gangrene may occur. INGESTION: Burning sensation in mouth and esophagus. Vomiting may result. Absorption by all routes may cause muscular weakness, gastroenteric disturbance, severe depression and collapse. Effects are primarily on central nervous system, edema of lungs, injury of spleen and pancreas may occur. 5.3 <b>Treatment of Exposure:</b> Call a physician. INHALATION: Move to fresh air. Irritation of nose or throat may be relieved to some extent by spraying or gargling with water until odor disappears. For respiratory distress administer oxygen. EYES: Irrigate with copious quantities of running water for at least 15 min. SKIN: Remove contaminated clothing. Wash with soap and water until all cresol odor disappears. Follow with alcohol or glycerin (20% solution) wash. Follow with water. INGESTION: Dilute with large quantities of liquid (salt water, weak sodium bicarbonate solution, milk or gruel). Follow with demulcent such as raw egg white or corn starch paste. Induce vomiting. 5.4 <b>Threshold Limit Value:</b> 5 ppm. Skin absorption can contribute to exposure. 5.5 <b>Short Term Inhalation Limits:</b> 10 ppm. 5.6 <b>Toxicity by Ingestion:</b> Grade 3; LD <sub>50</sub> : - 50 - 500 mg/kg. 5.7 <b>Late Toxicity:</b> May produce neoplasms or act as tumor promoters. Can cause central nervous system damage and chronic gastritis. Possible liver and kidney damage and lesions of the heart and brain. Can cause dermatitis. 5.8 <b>Vapor (Gas) Irritant Characteristics:</b> Vapors cause moderate irritation such that per-sonnel will find high concentrations unpleasant. The effect is temporary. 5.9 <b>Liquid or Solid Irritant Characteristics:</b> Fairly severe skin irritant. May cause pain and second-degree burns after a few minutes contact. 5.10 <b>Odor Threshold:</b> 0.2 ppm recognition in air; 0.46 ppb detection in air. 5.11 <b>IDLH Value:</b> 250 ppm			

<b>6. FIRE HAZARDS</b> 6.1 Flash Point: 187°F C.C. 6.2 Flammable Limits in Air: 1.06% - 1.4% 6.3 Fire Extinguishing Agents: CO <sub>2</sub> , dry chemical, foam, water spray or fog. 6.4 Fire Extinguishing Agents Not to be Used: Water may cause frothing. 6.5 Special Hazards of Combustion: Products: Emits highly toxic fumes. 6.6 Behavior in Fire: Flammable toxic vapors may be given off. 6.7 Ignition Temperature: 1038°F. 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	<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) <p style="text-align: center;"><b>A P Q</b></p> <b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Corrosive material 11.2 HAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: <table style="width: 100%; border: none;"> <tr> <td style="text-align: right;">Category</td> <td style="text-align: right;">Classification</td> </tr> <tr> <td style="text-align: right;">Health Hazard (Blue)</td> <td style="text-align: right;">3</td> </tr> <tr> <td style="text-align: right;">Flammability (Red)</td> <td style="text-align: right;">1</td> </tr> <tr> <td style="text-align: right;">Reactivity (Yellow)</td> <td style="text-align: right;">0</td> </tr> </table>	Category	Classification	Health Hazard (Blue)	3	Flammability (Red)	1	Reactivity (Yellow)	0
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<b>7. CHEMICAL REACTIVITY</b> 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: 21	<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Solid 12.2 Molecular Weight: 108.134 12.3 Boiling Point at 1 atm: 395.46°F = 201.92°C = 475°K. 12.4 Freezing Point: 94.6°F = 34.78°C = 307.93°K. 12.5 Critical Temperature: 808.5°F = 431.4°C = 704.6°K. 12.6 Critical Pressure: 746.7 psia = 50.8 atm = 5.15 MN/m <sup>2</sup> . 12.7 Specific Gravity: 1.034 at 20°C. 12.8 Liquid Surface Tension: 41.8 dynes/cm = 0.041 N/m at 40°C. 12.9 Liquid Water Interfacial Tension: 31.2 dynes/cm = 0.0312 N/m at 40°C. 12.10 Vapor (Gas) Specific Gravity: 3.72 12.11 Ratio of Specific Heats of Vapor (Gas): > 1.105 (est.) 12.12 Latent Heat of Vaporization: 188.7 Btu/lb = 104.85 cal/g = 4.39 X 10 <sup>3</sup> J/kg. 12.13 Heat of Combustion: -14014 Btu/lb = -7786 cal/g = -326 X 10 <sup>3</sup> 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: 26.28 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available								
<b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 21 ppm/24 hr/crucian carp/LC <sub>50</sub> 17 ppm/24 hr/roach/LC <sub>50</sub> 16 ppm/24 hr/fenich/LC <sub>50</sub> 24 ppm/48 hr/mosquito fish/TL <sub>50</sub> /pond 10 ppm/96 hr/bluegill/TL <sub>50</sub> /distilled water 8.2 Waterfowl Toxicity: Chronic waterfowl limit is 25 ppm. 8.3 Biological Oxygen Demand (BOD): 1.4-1.48 lb/lb 5 days. 8.4 Food Chain Concentration Potential: None	<b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: 92-98% containing m-cresol. 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open								
<b>NOTES</b>									

# o-DICHLOROBENZENE

DBO

<p><b>Common Synonyms</b> 1, 2-Dichlorobenzene Orthodichlorobenzene Dowtherm E</p>	<p>Liquid  Sinks in water.</p>	<p>Colorless</p>	<p>Pleasant odor</p>
<p>Avoid contact with liquid. Wear goggles and self-contained breathing apparatus. Stop discharge if possible. Call fire department. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>			
<b>Fire</b>	<p>Combustible <b>POISONOUS GASES ARE PRODUCED IN FIRE.</b> Wear goggles and self-contained breathing apparatus. Extinguish with water, dry chemical, foam, or carbon dioxide. Cool exposed containers with water.</p>		
<b>Exposure</b>	<p>CALL FOR MEDICAL AID. <b>LIQUID</b> 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 and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.</p>		
<b>Water Pollution</b>	<p>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.</p>		
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-water contaminant Should be removed Chemical and physical treatment</p>		<p><b>2. LABEL</b> 2.1 Category: None 2.2 Class: Not pertinent</p>	
<p><b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Halogenated hydrocarbon 3.2 Formula: o-C<sub>6</sub>H<sub>4</sub>Cl<sub>2</sub> 3.3 IMO/UN Designation: 6.1/1591 3.4 DOT ID No.: 1591 3.5 CAS Registry No.: 95-50-1</p>		<p><b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic; characteristic</p>	
<p><b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: Organic vapor-acid gas respirator; neoprene or vinyl gloves; chemical safety spectacles, face shield, rubber footwear, apron, protective clothing. 5.2 Symptoms Following Exposure: Chronic inhalation of mist or vapors may result in damage to lungs, liver, and kidneys. Acute vapor exposure can cause symptoms ranging from coughing to central nervous system depression and transient anesthesia. Irritating to skin, eyes, and mucous membranes. May cause dermatitis. 5.3 Treatment of Exposure: INHALATION: remove victim to fresh air, keep him quiet and warm, and call a physician promptly. INGESTION: no known antidote; treat symptomatically; induce vomiting and get medical attention promptly. EYES AND SKIN: flush with plenty of water; get medical attention for eyes; remove contaminated clothing and wash before reuse. 5.4 Threshold Limit Value: 50 ppm 5.5 Short Term Inhalation Limits: 50 ppm for 15 min. 5.6 Toxicity by Ingestion: Grade 2; LD<sub>50</sub> = 0.5 to 5 g/kg 5.7 Late Toxicity: Causes kidney and liver damage in rats. Effects unknown humans. 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: 4.0 ppm; 50 ppm 5.11 IDLH Value: 1,700 ppm</p>			

<p><b>6. FIRE HAZARDS</b> 6.1 Flash Point: 165°F O.C.; 155°F C.C. 6.2 Flammable Limits in Air: 2.2%-9.2% 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: Poisonous vapors including hydrogen chloride gas, chlorocarbons, chlorine 6.6 Behavior in Fire: Not pertinent 6.7 Ignition Temperature: 1198°F 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: 1.3 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</p>	<p><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) <b>A-X-Y</b></p>																												
<p><b>7. CHEMICAL REACTIVITY</b> 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</p>	<p><b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: ORM-A 11.2 NAS Hazard Rating for Bulk Water Transportation:  <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: right;">Rating</th> </tr> </thead> <tbody> <tr> <td>Fire.....</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Health.....</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Vapor Irritant.....</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Liquid or Solid Irritant.....</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Poisons.....</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Water Pollution.....</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Human Toxicity.....</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Aquatic Toxicity.....</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Aesthetic Effect.....</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Reactivity.....</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Other Chemicals.....</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Water.....</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Self Reaction.....</td> <td style="text-align: right;">0</td> </tr> </tbody> </table> </p>	Category	Rating	Fire.....	1	Health.....	1	Vapor Irritant.....	2	Liquid or Solid Irritant.....	1	Poisons.....	1	Water Pollution.....	3	Human Toxicity.....	3	Aquatic Toxicity.....	1	Aesthetic Effect.....	3	Reactivity.....	2	Other Chemicals.....	2	Water.....	1	Self Reaction.....	0
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<p><b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 13 ppm/l/marine plankton/no growth/salt water *Time period not specified. 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): &lt;0.1% (theor.), 1/8 day 8.4 Food Chain Concentration Potential: Data not available</p>	<p><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 147.01 12.3 Boiling Point at 1 atm: 356.9°F = 180.5°C = 453.7°K 12.4 Freezing Point: 0.3°F = 17.6°C = 255.6°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.306 at 20°C (liquid) 12.8 Liquid Surface Tension: 37 dynes/cm = 0.037 N/m at 20°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): 1.080 12.12 Latent Heat of Vaporization: 115 Btu/lb = 63.9 cal/g = 2.68 X 10<sup>4</sup> J/kg 12.13 Heat of Combustion: -7969 Btu/lb = -4427 cal/g = -185.4 X 10<sup>4</sup> 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: 21.02 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 0.06 psia</p>																												
<p><b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Technical: 99.5% min. dichlorobenzene (ratio-ortho + para/meta: 80 min.) Technical: 85% orthodichlorobenzene, 14.0% paradedichlorobenzene Technical: 80% ortho, 17% para, 2% meta Pure: not less than 99.5% ortho, not more than 0.5% para 9.2 Storage Temperature: Data not available 9.3 Inert Atmosphere: Data not available 9.4 Venting: Data not available</p>																													
<p><b>NOTES</b></p>																													

# p-DICHLOROBENZENE

DBP

<p><b>Common Synonyms</b> Paradichlorobenzene Dichloride Paradi Parador Paramoth Santochlor</p>	<p>Solid crystals      White to clear      Mothballs odor</p> <p>Sinks in water.</p>	
<p>Avoid contact with solid. Call fire department, isolate and remove discharged material. Notify local health and pollution control agencies.</p>		
<b>Fire</b>	<p>Combustible <b>POISONOUS GASES ARE PRODUCED IN FIRE.</b> Wear goggles and self-contained breathing apparatus. Extinguish with water, dry chemical, foam, or carbon dioxide. Cool exposed containers with water.</p>	
<b>Exposure</b>	<p>CALL FOR MEDICAL AID. SOLID Irritating to skin and eyes. Harmful if swallowed. Removes 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.</p>	
<b>Water Pollution</b>	<p>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.</p>	
<b>1. RESPONSE TO DISCHARGE</b> <small>(See Response Methods Handbook)</small>	<b>2. LABEL</b>	
<p>Issue warning-water contaminant Should be removed Chemical and physical treatment</p>	<p>2.1 Category: None 2.2 Class: Not pertinent</p>	
<b>3. CHEMICAL DESIGNATIONS</b>	<b>4. OBSERVABLE CHARACTERISTICS</b>	
<p>3.1 CG Compatibility Class: Halogenated hydrocarbon 3.2 Formula: p-C<sub>6</sub>H<sub>4</sub>Cl<sub>2</sub> 3.3 IMO/UM Designation: 9 D/1592 3.4 DOT ID No.: 1592 3.5 CAS Registry No.: 106-46-7</p>	<p>4.1 Physical State (as shipped): Solid 4.2 Color: White 4.3 Odor: Aromatic</p>	
<b>5. HEALTH HAZARDS</b>		
<p>5.1 Personal Protective Equipment: Full face mask fitted with organic vapor canister for concentrations over 75 ppm; clean protective clothing; eye protection. 5.2 Symptoms Following Exposure: INHALATION: irritation of upper respiratory tract; over-exposure may cause depression and injury to liver and kidney. EYE CONTACT: pain and mild irritation. 5.3 Treatment of Exposure: INHALATION: if any ill effects develop, remove patient to fresh air and get medical attention. If breathing stops, give artificial respiration. EYES: flush with plenty of water and get medical attention if ill effects develop. SKIN AND INGESTION: no problem likely. 5.4 Threshold Limit Value: 75 ppm 5.5 Short Term Inhalation Limits: 50 ppm for 60 min. 5.6 Toxicity by Ingestion: Grade 2, LD<sub>50</sub> = 0.5 to 5 g/kg 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: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin. 5.10 Odor Threshold: 15-30 ppm 5.11 IDLH Value: 1,000 ppm</p>		

<p style="text-align: center;"><b>6. FIRE HAZARDS</b></p> <p>6.1 Flash Point: 165°F O.C.; 150°F C.C. 6.2 Flammable Limits in Air: Data not available 6.3 Fire Extinguishing Agents: Water, foam, carbon dioxide or dry chemical. 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Products: Vapors are irritating. Toxic chlorine, hydrogen chloride, and phosgene gases may be generated in fires. 6.6 Behavior in Fire: Not pertinent 6.7 Ignition Temperature: Data not available 6.8 Electrical Hazard: Not pertinent 6.9 Burning Rate: 1.3 mm/min. (approx.) 6.10 Adiabatic Flame Temperature: Data not available</p> <p style="text-align: right;"><i>(Continued)</i></p>	<p style="text-align: center;"><b>10. HAZARD ASSESSMENT CODE</b> <small>(See Hazard Assessment Handbook)</small> 11</p> <p style="text-align: center;"><b>11. HAZARD CLASSIFICATIONS</b></p> <p>11.1 Code of Federal Regulations: ORM-A 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: Category      Classification Health Hazard (Blue)..... 2 Flammability (Red)..... 2 Reactivity (Yellow)..... 0</p>
<b>7. CHEMICAL REACTIVITY</b>	
<p>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</p>	
<b>8. WATER POLLUTION</b>	
<p>8.1 Aquatic Toxicity: 50 ppm/"/fish/lethal/fresh water 880 mg/1/48 hr/rainbow trout/TL<sub>50</sub>/fresh water *No time interval specified 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</p>	
<b>9. SHIPPING INFORMATION</b>	
<p>9.1 Grades of Purity: Solid: 5 grades, chemical purity close to 100% Liquid: 1-2% orthodichlorobenzene. 9.2 Storage Temperature: Data not available 9.3 Inert Atmosphere: Data not available 9.4 Venting: Data not available</p>	
<b>6. FIRE HAZARDS (Continued)</b>	
<p>6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>	
<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b>	
<p>12.1 Physical State at 15°C and 1 atm: Solid 12.2 Molecular Weight: 147.01 12.3 Boiling Point at 1 atm: 345.6°F = 174.2°C = 447.4°K 12.4 Freezing Point: 130°F = 53°C = 326°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 1.458 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: 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: 29.07 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available</p>	

# 1,1-DICHLOROETHANE

DCH

<b>Common Synonyms</b> Ethylene chloride Ethylene dichloride Chlorinated hydrocarbon ether		Oily liquid Sinks and mixes with water.	Colorless Chloroform like ethereal
Wear goggles, self-contained breathing apparatus, and rubber overclothing. Stop discharge if possible. Keep people away. Shut off ignition sources and call fire department. Avoid contact with liquid. Isolate and remove discharged material. Notify local health and pollution control agencies.			
<b>Fire</b>		Flammable <b>POISONOUS GAS MAY BE PRODUCED IN FIRE OR WHEN HEATED.</b> Containers may explode in fire. Wear goggles and self-contained breathing apparatus. Extinguish with alcohol foam, carbon dioxide, or dry chemical. Water may be ineffective on fire.	
<b>Exposure</b>		CALL FOR MEDICAL AID. <b>LIQUID</b> If swallowed may cause nausea, vomiting and faintness. Irritating to skin and eyes. 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 induce vomiting.	
<b>Water Pollution</b>		Dangerous to aquatic life in high concentrations. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.	
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability. Restrict access. Chemical and physical treatment.		<b>2. LABEL</b> 2.1 Category: None 2.2 Class: Not pertinent	
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Halogenated hydrocarbon 3.2 Formula: C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub> 3.3 IMO/UN Designation: Not listed 3.4 DOT ID No.: 2362 3.5 CAS Registry No.: 75-34-3		<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Oily liquid 4.2 Color: Colorless 4.3 Odor: Chloroform	
<b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: In areas of poor ventilation or high concentration, a self-contained breathing apparatus with full face mask should be worn. Chemical workers goggles, rubber gloves, and protective clothing should be worn. 5.2 Symptoms Following Exposure: INHALATION: Irritation of respiratory tract. Salivation, sneezing, coughing, dizziness, nausea, and vomiting. EYES: Irritation, lacrimation, and reddening of conjunctiva. SKIN: Irritation. Prolonged or repeated skin contact can produce a slight burn. INGESTION: Ingestion incidental to industrial handling is not considered to be a problem. Swallowing of substantial amounts could cause nausea, vomiting, faintness, drowsiness, cyanosis, and circulatory failure. 5.3 Treatment of Exposure: Call a doctor. INHALATION: Remove from contaminated area; keep warm and quiet. If breathing has stopped, give artificial respiration. Administer oxygen. EYES: Flush with large amounts of water or weak bicarbonate of soda solution. SKIN: Dilute with large amounts of water. Remove contaminated clothing. INGESTION: Attempt to empty stomach; dilute by administering fluids (tap water, soapy water, salt water, or milk). 5.4 Threshold Limit Value: 200 ppm. 5.5 Short Term Inhalation Limits: 250 ppm. 5.6 Toxicity by Ingestion: Grade 2; LD <sub>50</sub> = 0.5 to 5 g/kg (rat). 5.7 Late Toxicity: Chronic exposure may cause liver damage and dermatitis. Animal experimentation has shown this compound to be slightly embryo-toxic and to retard fetal development. 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: 4,000 ppm			

<b>6. FIRE HAZARDS</b> 6.1 Flash Point: 57°F O.C. = 22°F C.C. 6.2 Flammable Limits in Air: 5.6% to 11.4% 6.3 Fire Extinguishing Agents: Alcohol foam, water, foam, CO <sub>2</sub> , dry chemical, carbon tetrachloride 6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective 6.5 Special Hazards of Combustion Products: When heated to decomposition emits highly toxic fumes to phosgene. 6.6 Behavior in Fire: Explosion hazard 6.7 Ignition Temperature: 856°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		<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) <b>A-P-Q-R-S</b>									
<b>7. CHEMICAL REACTIVITY</b> 7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: Data not available 7.3 Stability During Transport: Data not available 7.4 Neutralizing Agents for Acids and Caustics: Data not available 7.5 Polymerization: Data not available 7.6 Inhibitor of Polymerization: Inhibitor Data not available 7.7 Molar Ratio (Reactant to Product): Data not available 7.8 Reactivity Group: 36		<b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Not listed 11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification: <table border="0"> <tr> <td>Category</td> <td>Classification</td> </tr> <tr> <td>Health Hazard (Blue).....</td> <td>2</td> </tr> <tr> <td>Flammability (Red).....</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow).....</td> <td>0</td> </tr> </table>		Category	Classification	Health Hazard (Blue).....	2	Flammability (Red).....	3	Reactivity (Yellow).....	0
Category	Classification										
Health Hazard (Blue).....	2										
Flammability (Red).....	3										
Reactivity (Yellow).....	0										
<b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: TL <sub>50</sub> (Marine piperch) 250 to 275 mg/l 24-hour TL <sub>50</sub> Brine shrimp: 320 mg/l 24-hour TL <sub>50</sub> Piperch: 160 mg/l 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): Percent, 0.05 g/g for 10 days Percent, 0.002 g/g for 5 days 8.4 Food Chain Concentration Potential: Data not available		<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 98.97 12.3 Boiling Point at 1 atm: 135.14°F = 57.3°C = 330.5°K 12.4 Freezing Point: -143.32°F = -97.4°C = 175.75°K 12.5 Critical Temperature: 502.7°F = 261.5°C = 534.65°K 12.6 Critical Pressure: 734.6 psia = 50 atm = 5,065 MN/m <sup>2</sup> 12.7 Specific Gravity: 1.174 at 20°C 12.8 Liquid Surface Tension: 24.75 dynes/cm = 0.02475 N/m at 20°C 12.9 Liquid Water Interfacial Tension: Data not available 12.10 Vapor (Gas) Specific Gravity: 3.42 12.11 Ratio of Specific Heats of Vapor (Gas): 1.136 at 20°C (68°F) 12.12 Latent Heat of Vaporization: 131.6 Btu/lb = 73.1 cal/g = 3.06 X 10 <sup>4</sup> J/kg 12.13 Heat of Combustion: -4,774 Btu/lb = -2,852 cal/g = -111 X 10 <sup>4</sup> J/kg 12.14 Heat of Decomposition: Data not available 12.15 Heat of Solution: Data not available 12.16 Heat of Polymerization: Data not available 12.25 Heat of Fusion: Data not available 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 7.35 psia									
<b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Data not available 9.2 Storage Temperature: Cool 9.3 Inert Atmosphere: Data not available 9.4 Venting: Data not available		<b>NOTES</b>									

# 1,2-DICHLOROETHYLENE

DEL

<p><b>Common Synonyms</b> Acetylene dichloride sym-dichloroethylene Diolorm cis-1, 2-dichloroethylene trans-1, 2-dichloroethylene</p>		<p>Liquid</p>	<p>Colorless</p>	<p>Sweet pleasant odor</p>
<p>Sinks in water. Flammable, irritating vapor is produced.</p>				
<p>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.</p>				
<p><b>Fire</b></p>		<p><b>FLAMMABLE.</b> <b>POISONOUS GASES MAY BE PRODUCED IN FIRE.</b> 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.</p>		
<p><b>Exposure</b></p>		<p><b>CALL FOR MEDICAL AID.</b> <b>VAPOR</b> 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. <b>LIQUID</b> Harmful if swallowed. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.</p>		
<p><b>Water Pollution</b></p>		<p>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.</p>		
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Restrict access Evacuate area Should be removed Chemical and physical treatment</p>		<p><b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3</p>		
<p><b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Not listed 3.2 Formula: C<sub>2</sub>H<sub>2</sub>Cl<sub>2</sub> 3.3 IMO/UN Designation: 3.2/1150 3.4 DOT ID No.: 1150 3.5 CAS Registry No.: 540-59-0</p>		<p><b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Ethereal, slightly acid; pleasant, chloroform-like</p>		
<p><b>5. HEALTH HAZARDS</b> 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 Limit: Data not available 5.6 Toxicity by Ingestion: Grade 2; oral LD<sub>50</sub> = 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</p>				

<p><b>6. FIRE HAZARDS</b> 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: 660°F 6.8 Electrical Hazard: Data not available 6.9 Burning Rate: 2.6 mm/min. 6.10 Adiabatic Flame Temperature: Data not available</p>		<p><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) <b>A-X-Y</b></p>	
<p>(Continued)</p>		<p><b>11. HAZARD CLASSIFICATIONS</b> 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 ..... Health Hazard (Blue) ..... 2 Flammability (Red) ..... 3 Reactivity (Yellow) ..... 2</p>	
<p><b>7. CHEMICAL REACTIVITY</b> 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</p>		<p><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 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: 110°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 X 10<sup>5</sup> J/kg 12.13 Heat of Combustion: -4,847.2 Btu/lb = -2,692.9 cal/g = -112.67 X 10<sup>3</sup> 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</p>	
<p><b>8. WATER POLLUTION</b> 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</p>		<p><b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Commercial 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum</p>	
<p><b>6. FIRE HAZARDS (Continued)</b> 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available</p>			

# 1,2-DICHLOROPROPANE

DPP

<p><b>Common Synonyms</b> Propylene dichloride Dichloropropane</p>		<p>Watery liquid      Colorless      Sweet odor</p> <p>Sinks in water. Flammable, irritating vapor is produced.</p>
<p>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.</p>		
<p><b>Fire</b></p>		<p><b>FLAMMABLE</b> POISONOUS GASES ARE PRODUCED IN FIRE. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Wear goggles and self-contained breathing apparatus. Extinguish with foam, dry chemical, or carbon dioxide. Cool exposed containers with water.</p>
<p><b>Exposure</b></p>		<p><b>CALL FOR MEDICAL AID.</b></p> <p><b>VAPOR</b> Irritating to eyes, nose and throat. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p><b>LIQUID</b> 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.</p>
<p><b>Water Pollution</b></p>		<p>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.</p>
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Evacuate area</p>		<p><b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3</p>
<p><b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Competibility Class: Halogenated hydrocarbon 3.2 Formula: CH<sub>2</sub>CHClCH<sub>2</sub>Cl 3.3 IMO/UN Designation: 3 2/1279 3.4 DOT ID No.: 1279 3.5 CAS Registry No.: 78-87-5</p>		<p><b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Sweet</p>
<p><b>5. HEALTH HAZARDS</b></p> <p>5.1 Personal Protective Equipment: Air supply in confined area, rubber gloves, chemical goggles, protective coveralls and rubber footwear. 5.2 Symptoms Following Exposure: Contact with skin or eyes may cause irritation. 5.3 Treatment of Exposure: INHALATION: remove to fresh air. CONTACT WITH SKIN OR EYES: wash skin thoroughly with soap and water. Flush eyes with water for 15 min. Call a doctor. 5.4 Threshold Limit Value: 75 ppm 5.5 Short Term Inhalation Limits: Data not available 5.6 Toxicity by Ingestion: Grade 2; LD<sub>50</sub> = 0.5 to 5 g/kg (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: Data not available 5.11 IDLH Value: 2,000 ppm</p>		

**6. FIRE HAZARDS**

6.1 Flash Point: 70°F O.C.; 60°F C.C.  
6.2 Flammable Limits in Air: 3.4%-14.5%  
6.3 Fire Extinguishing Agents: Foam, carbon dioxide, dry chemical.  
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent  
6.5 Special Hazards of Combustion Products: Toxic and irritating gases may be generated.  
6.6 Behavior in Fire: Not pertinent  
6.7 Ignition Temperature: 1035°F  
6.8 Electrical Hazard: Not pertinent  
6.9 Burning Rate: (est.) 3.2 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: >100 ppm/crustacea/TL<sub>50</sub>/salt 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: Refined  
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 NIOSH 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: 102.9  
12.3 Boiling Point at 1 atm: 206°F = 96.4°C = 369.6°K  
12.4 Freezing Point: -148°F = -100°C = 173°K  
12.5 Critical Temperature: Not pertinent  
12.6 Critical Pressure: Not pertinent  
12.7 Specific Gravity: 1.158 at 20°C (liquid)  
12.8 Liquid Surface Tension: 29 dynes/cm = 0.029 N/m at 20°C  
12.9 Liquid Water Interfacial Tension: 37.9 dynes/cm = 0.0379 N/m at 22.7°C  
12.10 Vapor (Gas) Specific Gravity: 3.5  
12.11 Ratio of Specific Heats of Vapor (Gas): 1.094  
12.12 Latent Heat of Vaporization: 122 Btu/lb = 67.7 cal/g = 2.83 X 10<sup>5</sup> J/kg  
12.13 Heat of Combustion: (est.) 7300 Btu/lb = 4100 cal/g = 170 X 10<sup>3</sup> 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: 13.53 cal/g  
12.26 Limiting Value: Data not available  
12.27 Reid Vapor Pressure: 1.9 psia

NOTES

# ETHYLBENZENE

ETB

<p><b>Common Synonyms</b></p> <p>Phenylethane EB</p>	<p><b>Liquid</b></p> <p>Colorless</p> <p>Sweet, gasoline-like odor</p> <p>Floats on water. Flammable, irritating vapor is produced.</p>
<p>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.</p>	
<p><b>Fire</b></p>	<p><b>FLAMMABLE.</b> 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.</p>
<p><b>Exposure</b></p>	<p><b>CALL FOR MEDICAL AID.</b></p> <p><b>VAPOR</b> 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.</p> <p><b>LIQUID</b> Will burn skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES: hold eye lids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.</p>
<p><b>Water Pollution</b></p>	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. Floating to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook)</p> <p>Mechanical containment Should be removed Chemical and physical treatment</p>	<p><b>2. LABEL</b></p> <p>2.1 Category: Flammable liquid 2.2 Class: 3</p>
<p><b>3. CHEMICAL DESIGNATIONS</b></p> <p>3.1 CQ Competibility Class: Aromatic hydrocarbon 3.2 Formula: C<sub>8</sub>H<sub>10</sub>CH<sub>3</sub> 3.3 IMO/IUN Designation: 3.3/1175 3.4 DOT ID No.: 1175 3.5 CAS Registry No.: 100-41-4</p>	<p><b>4. OBSERVABLE CHARACTERISTICS</b></p> <p>4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Aromatic</p>
<p><b>5. HEALTH HAZARDS</b></p> <p>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 eyes 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<sub>50</sub> = 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</p>	

**6. FIRE HAZARDS**

6.1 Flash Point: 80°F O.C.; 56°F C.C.  
6.2 Flammable Limits in Air: 1.0%-8.7%  
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: 960°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: 20 ppm/96 hr/bluegill/TL<sub>50</sub>/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 = 408.4°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/m<sup>2</sup>  
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 X 10<sup>4</sup> J/kg  
12.13 Heat of Combustion: -17,780 Btu/lb = -8877 cal/g = -413.5 X 10<sup>4</sup> 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 DICHLORIDE

EDC

<b>Common Synonyms</b> 1, 2-Dichloroethane Ethylene chloride EDC Brocade Dutch liquid Glycol dichloride	Liquid Colorless Sweet odor Sinks in 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.		
<b>Fire</b>	<b>FLAMMABLE</b> POISONOUS GASES ARE PRODUCED IN FIRE. 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.	
<b>Exposure</b>	CALL FOR MEDICAL AID. <b>VAPOR</b> Irritating to eyes, nose and throat. If inhaled, will cause nausea, dizziness or difficult breathing. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. <b>LIQUID</b> Will burn skin and eyes. Irritant 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 and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.	
<b>Water Pollution</b>	Dangerous to aquatic life in high concentrations. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.	
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability. Disperse and flush.	<b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3	
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Halogenated hydrocarbon 3.2 Formula: C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub> 3.3 IMO/UN Designation: 3.2/1184 3.4 DOT ID No.: 1184 3.5 CAS Registry No.: 107-06-2	<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Ethereal, chloroform-like, ether-like	
<b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: Clean, body-covering clothing and safety glasses with side shields. Respiratory protection: up to 50 ppm, none; 50 ppm to 2%, 1/2 hr or less, full face mask and canister; greater than 2%, self-contained breathing apparatus. 5.2 Symptoms Following Exposure: Inhalation of vapors causes nausea, drunkenness, depression. Contact of liquid with eyes may produce corneal injury. Prolonged contact with skin may cause a burn. 5.3 Treatment of Exposure: INHALATION: if victim is overcome, remove him to fresh air, keep him quiet and warm, and get medical attention immediately; if breathing stops, give artificial respiration. INGESTION: induce vomiting; call a physician; treat the symptoms. EYES: flush immediately with copious amounts of flowing water for at least 15 min. SKIN: remove clothing and wash skin thoroughly with soap and water; wash contaminated clothing before reuse. 5.4 Threshold Limit Value: 10 ppm 5.5 Short Term Inhalation Limits: 200 ppm for 5 min. during any 3-hour period. 5.6 Toxicity by Ingestion: Grade 2; LD <sub>50</sub> = 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 smearing of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure. 5.10 Odor Threshold: 100 ppm 5.11 IDLH Value: 1,000 ppm		

<b>6. FIRE HAZARDS</b> 6.1 Flash Point: 60°F O.C.; 55°F C.C. 6.2 Flammable Limits in Air: 6.2%-15.6% 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: Toxic and irritating gases (hydrogen chloride, phosgene) are generated. 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: 775°F 6.8 Electrical Hazard: Class I, group D 6.9 Burning Rate: 1.6 mm/min 6.10 Adiabatic Flame Temperature: Data Not Available (Continued)
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<b>7. CHEMICAL REACTIVITY</b> 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
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<b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 150 ppm/7 pin perch/TL <sub>50</sub> /salt water *Time period not specified 8.2 Waterflow Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 0.002 lb/lb, 5 days 8.4 Food Chain Concentration Potential: None
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<b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Commercial 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Pressure-vacuum
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<b>6. FIRE HAZARDS (Continued)</b> 6.11 Stoichiometric Air to Fuel Ratio: Data Not Available 6.12 Flame Temperature: Data Not Available
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<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-X																																				
<b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation: <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: left;">Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>3</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td>2</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>2</td> </tr> <tr> <td>Poisons</td> <td>3</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td>3</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>2</td> </tr> <tr> <td>Aesthetic Effect</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td>1</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Self Reaction</td> <td>0</td> </tr> </tbody> </table> 11.3 NFPA Hazard Classification: <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: left;">Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>1</td> </tr> </tbody> </table>	Category	Rating	Fire	3	Health		Vapor Irritant	2	Liquid or Solid Irritant	2	Poisons	3	Water Pollution		Human Toxicity	3	Aquatic Toxicity	2	Aesthetic Effect	2	Reactivity		Other Chemicals	1	Water	0	Self Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	1
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<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Liquid 12.2 Molecular Weight: 98.96 12.3 Boiling Point at 1 atm: 182.3°F = 83.5°C = 356.7°K 12.4 Freezing Point: -32.3°F = -35.7°C = 237.5°K 12.5 Critical Temperature: 550°F = 288°C = 561°K 12.6 Critical Pressure: 735 psia = 50 atm = 5.1 MN/m <sup>2</sup> 12.7 Specific Gravity: 1.253 at 20°C (liquid) 12.8 Liquid Surface Tension: 32.2 dynes/cm = 0.0322 N/m at 20°C 12.9 Liquid Water Interfacial Tension: (est.) 30 dynes/cm = 0.03 N/m at 25°C 12.10 Vapor (Gas) Specific Gravity: 3.4 12.11 Ratio of Specific Heats of Vapor (Gas): 1.118 12.12 Latent Heat of Vaporization: 136 Btu/lb = 76.4 cal/g = 3.2 X 10 <sup>4</sup> J/kg 12.13 Heat of Combustion: (est.) 3400 Btu/lb 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: 21.12 cal/g 12.26 Limiting Value: Data Not Available 12.27 Reid Vapor Pressure: 2.7 psia
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# NAPHTHALENE

NTM

<p><b>Common Synonyms</b> Naphthalin Tar camphor</p>	<p><b>Solid</b> Colorless Mothballs odor</p>	<p>Solidifies and floats or sinks in water.</p>	
<p>Stop discharge if possible. Keep people away. Call fire department. Avoid contact with liquid and solid. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>			
<b>Fire</b>	<p>Combustible Wear goggles and self-contained breathing apparatus. Extinguish with water, foam, dry chemical or carbon dioxide. Cool exposed containers with water.</p>		
<b>Exposure</b>	<p>CALL FOR MEDICAL AID. <b>SOLID OR LIQUID</b> irritating to skin and eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. <b>IF IN EYES</b>, hold eyelids open and flush with plenty of water.</p>		
<b>Water Pollution</b>	<p><b>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.</b> Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>		
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Should be removed. Chemical and physical treatment</p>		<p><b>2. LABEL</b> 2.1 Category: None 2.2 Class: Not pertinent</p>	
<p><b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: C<sub>10</sub>H<sub>8</sub> 3.3 IMO/UN Designation: 4.1/2304 3.4 DOT ID No.: 2304 3.5 CAS Registry No.: 91-20-3</p>		<p><b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Molten solid 4.2 Color: Colorless 4.3 Odor: Coal tar; moth balls</p>	
<p><b>5. HEALTH HAZARDS</b></p>			
<p>5.1 <b>Personal Protective Equipment:</b> Approved organic vapor canister unit, rubber gloves, chemical safety goggles, face shield, coveralls and/or rubber apron, rubber shoes or boots. 5.2 <b>Symptoms Following Exposure:</b> Vapors or fumes are irritating to eyes, nose, and throat and may cause headaches, dizziness, nausea, etc. Solid may be irritating to skin. 5.3 <b>Treatment of Exposure:</b> <b>INHALATION:</b> remove to fresh air. <b>SKIN OR EYES:</b> flush immediately with plenty of water for at least 15 min.; remove contaminated clothing immediately; call a physician. 5.4 <b>Threshold Limit Value:</b> 10 ppm 5.5 <b>Short Term Inhalation Limits:</b> 15 ppm for 5 min. 5.6 <b>Toxicity by Ingestion:</b> Grade 2; oral rat LD<sub>50</sub> = 1780 mg/kg 5.7 <b>Late Toxicity:</b> Data not available 5.8 <b>Vapor (Gas) Irritant Characteristics:</b> Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary. 5.9 <b>Liquid or Solid Irritant Characteristics:</b> Hot liquid can cause severe burn. The solid may irritate the skin. 5.10 <b>Odor Threshold:</b> Data not available 5.11 <b>IDLH Value:</b> 500 ppm</p>			

**6. FIRE HAZARDS**

6.1 **Flash Point:** 174°F C.C.; 190°F O.C.  
6.2 **Flammable Limits in Air:** 0.9%-5.9%  
6.3 **Fire Extinguishing Agents:** Water fog, carbon dioxide, dry chemical, or foam  
6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent  
6.5 **Special Hazards of Combustion:** Products: Toxic vapors given off in a fire.  
6.6 **Behavior in Fire:** Not pertinent  
6.7 **Ignition Temperature:** 979°F  
6.8 **Electrical Hazard:** Not pertinent  
6.9 **Burning Rate:** 4.3 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:** Molten naphthalene splatters and foams in contact with water. No chemical reaction is involved.  
7.2 **Reactivity with Common Materials:** None  
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:**  
150 mg/l/96 hr/sunfish/TL<sub>50</sub>/fresh water  
1.8 ppm/72 hr/fingering salmon/cnbcal/ salt water  
8.2 **Waterfowl Toxicity:** Data not available  
8.3 **Biological Oxygen Demand (BOD):** (theor.) 59.5%, 6 days  
8.4 **Food Chain Concentration Potential:** None

**9. SHIPPING INFORMATION**

9.1 **Grades of Purity:** Pure; crude; 95% Pure; mp = 176°F Crude; mp = 165-176°F  
9.2 **Storage Temperature:** Elevated  
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-X

**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.....	2
Vapor Irritant.....	1
Liquid or Solid Irritant.....	1
Poisons.....	2
Water Pollution.....	3
Human Toxicity.....	1
Aquatic Toxicity.....	3
Aesthetic Effect.....	3
Reactivity.....	0
Other Chemicals.....	1
Water.....	0
Self Reaction.....	0

11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue).....	2
Flammability (Red).....	2
Reactivity (Yellow).....	0

**12. PHYSICAL AND CHEMICAL PROPERTIES**

12.1 **Physical State at 15°C and 1 atm:** Solid  
12.2 **Molecular Weight:** 128.18  
12.3 **Boiling Point at 1 atm:** 424°F = 218°C = 491°K  
12.4 **Freezing Point:** 176.4°F = 80.2°C = 253.4°K  
12.5 **Critical Temperature:** 887.4°F = 475.2°C = 748.4°K  
12.6 **Critical Pressure:** 588 psia = 40.0 atm = 4.05 MN/m<sup>2</sup>  
12.7 **Specific Gravity:** 1.145 at 20°C (solid)  
12.8 **Liquid Surface Tension:** 31.8 dynes/cm = 0.0318 N/m at 100°C  
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):** 1.068  
12.12 **Latent Heat of Vaporization:** 145 Btu/lb = 80.7 cal/g = 3.38 X 10<sup>4</sup> J/kg  
12.13 **Heat of Combustion:** -16,720 Btu/lb = -9287 cal/g = -388.8 X 10<sup>4</sup> 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:** 35.06 cal/g  
12.26 **Limiting Value:** Data not available  
12.27 **Reid Vapor Pressure:** Low

NOTES

# POTASSIUM PERMANGANATE

PTP

Common Synonyms	Solid crystals Dark purple Odorless
	Sinks and moves slowly with water.
<p>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.</p>	
<b>Fire</b>	<p>Not flammable Containers may explode in fire. May cause fire and explode on contact with combustibles. Flood discharge area with water. Cool exposed containers with water.</p>
<b>Exposure</b>	<p>CALL FOR MEDICAL AID.</p> <p><b>SOLID</b> Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, or loss of consciousness. Flush affected areas with plenty of water. <b>IF IN EYES</b>, hold eyelids open and flush with plenty of water. <b>IF SWALLOWED</b> and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. <b>IF SWALLOWED</b> and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.</p>
<b>Water Pollution</b>	<p>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.</p>
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-water contaminant Disperse and flush</p>	<p><b>2. LABEL</b></p> <p>2.1 Category: Oxidizer 2.2 Class: 5</p>
<p><b>3. CHEMICAL DESIGNATIONS</b></p> <p>3.1 CG Compatibility Class: Not listed 3.2 Formula: <math>KMnO_4</math> 3.3 IMO/UN Designation: 5.1/1490 3.4 DOT ID No.: 1490 3.5 CAS Registry No.: 7722-84-7</p>	<p><b>4. OBSERVABLE CHARACTERISTICS</b></p> <p>4.1 Physical State (as shipped): Solid 4.2 Color: Dark purple or bronze-like 4.3 Odor: Odorless</p>
<p style="text-align: center;"><b>5. HEALTH HAZARDS</b></p> <p>5.1 Personal Protective Equipment: Goggles or face shield; rubber gloves. 5.2 Symptoms Following Exposure: Burns and stains the skin dark brown. If ingested will cause severe distress of gastro-intestinal system. May be fatal if over 4 oz. are consumed. 5.3 Treatment of Exposure: <b>INGESTION:</b> induce vomiting and follow with thorough gastric lavage, demulcents, glucose I.V., fluid therapy, and antibiotics. Tracheostomy may be lifesaving. 5.4 Threshold Limit Value: Data not available 5.5 Short Term Inhalation Limits: Not pertinent 5.6 Toxicity by Ingestion: Grade 3; <math>LD_{50} = 50</math> to 500 mg/kg 5.7 Late Toxicity: None 5.8 Vapor (Gas) Irritant Characteristics: Non-volatile 5.9 Liquid or Solid Irritant Characteristics: Can burn skin if not flushed with water. 5.10 Odor Threshold: Not pertinent 5.11 IDLH Value: Data not available</p>	

<p style="text-align: center;"><b>6. FIRE HAZARDS</b></p> <p>6.1 Flash Point: Not flammable 6.2 Flammable Limits in Air: Not flammable 6.3 Fire Extinguishing Agents: Flood spill area with water. 6.4 Fire Extinguishing Agents Not to be Used: Not pertinent 6.5 Special Hazards of Combustion Products: Not pertinent 6.6 Behavior in Fire: May cause fire on contact with combustibles. Containers may explode. 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</p>	<p style="text-align: center;"><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) SS</p>										
<p style="text-align: center;"><b>7. CHEMICAL REACTIVITY</b></p> <p>7.1 Reactivity With Water: No reaction 7.2 Reactivity with Common Materials: Attacks rubber and most fibers. May cause ignition of wood. Some acids, such as sulfuric acid, may cause an explosion. 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</p>	<p style="text-align: center;"><b>11. HAZARD CLASSIFICATIONS</b></p> <p>11.1 Code of Federal Regulations: Oxidizer 11.2 HAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification:</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: right;">Category</td> <td style="text-align: right;">Classification</td> </tr> <tr> <td style="text-align: right;">Health Hazard (Blue).....</td> <td style="text-align: right;">1</td> </tr> <tr> <td style="text-align: right;">Flammability (Red).....</td> <td style="text-align: right;">0</td> </tr> <tr> <td style="text-align: right;">Reactivity (Yellow).....</td> <td style="text-align: right;">0</td> </tr> <tr> <td></td> <td style="text-align: right;">oxy</td> </tr> </table>	Category	Classification	Health Hazard (Blue).....	1	Flammability (Red).....	0	Reactivity (Yellow).....	0		oxy
Category	Classification										
Health Hazard (Blue).....	1										
Flammability (Red).....	0										
Reactivity (Yellow).....	0										
	oxy										
<p style="text-align: center;"><b>8. WATER POLLUTION</b></p> <p>8.1 Aquatic Toxicity: 5.4 ppm/48 hr/bluegill/TL<sub>50</sub>/fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): None 8.4 Food Chain Concentration Potential: None</p>	<p style="text-align: center;"><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b></p> <p>12.1 Physical State at 15°C and 1 atm: Solid 12.2 Molecular Weight: 158.04 12.3 Boiling Point at 1 atm: Decomposes 12.4 Freezing Point: &gt;464°F = &gt;240°C = &gt;513°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 2.70 at 15°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: 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</p>										
<p style="text-align: center;"><b>9. SHIPPING INFORMATION</b></p> <p>9.1 Grades of Purity: USP, Reagent (both 99+%) 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open</p>	<p style="text-align: center;">NOTES</p>										

# SODIUM HYDROXIDE

SHD

<p><b>Common Synonyms</b> Caustic soda Lye</p>	<p>Solid flakes or pellets White      Odorless</p> <p>Sinks and mixes with water.</p>	
<p>Avoid contact with solid and dust. Keep people away. Wear rubber overclothing (including gloves). Stop discharge if possible. Isolate and remove discharged material. Notify local health and pollution control agencies.</p>		
<b>Fire</b>	<p>Not flammable. May cause fire on contact with combustibles. Flammable gas may be produced on contact with metals. Wear rubber overclothing (including gloves). Flood discharge area with water. Cool exposed containers with water.</p>	
<b>Exposure</b>	<p><b>CALL FOR MEDICAL AID.</b> <b>DUST</b> Irritating to eyes, nose and throat. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. IF IN EYES, hold eyelids open and flush with plenty of water. <b>SOLID</b> 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. <b>DO NOT INDUCE VOMITING.</b></p>	
<b>Water Pollution</b>	<p>Dangerous to aquatic life in high concentrations. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>	
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-corrosive Restrict access Disperse and flush</p>		<p><b>2. LABEL</b> 2.1 Category: Corrosive 2.2 Class: B</p>
<p><b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Caustics 3.2 Formula: NaOH 3.3 IMO/UN Designation: 8.0/1823 3.4 DOT ID No.: 1823 3.5 CAS Registry No.: 1310-73-2</p>		<p><b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Solid 4.2 Color: White 4.3 Odor: Odorless</p>
<p><b>5. HEALTH HAZARDS</b></p>		
<p>5.1 Personal Protective Equipment: Chemical safety goggles; face shield; filter or dust-type respirator; rubber boots; rubber gloves. 5.2 Symptoms Following Exposure: Strong corrosive action on contacted tissues. INHALATION: dust may cause damage to upper respiratory tract and lung itself, producing from mild nose irritation to pneumonitis. INGESTION: severe damage to mucous membranes; severe scar formation or perforation may occur. EYE CONTACT: produces severe damage. 5.3 Treatment of Exposure: INHALATION: remove from exposure; support respirator; call physician. INGESTION: give water or milk followed by dilute vinegar or fruit juice; do NOT induce vomiting. SKIN: wash immediately with large quantities of water under emergency safety shower while removing clothing; continue washing until medical help arrives; call physician. EYES: irrigate immediately with copious amounts of water for at least 15 min.; call physician. 5.4 Threshold Limit Value: 2 mg/m<sup>3</sup> 5.5 Short Term Inhalation Limits: Not pertinent 5.6 Toxicity by Ingestion: (10% solution) oral rabbit LD<sub>50</sub> = 500 mg/kg 5.7 Late Toxicity: None 5.8 Vapor (Gas) Irritant Characteristics: Non-volatile 5.9 Liquid or Solid Irritant Characteristics: Severe skin irritant. Causes second and third-degree burns on short contact and is very injurious to the eyes. 5.10 Odor Threshold: Not pertinent 5.11 IDLH Value: 200 mg/m<sup>3</sup></p>		

<p><b>6. FIRE HAZARDS</b></p> <p>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: Not pertinent 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</p>	<p><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) SS</p>								
<p><b>7. CHEMICAL REACTIVITY</b></p> <p>7.1 Reactivity With Water: Dissolves with liberation of much heat; may steam and splatter 7.2 Reactivity with Common Materials: When wet, attacks metals such as aluminum, tin, lead, and zinc to produce flammable hydrogen gas. 7.3 Stability During Transport: Stable 7.4 Neutralizing Agents for Acids and Caustics: Flush with water, rinse with dilute acetic acid 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: 5</p>	<p><b>11. HAZARD CLASSIFICATIONS</b></p> <p>11.1 Code of Federal Regulations: Corrosive material 11.2 MAS Hazard Rating for Bulk Water Transportation: Not listed 11.3 NFPA Hazard Classification:</p> <table style="width: 100%; border: none;"> <tr> <td style="text-align: right;">Category</td> <td style="text-align: right;">Classification</td> </tr> <tr> <td style="text-align: right;">Health Hazard (Blue)</td> <td style="text-align: right;">3</td> </tr> <tr> <td style="text-align: right;">Flammability (Red)</td> <td style="text-align: right;">0</td> </tr> <tr> <td style="text-align: right;">Reactivity (Yellow)</td> <td style="text-align: right;">1</td> </tr> </table>	Category	Classification	Health Hazard (Blue)	3	Flammability (Red)	0	Reactivity (Yellow)	1
Category	Classification								
Health Hazard (Blue)	3								
Flammability (Red)	0								
Reactivity (Yellow)	1								
<p><b>8. WATER POLLUTION</b></p> <p>8.1 Aquatic Toxicity: 125 ppm/96 hr/mosquito fish/TL<sub>50</sub>/fresh 180 ppm/23 hr/oysters/lethal/salt water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): None 8.4 Food Chain Concentration Potential: None</p>	<p><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b></p> <p>12.1 Physical State at 15°C and 1 atm: Solid 12.2 Molecular Weight: 40.00 12.3 Boiling Point at 1 atm: Very high 12.4 Freezing Point: 604°F = 318°C = 591°K 12.5 Critical Temperature: Not pertinent 12.6 Critical Pressure: Not pertinent 12.7 Specific Gravity: 2.13 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: 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: 50.0 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: Data not available</p>								
<p><b>9. SHIPPING INFORMATION</b></p> <p>9.1 Grades of Purity: Technical flakes; USP pellets 9.2 Storage Temperature: Ambient 9.3 Inert Atmosphere: No requirement 9.4 Venting: Open</p>	<p style="text-align: center;">NOTES</p>								

# SULFURIC ACID

SFA

<b>Common Synonyms</b> Oil of vitriol Battery acid Fertilizer acid Chamber acid		Oily liquid Colorless Odorless
Sinks and mixes violently with water. Irritating mist is produced.		
AVOID CONTACT WITH LIQUID. Keep people away. Wear goggles, self-contained breathing apparatus, and rubber overclothing. Stop discharge if possible. Isolate and remove discharged material. Notify local health and pollution control agencies.		
<b>Fire</b>	Not flammable. May cause fire on contact with combustibles. Flammable gas may be produced on contact with metals. <b>POISONOUS GAS MAY BE PRODUCED IN FIRE.</b> Wear goggles, self-contained breathing apparatus, and rubber overclothing. <b>DO NOT USE WATER ON ADJACENT FIRES.</b> Extinguish with dry chemical or carbon dioxide.	
<b>Exposure</b>	CALL FOR MEDICAL AID.  <b>MIST</b> Irritating to eyes, nose and throat. If inhaled, will cause coughing, difficult breathing, or loss of consciousness. Move 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.  <b>LIQUID</b> 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. <b>DO NOT INDUCE VOMITING.</b>	
<b>Water Pollution</b>	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.	
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-corrosive Restrict access Disperse and flush with care		<b>2. LABEL</b> 2.1 Category: Corrosive 2.2 Class: 8
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Competibility Class: Sulfuric acid 3.2 Formula: H <sub>2</sub> SO <sub>4</sub> 3.3 IMO/UN Designation: 8.0/1830 3.4 DOT ID No.: 1830 3.5 CAS Registry No.: 7664-93-9		<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless (pure) to dark brown 4.3 Odor: Odorless unless hot, then choking
<b>5. HEALTH HAZARDS</b> 5.1 Personal Protective Equipment: Safety shower; eyewash fountain; safety goggles; face shield; approved respirator (self-contained or air-line); rubber safety shoes; rubber apron. 5.2 Symptoms Following Exposure: Inhalation of vapor from hot, concentrated acid may injure lungs. Swallowing may cause severe injury or death. Contact with skin or eyes causes severe burns. 5.3 Treatment of Exposure: Call a doctor. INHALATION: Observe victim for delayed pulmonary reaction. INGESTION: Have victim drink water if possible; do NOT induce vomiting. EYES AND SKIN: Wash with large amounts of water for at least 15 min.; do not use oils or ointments in eyes; treat skin burns. 5.4 Threshold Limit Value: 1 mg/m <sup>3</sup> 5.5 Short Term Inhalation Limits: 10 mg/m <sup>3</sup> for 5 min.; 5 mg/m <sup>3</sup> for 10 min.; 2 mg/m <sup>3</sup> for 30 min.; 1 mg/m <sup>3</sup> for 60 min. 5.6 Toxicity by Ingestion: No effects except those secondary to tissue damage. 5.7 Late Toxicity: None 5.8 Vapor (Gas) Irritant Characteristics: Vapors from hot acid (77-98%) cause moderate irritation of eyes and respiratory system. Effect is temporary. 5.9 Liquid or Solid Irritant Characteristics: 77-98% acid causes severe second- and third-degree burns of skin on short contact and is very injurious to the eyes. 5.10 Odor Threshold: Greater than 1 mg/m <sup>3</sup> 5.11 IDLH Value: 50 mg/m <sup>3</sup>		

**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: Water used on adjacent fires should be carefully handled.  
 6.5 Special Hazards of Combustion Products: Not pertinent  
 6.6 Behavior in Fire: Not flammable  
 6.7 Ignition Temperature: Not flammable  
 6.8 Electrical Hazard: None  
 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: Reacts violently with evolution of heat. Spattering occurs when water is added to the compound.  
 7.2 Reactivity with Common Materials: Extremely hazardous in contact with many materials, particularly metals and combustibles. Dilute acid reacts with most metals, releasing hydrogen which can form explosive mixtures with air in confined spaces.  
 7.3 Stability During Transport: Stable  
 7.4 Neutralizing Agents for Acids and Caustics: Dilute with water, then neutralize with lime, limestone, or soda ash.  
 7.5 Polymerization: Not pertinent  
 7.6 Inhibitor of Polymerization: Not pertinent

**8. WATER POLLUTION**

8.1 Aquatic Toxicity:  
 24.5 ppm/24 hr/bluegill/lethal/fresh water  
 42.5 ppm/48 hr/prawn/LC50/salt water  
 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: CP; USP; Technical, at 33% to 98% (50° Be to 66° Be).  
 9.2 Storage Temperature: Ambient  
 9.3 Inert Atmosphere: No requirement  
 9.4 Venting: Open

**7. CHEMICAL REACTIVITY (Continued)**

7.7 Molar Ratio (Reactant to Product): Data not available  
 7.8 Reactivity Group: 2

**10. HAZARD ASSESSMENT CODE**  
 (See Hazard Assessment Handbook)  
 A-P-O

**11. HAZARD CLASSIFICATIONS**

11.1 Code of Federal Regulations:  
 Corrosive material  
 11.2 NAS Hazard Rating for Bulk Water Transportation:  

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

 11.3 NFPA Hazard Classification:  

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	0
Reactivity (Yellow)	2

 W

**12. PHYSICAL AND CHEMICAL PROPERTIES**

12.1 Physical State at 15°C and 1 atm: Liquid  
 12.2 Molecular Weight: 98.08  
 12.3 Boiling Point at 1 atm: 644°F = 340°C = 613°K  
 12.4 Freezing Point: Not pertinent  
 12.5 Critical Temperature: Not pertinent  
 12.6 Critical Pressure: Not pertinent  
 12.7 Specific Gravity: 1.84 at 20°C (liquid)  
 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: Not pertinent  
 12.14 Heat of Decomposition: Not pertinent  
 12.15 Heat of Solution: -418.0 Btu/lb = -232.2 cal/g = -9.715 X 10<sup>4</sup> J/kg  
 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: Low

\*Physical properties apply to concentrated (98%) acid unless otherwise stated. More dilute acid is more water-like.

# TETRACHLOROETHYLENE

TTE

Common Synonyms Tetracel Perclene Perchloroethylene Perk		Watery liquid	Colorless	Sweet odor
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	<p>CALL FOR MEDICAL AID</p> <p><b>VAPOR</b> 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.</p> <p><b>LIQUID</b> 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, do not vomit. GIVE 1-2 GLASSES OF WATER TO DRINK.</p>			
Water Pollution	Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and welfare 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 <sub>2</sub> Cl <sub>4</sub> 3.3 IMO/UN Designation: 9.0/1897 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: Etheral; 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 <sub>50</sub> = 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 x 10<sup>4</sup> 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

# TOLUENE

TOL

<b>Common Synonyms</b> Toluol Methylbenzene Methylbenzol	Watery liquid Colorless Pleasant 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. Avoid contact with liquid and vapor. Isolate and remove discharged material. Notify local health and pollution control agencies.	
<b>Fire</b>	<b>FLAMMABLE.</b> 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. Cook exposed containers with water.
<b>Exposure</b>	<b>CALL FOR MEDICAL AID</b> <b>VAPOR</b> Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, headache, dizziness, without breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing difficult, give oxygen. <b>LIQUID</b> 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. <b>DO NOT INDUCE VOMITING.</b>
<b>Water Pollution</b>	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.
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability. Evacuate area.	<b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: C <sub>7</sub> H <sub>8</sub> CH <sub>3</sub> 3.3 IMO/UN Designation: 5 211 294 3.4 DOT ID No.: 1294 3.5 CAS Registry No.: 108-88-3	<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Pungent, aromatic, benzene-like, distinct, pleasant
<b>5. HEALTH HAZARDS</b> 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 Limit: 600 ppm for 30 min 5.6 Toxicity by Ingestion: Grade 2; LD <sub>50</sub> = 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 stinging 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 stinging and reddening of the skin. 5.10 Odor Threshold: 0.17 ppm 5.11 IDLH Value: 2,000 ppm	

<b>6. FIRE HAZARDS</b> 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
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<b>7. CHEMICAL REACTIVITY</b> 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	<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-T-U <b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation: <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left;">Category</th> <th style="text-align: left;">Rating</th> </tr> <tr> <td>Fire</td> <td>3</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td>1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>1</td> </tr> <tr> <td>Poisons</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td>1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>3</td> </tr> <tr> <td>Aesthetic Effect</td> <td>2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td>1</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Self Reaction</td> <td>0</td> </tr> </table> 11.3 NFPA Hazard Classification: <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left;">Category</th> <th style="text-align: left;">Classification</th> </tr> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>0</td> </tr> </table>	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	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0
Category	Rating																																				
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Poisons	2																																				
Water Pollution																																					
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Reactivity																																					
Other Chemicals	1																																				
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Health Hazard (Blue)	2																																				
Flammability (Red)	3																																				
Reactivity (Yellow)	0																																				

<b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: 1180 mg/l/96 hr/sunfish/TL <sub>50</sub> /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
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<b>9. SHIPPING INFORMATION</b> 9.1 Grades of Purity: Research, reagent, nitrogen-free 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
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<b>6. FIRE HAZARDS (Continued)</b> 6.11 Stoichiometric Air to Fuel Ratio: Data not available 6.12 Flame Temperature: Data not available
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<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 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 = 383.6°K 12.4 Freezing Point: -139°F = -95.0°C = 178.2°K 12.5 Critical Temperature: 605.4°F = 318.5°C = 591.8°K 12.6 Critical Pressure: 596.1 psia = 40.55 atm = 4.108 MN/m <sup>2</sup> 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 X 10 <sup>4</sup> J/kg 12.13 Heat of Combustion: -17,430 Btu/lb = -9686 cal/g = -405.5 X 10 <sup>4</sup> 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
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# TRICHLOROETHYLENE

TCL

<p><b>Common Synonyms</b></p> <p>Trichloroethylene Triclene, Akyfen Chlorlyen Gemalene Tetraethene Trichloran, Trilene</p>		<p>Watery liquid</p> <p>Colorless</p> <p>Sweet odor</p>
<p>Sinks in water. Irritating vapor is produced.</p>		
<p>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.</p>		
<p><b>Fire</b></p>	<p>Combustible. POISONOUS GASES ARE PRODUCED IN FIRE. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, carbon dioxide, or foam.</p>	
<p><b>Exposure</b></p>	<p>CALL FOR MEDICAL AID.</p> <p><b>VAPOR</b> 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.</p> <p><b>LIQUID</b> 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.</p>	
<p><b>Water Pollution</b></p>	<p>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.</p>	
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Should be removed. Chemical and physical treatment.</p>		<p><b>2. LABEL</b></p> <p>2.1 Category: None 2.2 Class: Not pertinent</p>
<p><b>3. CHEMICAL DESIGNATIONS</b></p> <p>3.1 CG Compatibility Class: Halogenated hydrocarbon 3.2 Formula: CHCl<sub>2</sub>-CCl<sub>2</sub> 3.3 IMO/UN Designation: 9.0/1710 3.4 DOT ID No.: 1710 3.5 CAS Registry No.: 79-01-6</p>		<p><b>4. OBSERVABLE CHARACTERISTICS</b></p> <p>4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Chloroform-like, ethereal</p>
<p><b>5. HEALTH HAZARDS</b></p> <p>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 Limit: 200 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 3; LD<sub>50</sub> = 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</p>		

**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/kil/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
Salt 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 X 10<sup>4</sup> 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

# VINYL CHLORIDE

VCM

Common Synonyms Chlorethylene VCL Vinyl C Monomer VCM		Gas	Colorless	Sweet odor
Liquid floats and boils on water. Flammable, irritating visible vapor cloud 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. Evacuate area in case of large discharge. Avoid contact with liquid and vapor. Notify local health and pollution control agencies.				
<b>Fire</b>	<p><b>FLAMMABLE.</b>  <b>POISONOUS GAS IS PRODUCED IN FIRE.</b>                  Flashback along vapor trail may occur.                  May explode if ignited in an enclosed area.                  Wear self-contained breathing apparatus.                  Cool exposed containers and protect men effecting shutoff with water.                  Stop flow of gas if possible.                  Let fire burn.                  Extinguish small fires with dry chemical.</p>			
<b>Exposure</b>	<p>CALL FOR MEDICAL AID.</p> <p><b>VAPOR</b>                  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.</p> <p><b>LIQUID</b>                  Will cause frostbite.                  Flush affected areas with plenty of water.  <b>DO NOT RUB AFFECTED AREAS.</b></p>			
<b>Water Pollution</b>	Not harmful to aquatic life.			
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Evacuate area		<b>2. LABEL</b> 2.1 Category: Flammable gas 2.2 Class: 2		
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CQ Compatibility Class: Vinyl halides 3.2 Formula: CH <sub>2</sub> =CHCl 3.3 IMO/UN Designation: 2.0/1066 3.4 DOT ID No.: 1066 3.5 CAS Registry No.: 75-01-4		<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquefied compressed gas 4.2 Color: Colorless 4.3 Odor: Pleasant, sweet		
<b>5. HEALTH HAZARDS</b>				
5.1 Personal Protective Equipment: Rubber gloves and shoes; gas-tight goggles; organic vapor canister or self-contained breathing apparatus.				
5.2 Symptoms Following Exposure: INHALATION: high concentrations cause dizziness, anesthesia, lung irritation. SKIN: may cause frostbite; phenol inhibitor may be absorbed through skin if large amounts of liquid evaporate.				
5.3 Treatment of Exposure: INHALATION: remove patient to fresh air and keep him quiet and warm; call a doctor; give artificial respiration if breathing stops. EYES AND SKIN: flush with plenty of water for at least 15 min.; for eyes, get medical attention; remove contaminated clothing.				
5.4 Threshold Limit Value: 5 ppm				
5.5 Short Term Inhalation Limits: 500 ppm for 5 min.				
5.6 Toxicity by Ingestion: Not pertinent				
5.7 Late Toxicity: Chronic exposure may cause liver damage.				
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 smearing and reddening of skin. May cause frostbite.				
5.10 Odor Threshold: 260 ppm				
5.11 IDLH Value: Data not available				

<b>6. FIRE HAZARDS</b>		<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-B-C-D-E-F-G-Z																																					
6.1 Flash Point: -110°F O.C.		<b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Flammable gas 11.2 NAS Hazard Rating for Bulk Water Transportation: <table border="1"> <thead> <tr> <th>Category</th> <th>Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td>4</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td>2</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td>1</td> </tr> <tr> <td>Poisons</td> <td>2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td>0</td> </tr> <tr> <td>Aquatic Toxicity</td> <td>0</td> </tr> <tr> <td>Aesthetic Effect</td> <td>0</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td>2</td> </tr> <tr> <td>Water</td> <td>0</td> </tr> <tr> <td>Self Reaction</td> <td>2</td> </tr> </tbody> </table> 11.3 NFPA Hazard Classification: <table border="1"> <thead> <tr> <th>Category</th> <th>Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td>2</td> </tr> <tr> <td>Flammability (Red)</td> <td>4</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td>1</td> </tr> </tbody> </table>		Category	Rating	Fire	4	Health		Vapor Irritant	2	Liquid or Solid Irritant	1	Poisons	2	Water Pollution		Human Toxicity	0	Aquatic Toxicity	0	Aesthetic Effect	0	Reactivity		Other Chemicals	2	Water	0	Self Reaction	2	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	4	Reactivity (Yellow)	1
Category	Rating																																						
Fire	4																																						
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Liquid or Solid Irritant	1																																						
Poisons	2																																						
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Flammability (Red)	4																																						
Reactivity (Yellow)	1																																						
6.2 Flammable Limits in Air: 4%-26%																																							
6.3 Fire Extinguishing Agents: For small fires use dry chemical or carbon dioxide. For large fires stop flow of gas. Cool exposed containers with water.																																							
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent																																							
6.5 Special Hazards of Combustion Products: Forms highly toxic combustion products such as hydrogen chloride, phosgenic, and carbon monoxide.																																							
6.6 Behavior in Fire: Container may explode in fire. Gas is heavier than air and may travel considerable distance to a source of ignition and flash back.																																							
6.7 Ignition Temperature: 882°F																																							
6.8 Electrical Hazard: Class I, Group D																																							
6.9 Burning Rate: 4.3 mm/min. (Continued)																																							
<b>7. CHEMICAL REACTIVITY</b>		<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 12.1 Physical State at 15°C and 1 atm: Gas 12.2 Molecular Weight: 62.50 12.3 Boiling Point at 1 atm: 7.2°F = 13.8°C = 259.4°K 12.4 Freezing Point: -244.8°F = -153.8°C = -119.4°K 12.5 Critical Temperature: 317.1°F = 158.4°C = 431.6°K 12.6 Critical Pressure: 775 psia = 52.7 atm = 5.34 MN/m <sup>2</sup> 12.7 Specific Gravity: 0.969 at -13°C (liquid) 12.8 Liquid Surface Tension: 16.0 dynes/cm = 0.0160 N/m at 25°C 12.9 Liquid Water Interfacial Tension: (est.) 30 dynes/cm = 0.03 N/m at 20°C 12.10 Vapor (Gas) Specific Gravity: 2.2 12.11 Ratio of Specific Heats of Vapor (Gas): 1.186 12.12 Latent Heat of Vaporization: 160 Btu/lb = 88 cal/g = 3.7 X 10 <sup>4</sup> J/kg 12.13 Heat of Combustion: -8136 Btu/lb = -4520 cal/g = -189.1 X 10 <sup>3</sup> J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: -729 Btu/lb = -405 cal/g = 16.9 X 10 <sup>4</sup> J/kg 12.25 Heat of Fusion: 18.14 cal/g 12.26 Limiting Value: Data not available 12.27 Reid Vapor Pressure: 75 psia																																					
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: Polymerizes in presence of air, sunlight, or heat unless stabilized by inhibitors.																																							
7.6 Inhibitor of Polymerization: Not normally used except when high temperatures are expected. Then 40-100 ppm of phenol used.																																							
7.7 Molar Ratio (Reactant to Product): Data not available																																							
7.8 Reactivity Group: 35																																							
<b>8. WATER POLLUTION</b>		<b>6. FIRE HAZARDS (Continued)</b> 6.10 Adiabatic Flame Temperature: Data not available 6.11 Stoichiometric Air to Fuel Ratio: 5.490 (Est.) 6.12 Flame Temperature: Data not available																																					
8.1 Aquatic Toxicity: None																																							
8.2 Waterfowl Toxicity: None																																							
8.3 Biological Oxygen Demand (BOD): None																																							
8.4 Food Chain Concentration Potential: None																																							
<b>9. SHIPPING INFORMATION</b>																																							
9.1 Grades of Purity: Commercial or technical 99+ %																																							
9.2 Storage Temperature: Under pressure; ambient at atm. pressure; low																																							
9.3 Inert Atmosphere: No requirement																																							
9.4 Venting: Under pressure; safety relief at atm. pressure; pressure-vacuum																																							

# m-XYLENE

XLM

<p><b>Common Synonyms</b> 1, 3-Dimethylbenzene Xylol</p>	<p>Watery liquid      Colorless      Sweet odor</p> <p>Floats on water. Flammable, irritating vapor is produced.</p>
<p>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.</p>	
<b>Fire</b>	<p><b>FLAMMABLE</b> 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.</p>
<b>Exposure</b>	<p><b>CALL FOR MEDICAL AID.</b> <b>VAPOR</b> 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. <b>LIQUID</b> 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. <b>IF IN EYES:</b> hold eyelids open and flush with plenty of water. <b>IF SWALLOWED and victim is CONSCIOUS:</b> have victim drink water or milk. <b>DO NOT INDUCE VOMITING.</b></p>
<b>Water Pollution</b>	<p><b>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.</b> Floating to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Evacuate area Should be removed Chemical and physical treatment</p>	<p><b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3</p>
<p><b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: m-C<sub>8</sub>H<sub>10</sub>(CH<sub>3</sub>)<sub>2</sub> 3.3 IMO/UN Designation: 3.2/1307 3.4 DOT ID No.: 1307 3.5 CAS Registry No.: 106-38-3</p>	<p><b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Like benzene; characteristic aromatic</p>
<p style="text-align: center;"><b>5. HEALTH HAZARDS</b></p> <p>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: <b>INHALATION:</b> remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. <b>INGESTION:</b> do NOT induce vomiting; call a doctor. <b>EYES:</b> flush with water for at least 15 min. <b>SKIN:</b> wipe off, wash with soap and water. 5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Inhalation Limit: 300 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 3; LD<sub>50</sub> = 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</p>	

<p style="text-align: center;"><b>6. FIRE HAZARDS</b></p> <p>6.1 Flash Point: 84°F C.C. 6.2 Flammable Limits in Air: 1.1%-8.4% 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: 988°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</p>	<p style="text-align: center;"><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-T-U</p>																																				
<p style="text-align: center;"><b>7. CHEMICAL REACTIVITY</b></p> <p>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</p>	<p style="text-align: center;"><b>11. HAZARD CLASSIFICATIONS</b></p> <p>11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: right;">Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Poisons</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Aesthetic Effect</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Water</td> <td style="text-align: right;">0</td> </tr> <tr> <td>Self Reaction</td> <td style="text-align: right;">0</td> </tr> </tbody> </table> <p>11.3 NFPA Hazard Classification:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: right;">Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Flammability (Red)</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td style="text-align: right;">0</td> </tr> </tbody> </table>	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	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0
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<p style="text-align: center;"><b>8. WATER POLLUTION</b></p> <p>8.1 Aquatic Toxicity: 22 ppm/96 hr/bluegill/TL<sub>50</sub>/fresh water 8.2 Waterfowl Toxicity: Data not available 8.3 Biological Oxygen Demand (BOD): 0 lb/lb, 5 days; 0% (theor.), 8 days 8.4 Food Chain Concentration Potential: Data not available</p>	<p style="text-align: center;"><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b></p> <p>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: 660.8°F = 343.8°C = 617.0°K 12.6 Critical Pressure: 513.8 atm = 34.95 psia = 3.540 MN/m<sup>2</sup> 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<sup>4</sup> J/kg 12.13 Heat of Combustion: -17,554 Btu/lb = -8752.4 cal/g = -406.31 X 10<sup>4</sup> 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</p>																																				
<p style="text-align: center;"><b>9. SHIPPING INFORMATION</b></p> <p>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</p>																																					
<p style="text-align: center;">NOTES</p>																																					

# O-XYLENE

XLO

<b>Common Synonyms</b> 1, 2-Dimethylbenzene Xylol	Watery liquid      Colorless      Sweet odor  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.	
<b>Fire</b>	<b>FLAMMABLE</b> 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.
<b>Exposure</b>	<b>CALL FOR MEDICAL AID.</b> <b>VAPOR</b> 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. <b>LIQUID</b> 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.
<b>Water Pollution</b>	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.
<b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook) Issue warning-high flammability Evacuate area Should be removed Chemical and physical treatment	<b>2. LABEL</b> 2.1 Category: Flammable liquid 2.2 Class: 3
<b>3. CHEMICAL DESIGNATIONS</b> 3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: $C_8H_{10}$ 3.3 IMO/UN Designation: 3.2/1307 3.4 DOT ID No.: 1307 3.5 CAS Registry No.: 95-47-6	<b>4. OBSERVABLE CHARACTERISTICS</b> 4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Benzene-like, characteristic aromatic
<b>5. HEALTH HAZARDS</b> 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 <sub>50</sub> = 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 IDLN Value: 10,000 ppm	

<b>6. FIRE HAZARDS</b> 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	<b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) <p style="text-align: center;">A-T-U</p> <b>11. HAZARD CLASSIFICATIONS</b> 11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation: <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: right;">Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Poisons</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Aesthetic Effect</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Water</td> <td style="text-align: right;">0</td> </tr> <tr> <td>Sol Reaction</td> <td style="text-align: right;">0</td> </tr> </tbody> </table> 11.3 NFPA Hazard Classification: <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: right;">Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Flammability (Red)</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td style="text-align: right;">0</td> </tr> </tbody> </table>	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	Sol Reaction	0	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0
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<b>7. CHEMICAL REACTIVITY</b> 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	<b>12. PHYSICAL AND CHEMICAL PROPERTIES</b> 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 = 417.6°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 <sup>2</sup> 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 x 10 <sup>4</sup> J/kg 12.13 Heat of Combustion: -17,558 Btu/lb = -8754.7 cal/g = -408.41 x 10 <sup>3</sup> 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: 0.26 psia																																				
<b>8. WATER POLLUTION</b> 8.1 Aquatic Toxicity: >100 mg/l/96 hr/D, magna/TL <sub>50</sub> /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	<b>9. SHIPPING INFORMATION</b> 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																																				
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# p-XYLENE

XLP

<p><b>Common Synonyms</b> 1, 4-Dimethylbenzene Xylol</p>	<p><b>Watery liquid</b>      <b>Colorless</b>      <b>Sweet odor</b></p> <p>Floats on water. Flammable, irritating vapor is produced. Freezing point is 56°F.</p>
<p>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.</p>	
<b>Fire</b>	<p><b>FLAMMABLE</b> 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.</p>
<b>Exposure</b>	<p><b>CALL FOR MEDICAL AID.</b></p> <p><b>VAPOR</b> 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.</p> <p><b>LIQUID</b> 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. <b>DO NOT INDUCE VOMITING.</b></p>
<b>Water Pollution</b>	<p><b>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.</b> Floating to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>
<p><b>1. RESPONSE TO DISCHARGE</b> (See Response Methods Handbook)</p> <p>Issue warning-high flammability Evacuate area Should be removed Chemical and physical treatment</p>	<p><b>2. LABEL</b></p> <p>2.1 Category: Flammable liquid 2.2 Class: 3</p>
<p><b>3. CHEMICAL DESIGNATIONS</b></p> <p>3.1 CG Compatibility Class: Aromatic Hydrocarbon 3.2 Formula: p-C<sub>6</sub>H<sub>4</sub>(CH<sub>3</sub>)<sub>2</sub> 3.3 IMO/IUN Designation: 3.2/1307 3.4 DOT ID No.: 1307 3.5 CAS Registry No.: 106-42-3</p>	<p><b>4. OBSERVABLE CHARACTERISTICS</b></p> <p>4.1 Physical State (as shipped): Liquid 4.2 Color: Colorless 4.3 Odor: Like benzene; characteristic aromatic</p>
<p style="text-align: center;"><b>5. HEALTH HAZARDS</b></p> <p>5.1 Personal Protective Equipment: Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.</p> <p>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.</p> <p>5.3 Treatment of Exposure: <b>INHALATION:</b> remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. <b>INGESTION:</b> do NOT induce vomiting; call a doctor. <b>EYES:</b> flush with water for at least 15 min. <b>SKIN:</b> wipe off, wash with soap and water.</p> <p>5.4 Threshold Limit Value: 100 ppm 5.5 Short Term Inhalation Limit: 300 ppm for 30 min. 5.6 Toxicity by Ingestion: Grade 3; LD<sub>50</sub> = 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</p>	

<p style="text-align: center;"><b>6. FIRE HAZARDS</b></p> <p>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</p> <p style="text-align: center;"><b>7. CHEMICAL REACTIVITY</b></p> <p>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</p>	<p style="text-align: center;"><b>10. HAZARD ASSESSMENT CODE</b> (See Hazard Assessment Handbook) A-T-U</p> <p style="text-align: center;"><b>11. HAZARD CLASSIFICATIONS</b></p> <p>11.1 Code of Federal Regulations: Flammable liquid 11.2 NAS Hazard Rating for Bulk Water Transportation:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: left;">Rating</th> </tr> </thead> <tbody> <tr> <td>Fire</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Health</td> <td></td> </tr> <tr> <td>Vapor Irritant</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Liquid or Solid Irritant</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Poisons</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Water Pollution</td> <td></td> </tr> <tr> <td>Human Toxicity</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Aquatic Toxicity</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Aesthetic Effect</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Reactivity</td> <td></td> </tr> <tr> <td>Other Chemicals</td> <td style="text-align: right;">1</td> </tr> <tr> <td>Water</td> <td style="text-align: right;">0</td> </tr> <tr> <td>Self Reaction</td> <td style="text-align: right;">0</td> </tr> </tbody> </table> <p>11.3 NFPA Hazard Classification:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Category</th> <th style="text-align: left;">Classification</th> </tr> </thead> <tbody> <tr> <td>Health Hazard (Blue)</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Flammability (Red)</td> <td style="text-align: right;">3</td> </tr> <tr> <td>Reactivity (Yellow)</td> <td style="text-align: right;">0</td> </tr> </tbody> </table>	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	Category	Classification	Health Hazard (Blue)	2	Flammability (Red)	3	Reactivity (Yellow)	0
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<p style="text-align: center;"><b>8. WATER POLLUTION</b></p> <p>8.1 Aquatic Toxicity: 22 ppm/96 hr/bluegill/TL<sub>50</sub>/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</p>																																					
<p style="text-align: center;"><b>9. SHIPPING INFORMATION</b></p> <p>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</p>																																					
<p style="text-align: center;"><b>12. PHYSICAL AND CHEMICAL PROPERTIES</b></p> <p>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 = 268.5°K 12.5 Critical Temperature: 648.4°F = 343.0°C = 616.2°K 12.6 Critical Pressure: 509.4 atm = 34.85 psia = 3.510 MN/m<sup>2</sup> 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 10<sup>4</sup> J/kg 12.13 Heat of Combustion: -17,558 Btu/lb = -754.7 cal/g = -408.41 X 10<sup>4</sup> J/kg 12.14 Heat of Decomposition: Not pertinent 12.15 Heat of Solution: Not pertinent 12.16 Heat of Polymerization: Not pertinent 12.17 Heat of Fusion: 37.83 cal/g 12.18 Limiting Value: Data not available 12.19 Reid Vapor Pressure: 0.34 psia</p>																																					
NOTES																																					

## 5.0 SITE CONTROL

5.1 ZONATION. The general zonation protocols that should be employed at hazardous waste sites are described in Chapter 8.0 of the CLEAN HASP (see Appendix A). The site-specific zonation that will be used for this project is described as follows.

The site will be divided into three zones: (1) the work area, considered the Exclusion Zone; (2) a perimeter area serving as the Support Zone; and (3) an area for decontamination, called the Contamination Reduction Zone (CRZ).

5.2 COMMUNICATIONS. When radio communication is not used, the following air horn signals will be employed:

HELP	three short blasts	( . . . )
EVACUATION	three long blasts	( _ _ _ )
ALL CLEAR	alternating long and short blasts	( _ . _ . )

The air horn will be kept in the Exclusion Zone or Support Zone.

5.3 WORK PRACTICES. General work practices to be used during ABB-ES projects are described in Chapter 9.0 of the CLEAN HASP. Work at the site will be conducted according to these established protocols and guidelines for the safety and health of all involved. Specific work practices necessary for this project or those that are of significant concern are described as follows.

- Work and sampling will be conducted initially in Level D clothing and equipment.

## 6.0 DECONTAMINATION AND DISPOSAL

All personnel and/or equipment leaving contaminated areas of the site will be subject to decontamination, which will take place in the CRZ. General decontamination practices used during ABB-ES projects are described in Chapter 13.0 of the CLEAN HASP.

6.1 PERSONNEL DECONTAMINATION. All personnel will follow standard decontamination practices when leaving hazardous waste sites, including proper decontamination, removal, and disposal of personal protective equipment (PPE) and tools. Personal protection levels for decontamination will correspond with the level of protection used during the field activity. Figure 6-1 illustrates a typical decontamination station for level B PPE. Decontamination procedures for level D PPE is minimal with workers doing their own decontaminating.

6.1.1 Small Equipment Decontamination Small equipment will be protected from contamination as much as possible by keeping the equipment covered when at the site and placing the equipment on plastic sheeting, not the ground. Sampling equipment used at the site will be used only once or will be field cleaned between samples in accordance with USEPA Region IV Standard Operating Procedures (SOPs) (USEPA, 1991).

6.1.2 Heavy Equipment Decontamination Drilling rigs and other heavy equipment will be cleaned with high-pressure water or steam. Loose material will be removed with a brush. Downhole tools and heavy equipment will be decontaminated in accordance with USEPA Region IV SOPs.

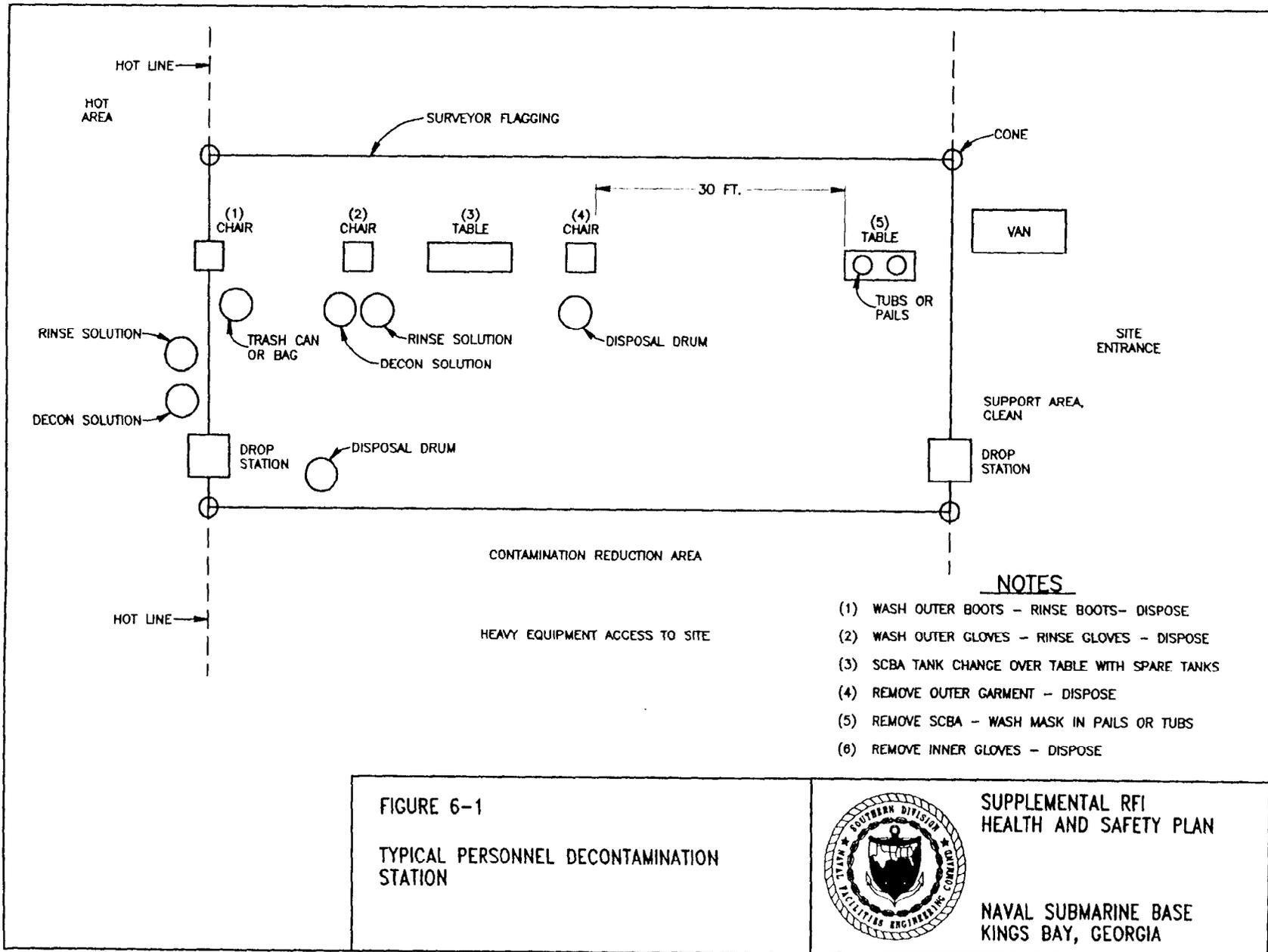
A decontamination pad will be constructed adjacent to the site to allow collection of decontamination fluids (see Figure 3-5).

6.2 COLLECTION AND DISPOSAL OF INVESTIGATION-DERIVED WASTES. Investigation-derived wastes (IDW) associated with the field program include: (1) soil cuttings, (2) drilling mud, (3) groundwater from development and purging, and (4) decontamination water.

Soil cuttings and drilling mud generated during the investigation will be temporarily stored in covered rolloff bins at the site. Composite samples will be collected from the bins and analyzed for toxicity characteristic leaching procedure parameters so that disposal options can be evaluated.

Development water and purge water generated from monitoring well locations on NSB Kings Bay property will be discharged to the ground surface on the downgradient side of each monitoring well.

IDW liquid wastes generated from locations outside of NSB Kings Bay property will be placed in 55-gallon drums, labeled, and transported to the IM treatment area for treatment. Decontamination fluids generated by steam cleaning and other activities will be decontamination fluids containing soaps and solvents and will also be added to the IM treatment system influent.



**FIGURE 6-1**  
 TYPICAL PERSONNEL DECONTAMINATION  
 STATION



**SUPPLEMENTAL RFI  
 HEALTH AND SAFETY PLAN**  
 NAVAL SUBMARINE BASE  
 KINGS BAY, GEORGIA

## 7.0 EMERGENCY AND CONTINGENCY PLAN

This section identifies emergency and contingency planning that has been undertaken for operations at this site. Most sections of the HASP provide information that would be used under emergency conditions. General emergency planning information is addressed in Chapter 14.0 of the CLEAN HASP. The following subsections present site-specific emergency and contingency planning information.

7.1 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATION. The site HSO or the Health and Safety designee has the primary authority for directing operations at the site under emergency conditions. All communications both on and off the site will be directed through the HSO or designee.

7.2 EVACUATION. In the event of an emergency situation such as fire, explosion, significant release of toxic gases, etc., an air horn or other appropriate device will be sounded for three long blasts indicating the initiation of evacuation procedures. All personnel will evacuate the work area. The location of safe areas will be upwind of the site. For efficient and safe site evacuation and assessment of the emergency situation, the HSO will have authority to initiate proper action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been given. The HSO must see that access for emergency equipment is provided and that any combustible apparatus has been shut down once the alarm has been sounded. Once the safety of all personnel is established, the NSB Kings Bay Environmental Coordinator, John Garner, will be notified by telephone of the emergency (912-673-8845).

The HSO will notify local fire and police departments, and other appropriate emergency response groups, if LEL values are above 25 percent in the work zone, or if an actual fire or explosion has taken place.

Fire Department: 911 (off base) or 673-3333 (on base)  
Police Department: 911 (off base) or 673-4444 (on base)

7.3 EMERGENCY MEDICAL TREATMENT AND FIRST AID. Any personnel injured onsite will be rendered first aid as appropriate and transported to competent medical facilities for further examination and/or treatment. The preferred method of transport would be through professional emergency transportation means; however, when this is not readily available or would result in excessive delay, other transport will be authorized. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment.

8.0 ADMINISTRATION

8.1 PERSONNEL AUTHORIZED DOWNRANGE. Personnel authorized to participate in downrange activities at this site have been reviewed and certified for site operations by the Project Manager and the HSS. Certification involves the completion of appropriate training, a medical examination, and a review of this site-specific HASP. All persons entering the site must use the buddy system, and check in with the Site Manager and/or HSO before going downrange.

CERTIFIED ABB ENVIRONMENTAL TEAM PERSONNEL:

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

OTHER CERTIFIED PERSONNEL:

_____	_____
_____	_____
_____	_____
_____	_____

- \* FIRST-AID-TRAINED
- + CPR-TRAINED

**8.2 HEALTH AND SAFETY PLAN APPROVALS.** By their signatures, the undersigned certify that this HASP will be used for the protection of the health and safety of all persons entering this site.

\_\_\_\_\_  
Health and Safety Officer

\_\_\_\_\_  
Date

\_\_\_\_\_  
Project Manager

\_\_\_\_\_  
Date

\_\_\_\_\_  
Health and Safety Manager/Supervisor

\_\_\_\_\_  
Date

8.3 FIELD TEAM REVIEW. I have read and reviewed the health and safety information in the HASP. I understand the information and will comply with the requirements of the HASP.

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

SITE/PROJECT: \_\_\_\_\_

8.4 MEDICAL DATA SHEET. This Medical Data Sheet will be completed by all onsite personnel and kept in the Support Zone during site operations. It is not a substitute for the Medical Surveillance Program requirements consistent with the CLEAN HASP. This data sheet will accompany any personnel when medical assistance or transport to hospital facilities is required. If more space is required, use the back of this sheet.

Project: \_\_\_\_\_

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Home Telephone: Area Code ( ) \_\_\_\_\_

Age: \_\_\_\_\_ Height: \_\_\_\_\_ Weight: \_\_\_\_\_

In case of emergency, contact: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: Area Code ( ) \_\_\_\_\_

Do you wear contact lenses? Yes ( ) No ( )

Allergies: \_\_\_\_\_

List medication(s) taken regularly: \_\_\_\_\_

Particular sensitivities: \_\_\_\_\_

Previous/current medical conditions or exposures to hazardous chemicals:  
\_\_\_\_\_

Name of Personal Physician: \_\_\_\_\_

Telephone: Area Code ( ) \_\_\_\_\_

**8.5 EMERGENCY TELEPHONE NUMBERS.**

Base Security	(912) 673-4444
Rescue Service	(912) 673-3333
Primary Hospital (Gillman Hospital)	(912) 882-4227
Alternate Hospital (Brunswick Hospital)	(912) 264-7000
Dr. David Barnes, Environmental Medicine Resources, Inc.	(800) 229-3674
Base Fire Department	(912) 673-3333
Offsite Emergency Services	(912) 673-3333
Poison Control Center	(800) 962-1253
National Response Center	(800) 424-8802
Regional USEPA Emergency Response	(800) 414-8802
Site HSO: <u>Tracey Keel</u>	(904) 277-2582
General Site Supervisor: <u>Tracey Keel</u>	(904) 277-2582
Project Manager: <u>Frank Cater</u>	(615) 531-1922
ABB Environmental HSM: <u>C.E. Sundquist</u>	(800) 341-0460 x3601
Environmental Coordinator: <u>John Garner</u>	(912) 673-8845

8.6 ROUTES TO EMERGENCY MEDICAL FACILITIES. The primary source of medical assistance for the site is:

Gillman Hospital  
805 Dillworth Street  
St. Marys, Georgia 31558

DIRECTIONS TO PRIMARY: From Jackson Gate, Stimson Gate, or Franklin Gate (all on Spur 40), travel south to intersection with Highway 40 (also known as Osborne Street). Turn left (south) on Highway 40, travel about 3 miles on Highway 40, take a right (west) on Dillworth Street, travel two blocks, to your right is the hospital (Figure 8-1).

The alternate source of medical assistance for the site is:

Brunswick Hospital  
3100 Kemble Avenue  
Parkwood, Georgia 31520

DIRECTIONS TO ALTERNATE: Exit NSB via Stimson Gate, Franklin Gate, or Jackson Gate. Turn left (south) on Spur 40, travel about 5 miles on Spur 40, take a right on Highway 40 west, continue on Highway 40 west for another 5 miles. Take interstate 95 north, travel about 30 miles, exit on Highway 17, continue north, take a left on Parkwood Drive, travel 10 blocks on Parkwood Drive.

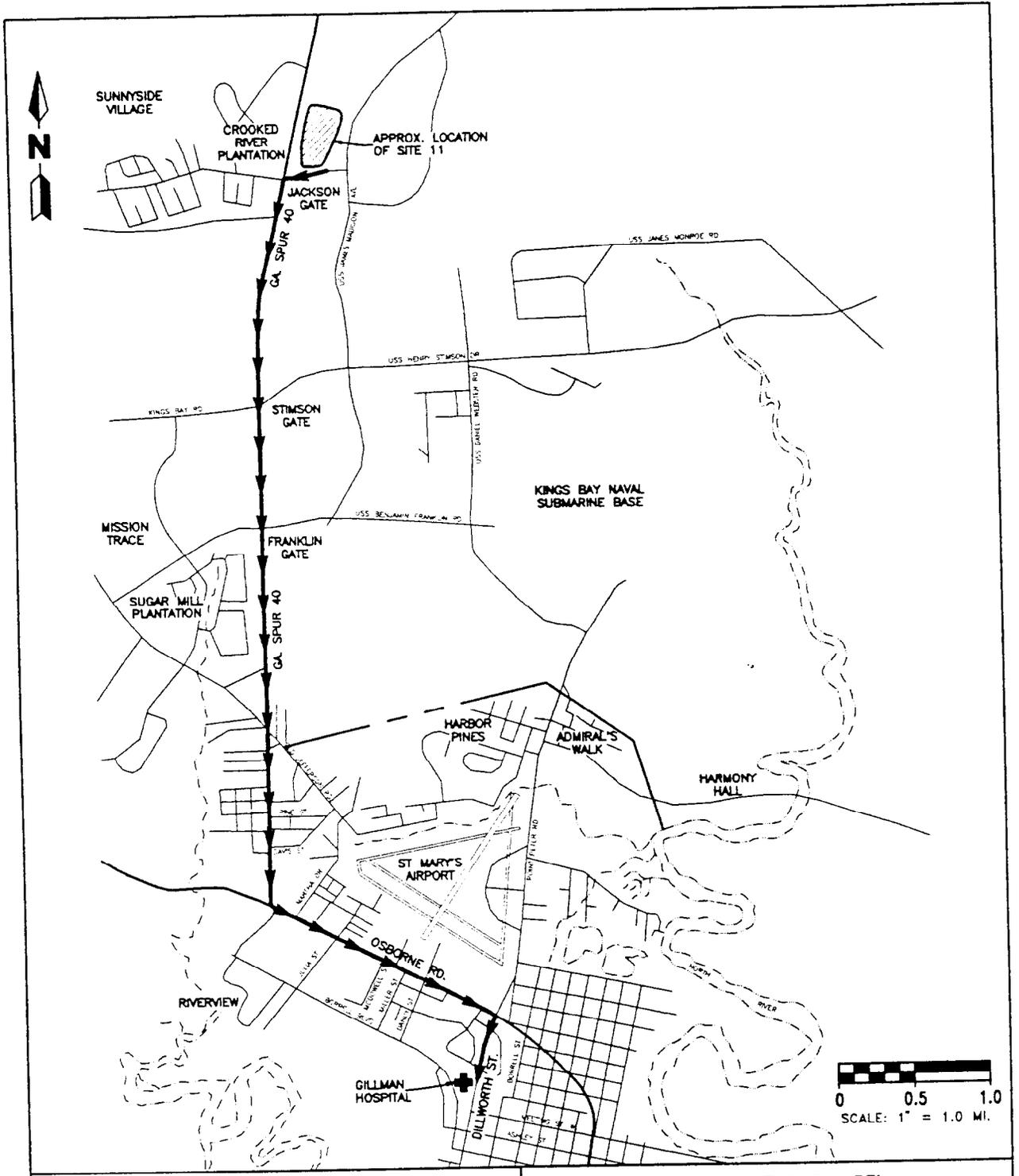


FIGURE 8-1

MAP FROM SITE TO  
GILLMAN HOSPITAL



SUPPLEMENTAL RFI  
HEALTH AND SAFETY PLAN

NAVAL SUBMARINE BASE  
KINGS BAY, GEORGIA

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- USEPA, 1993, Title 29, Code of Federal Regulations, Part 1910, Section 1000, Occupational Safety and Health Standards, Subpart Z, Toxic and Hazardous Substances, Air Contaminants. Revised July 1.
- U.S. Department of Transportation and United States Coast Guard, 1991, Chemical Hazards Response Information System (CHRIS) Hazardous Chemical Data Manual.

**APPENDIX A**  
**CLEAN GENERIC HASP**

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

DISTRICT I

GENERIC HEALTH AND SAFETY PLAN

APPROVED FOR:

ABB ENVIRONMENTAL SERVICES, INC.

\_\_\_\_\_  
Health and Safety Supervisor      Date  
Jack Davis

\_\_\_\_\_  
Program Manager      Date  
R. Anthony Allen, III

APPROVED BY:

SOUTHERN DIVISION  
NAVAL FACILITIES ENGINEERING COMMAND

\_\_\_\_\_  
Program Manager      Date  
Jerry Hudson

\_\_\_\_\_  
Health and Safety      Date  
Manager

Copy No. \_\_\_\_\_

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GENERIC HEALTH AND SAFETY PLAN

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## CHAPTER 1. INTRODUCTION

1.1 PURPOSE. ABB Environmental Services, Inc. (ABB-ES) has developed this Generic Health and Safety Plan (HASP) to guide activities conducted under the Comprehensive Long-term Environmental Action Navy (CLEAN) Program in a safe and efficient manner. This document describes the training, monitoring, and work procedures that will be employed to ensure that the program is implemented as designed. The objectives of this Generic HASP are as follows:

- to provide a safe work environment,
- to minimize the risk of human and economic losses,
- to comply with all applicable safety and health laws and regulations,
- to ensure that project work activities are carried out in a safe, efficient manner and satisfy project goals.

1.2 ORGANIZATION. The individual chapters of this Generic HASP describe personnel responsibilities; training and medical monitoring requirements; protection and monitoring equipment; work practices; special requirements for work in confined spaces and excavations; decontamination procedures; and emergency planning requirements.

1.3 IMPLEMENTATION. Each project site is classified hazardous or non-hazardous after a review of available data. Prior to on-site activities at those sites classified as hazardous, a site-specific health-specific health and safety plan (Appendix A) must be completed by the project engineer or 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 HASP is subsequently reviewed and must be approved by the Health and Safety Supervisor (HSS) (see Chapter 2). 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.

## CHAPTER 2. AUTHORITY AND RESPONSIBILITY OF HEALTH AND SAFETY PERSONNEL

This section describes the health and safety personnel and their general responsibilities for the project.

2.1 HEALTH AND SAFETY MANAGER. The Health and Safety Manager (HSM) for ABB-ES can be reached by telephone at (207) 775-5401 in Portland, Maine. The HSM has final authority over 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.

2.2 HEALTH AND SAFETY SUPERVISOR. The HSS is the health and safety professional serving as the ABB-ES 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; and (5) implementation of the HASP by the HSO. The HSS will notify the HSM of any Stop Work Orders issued by an HSO.

2.3 HEALTH AND SAFETY OFFICER. The HSO is responsible for developing and implementing the site-specific HASP in accordance with the CLEAN Generic HASP. The HSO will conduct safety inspections and investigations of 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 the site-specific HAS as site or environmental conditions change.

The HSO is vested with the authority to stop site operations by ABB-ES or subcontractor personnel (STOP WORK AUTHORITY) if he or 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 or safety reasons.

The HSO, through the HSS, ensures that all personnel entering the site are qualified for downrange deployment, in accordance with the CLEAN HASP requirements.

### CHAPTER 3. TRAINING PROGRAM

All personnel working on an ABB-ES site who potentially may be exposed to toxic substances or hazardous materials will participate in an initial training program on hazardous waste site operations and an annual refresher training or supervisory training (as appropriate), as well as site-specific training before commencement of the on-site assignment. The initial Health and Safety Training Program consists of the 40-hour training program required by the Occupational Safety and Health Administration (OSHA) in standard 29 Code of Federal Regulations (CFR) 1910.120. In addition to the initial training, ABB-ES uses 8-hour annual refresher and 8-hour supervisory training elements, which are augmented by site-specific training regarding site hazards and specialized problems and protocols.

3.1 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 40 hours of off site training and a minimum of three days of actual field experience under the direct supervision of a trained, experience supervisor. The training covers the following areas:

- familiarity with the regulations and implications of OSHA regulations in 29 CFR 1910.120;
- familiarity with the organizational structure responsible for site health and safety;
- explanation of the medical surveillance requirements, including recognition of health hazards;
- instruction in the use and maintenance of personal protective equipment;
- identification and analysis of site chemical and physical hazards;
- instruction regarding monitoring equipment, including personnel and environmental sampling instruments;
- instruction in site control and decontamination procedures;
- instruction in contingency planning; and
- instruction in confined-space entry procedures.

In lieu of the 40-hour training, 24 hour training is acceptable for workers who are on-site only occasionally for a limited task and are unlikely to be exposed to airborne contaminant levels above the permissible exposure limits (PELs) or published exposure limits, or if they work at a site that has been monitored and fully characterized, indicating that exposures are below the PELs and there is no health hazards nor the possibility of an emergency developing. If these workers become general site workers or are required to wear a respirator, an additional 16 hours of training will be required.

NOTE: All ABB-ES associates are required to have attended the 40-hour training.

3.2 ANNUAL REFRESHER AND SUPERVISORY TRAINING. Annually, all personnel required to participate in the initial training will take an 8-hour refresher training course as required by 29 CFR 1910.120. Those personnel with either site supervisory or health and safety responsibilities will participate in an 8-hour supervisory training course. The 8-hour supervisory training meets requirements of the annual refresher.

3.3 SITE-SPECIFIC TRAINING. All personnel assigned to an ABB-ES site must participate in the site-specific training presentation, which will cover major elements of the site HASP, as well as health and safety procedures regarding an individual's specific job responsibilities and tasks. The site HSO or health and safety designee will provide this training before an individual is permitted to work in a downrange position.

3.4 OTHER TRAINING. Additional training will be provided as determined by the HSM or the HSS, and may include additional refreshers on personal protective equipment, instrumentation, cardiopulmonary resuscitation (CPR), first aid, or any other pertinent health- or safety-related subject.

## CHAPTER 4. MEDICAL SURVEILLANCE PROGRAM

4.1 HEALTH MONITORING PROGRAM. All on-site ABB-ES personnel and laboratory staff must be enrolled in the Health Monitoring Program, which is implemented through Environmental Medicine Resources, Inc., a company consisting of a team of physicians and support personnel who specialize in occupational medicine. The health monitoring program consists of an initial medical examination to establish the employee's general health profile, which provides important baseline laboratory data for later comparative study and annual examinations. The contents of the initial comprehensive physical examination and laboratory testing routine are listed in Table 4-1. Follow-up examinations are completed annually for all personnel enrolled in the health monitoring program, or more frequently if project assignments warrant testing following specific field activities. Employees are certified fit for specific activities based on the results of the medical examination (see Figure 4-1).

4.2 REVIEW OF EXPOSURE SYMPTOMS. Symptoms of exposure to hazardous materials will be reviewed for each site 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 watch for outward evidence of changes in worker health. Symptoms 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. All on-site personnel are required to review and sign the site-specific health and safety plan describing site-specific hazards and associated risks (see Appendix A, Section 8.3).

TABLE 4-1  
BASELINE HEALTH MONITORING PROGRAM

PHYSICAL EXAMINATION

medical history  
medical examination  
vision:  
    - near/distant  
    - color  
audiometry  
radiology: PA/LAT  
spirometry  
electrocardiogram

LABORATORY ANALYSIS

Complete Blood Counts and Chemistries

white blood count  
differential cell counts  
methemoglobin  
uric acid  
lactic dehydrogenase  
alkaline phosphatase  
calcium  
phosphorus  
cholesterol  
urea nitrogen  
glucose  
albumin  
globulin  
total protein  
total bilirubin  
serum glutamic oxalacetic transaminase  
hemoglobin and/or hematocrit

Urine Analysis

color and character  
specific gravity  
pH  
protein  
acetone  
glucose  
microscopic examination

Medical Summary  
Environmental Medicine Resources, Inc.  
4360 Chamblee Dunwoody Road  
Atlanta, GA 30241

Ms. Gindy Sundquist  
ABB Environmental Services, Inc.                      Employee:  
261 Commercial Street                                      SSN#:  
P. O. Box 7050  
Portland, ME 04112                                      Exam Date:

Re-evaluation of Toxin Exposure 06.A  
Report Date:

---

The individual identified above has completed a medical surveillance examination. Review of the data from this examination resulted in the following conclusions:

MEDICAL AND SAFETY RESTRICTIONS/RECOMMENDATIONS

None

APPRAISAL OF LIFTING CAPACITY

Lifting Capacity for this individual appears to be II/II  
(I=up to 25 lbs., II=up to 60 lbs., III=up to 100 lbs. frequently)

CLEARANCE FOR WORK WITH HAZARDOUS MATERIALS

In compliance with 29 CFR 1910.120 (f), medical clearance is issued for individual to work with hazardous materials.

USE OF RESPIRATORY EQUIPMENT

In compliance with 29 CFR 1910.134, medical clearance is issued for unrestricted use of respiratory equipment.

EXPOSURE TO TEMPERATURE EXTREMES

Exposures to temperature extremes are acceptable providing that reasonable precautions are taken.

PUBLIC LAW 100-690

Not a requirement of this examination.

DEPARTMENT OF TRANSPORTATION CERTIFICATION

Not requested.

The employee has been informed of the results of this medical examination and also advised of any specific health implications of their employment to the extent required by existing law.

David L. Barnes, M.D., FACS, FACPM  
V.P. Medical Affairs/Medical Director

**FIGURE 4-1  
PHYSICIAN CERTIFICATION**

## CHAPTER 5. ENGINEERING CONTROLS

Whenever feasible, engineering controls will be used at the site to reduce employee exposure to hazardous substances. Feasible engineering controls may include the following:

- the use of pressurized cabs or control booths,
- the use of remotely operated materials-handling equipment, and
- the use of industrial-sized fans to blow hazardous vapors from the breathing zone when exposure is from a point source and a power source is available.

## CHAPTER 6. PERSONAL PROTECTIVE EQUIPMENT

6.1 PERSONAL PROTECTION LEVEL DETERMINATION. The level of personal protective equipment required will 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 ensure the safety of investigators and response personnel until 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.

6.2 LEVELS OF PROTECTION. The following subsections describe the basic composition of the generally recognized protective ensembles to be used for site operations. Specific components for any level of protection will be selected based on 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 risks during decontamination and possible cross-contamination during sample handling.

6.2.1 Level A Level A protection provides the highest level of protection for skin, eyes, and the respiratory system. It is appropriate for conditions where there are potential or actual high concentrations of atmospheric vapors, gases, or particulates. Level A should be used if site operations or work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to the skin or capable of being absorbed through the intact skin. Level A is used primarily for emergency situations or when the following conditions exist: (1) vapors or mists of strong acids; (2) known or probable immediately dangerous to life and health (IDLH) atmospheres with dermally active compounds; (3) high atmospheric concentrations of compounds that can be absorbed through the skin; and (4) operations that must be conducted in a confined, poorly ventilated area, where conditions requiring Level A have not yet been eliminated. The fully encapsulating suit and the pressure-demand self-contained breathing apparatus (SCBA) or hoseline respirator are the key elements in Level A personal protective equipment (PPE).

Level A equipment includes the following items:

- SCBA (pressure demand) or supplied air respirator (pressure demand with escape mask);
- total encapsulating suit;
- coveralls (optional);
- gloves (outer, chemical-resistant);
- gloves (inner, chemical-resistant);
- boots (chemical-resistant, steel-toed, steel shank);

- hardhat (optional);
- disposable protective suit, gloves, and boots (to be worn over or under encapsulating suit); and
- two-way radios.

**6.2.2 Level B** Level B protection should be used when the type and atmospheric concentration of substances have been identified and require a high level of respiratory protection; however, the atmospheric contaminant, splashing liquid, or other direct contact will not adversely affect or be absorbed through any exposed skin. This includes atmospheres with IDLH concentrations of specific substances that do not (1) represent a severe skin hazard, or (2) meet the criteria for use of air-purifying respirators. Level B has the same respiratory protection criteria as Level A; however, the danger of dermal exposure is not as severe.

Level B equipment includes the following items:

- SCBA (pressure demand) or supplied air respirator (pressure demand with escape SCBA),
- hooded chemical-resistant clothing (coated Tyvek)<sup>TM</sup>,
- coveralls (optional),
- gloves (outer, chemical-resistant),
- gloves (inner, chemical-resistant),
- boots (chemical-resistant, steel-toed, steel shank),
- boot covers (chemical-resistant) (optional),
- hardhat (optional),
- two-way radio (optional, to be worn outside protective clothing), and
- face shield (optional).

Wrist and ankle openings should be sealed with duct tape.

**6.2.3 Level C** Level C protection should be used when the atmospheric contaminant, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin. In addition, the types of air contaminants must have been identified, the concentration measured, and an air-purifying respirator must be available that can remove the contaminants. An air-purifying respirator can only be used if the oxygen content in the air is at least 19.5 percent, the contaminant has adequate warning properties (e.g., odor, taste, and irritating effect thresholds within two times the Threshold Limit Value), the concentration of the contaminant does not exceed the IDLH, and the worker's respirator has been fit-tested. Level C has the same splash protection as Level B; however, cartridge respirators are used instead of SCBAs.

Level C equipment includes the following items:

- full-face respirator (cartridge),
- hooded chemical-resistant clothing (coated Tyvek),
- coveralls (optional),
- gloves (inner, chemical-resistant),
- gloves (outer, chemical-resistant),
- boots (chemical-resistant, steel-toed, steel shank),
- boot covers (chemical-resistant) (optional),
- hardhat (optional),
- escape mask (optional),
- two-way radios (optional, worn outside protective clothing), and
- face shield (optional).

Wrist and ankle openings should be sealed with duct tape.

6.2.4 Level D Level D is a work uniform affording minimal protection and is used for nuisance contaminants only. Level D protection should only be used when the atmosphere contains no known hazard, all potential airborne contaminants can be monitored for, and work functions preclude splash, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.

Level D equipment includes the following items:

- coveralls,
- gloves (optional),
- boots (chemical-resistant, steel-toed, steel shank),
- boot covers (chemical-resistant) (optional),
- safety glasses or chemical splash goggles (optional),
- hardhat (optional),
- escape mask (optional), and
- face shield (optional).

## CHAPTER 7. MONITORING EQUIPMENT

The work environment will be monitored to ensure that IDLH or other dangerous conditions are identified. At a minimum, monitoring will include evaluations for combustible atmospheres, oxygen-deficient environments, hazardous concentrations of airborne contaminants, and radioactivity.

7.1 AIR SAMPLING: EQUIPMENT, CALIBRATION, AND MAINTENANCE. 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 used at the site, and may be used as the basis for upgrading or downgrading levels of protection, at the discretion of the site HSO.

7.1.1 ISD Dual Detector This meter monitors for combustible gases and oxygen. It can be used to determine (1) if an area contains concentrations of combustible gases with readings as a percentage of the lower explosive limit (LEL); and (2) the percentage of oxygen. This equipment will be calibrated in accordance with the manufacturer's instructions.

7.1.2 NMS MX-241 (Explosimeter) This instrument is calibrated to detect methane and monitors combustible gases as a percentage of the lower explosive limit. It will be calibrated in accordance with the manufacturer's instructions.

7.1.3 ISD HS267 This instrument monitors for the presence of hydrogen sulfide in parts per million (ppm). It will be calibrated in accordance with the manufacturer's instructions.

7.1.4 Photovac™ Organic Vapor Analyzer 10S50 The Photovac™ Organic Vapor Analyzer (OVA) is a total organic vapor analyzer capable of detecting volatile organic compounds (VOC) that can be ionized by ultraviolet (UV) light. Model 10S50 is commonly used on-site to estimate the presence of VOCs 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, which breaks down mixtures of VOC into individual components identified by retention time; and (2) detection accomplished by ionization in UV light. The charged component then moves to an electrode which, in turn, results in a meter deflection proportional to the concentration of the contaminant. This instrument does not read out directly in ppm unless calibrated against the material being measured; therefore, results must be interpreted conservatively and with care. Calibration and maintenance will be performed in accordance with the manufacturer's instructions.

7.1.5 HNU IS101 and Photovac TIP Photoionization Detector Like the OVA, the photoionization detector (PID) operates on the basis of ionization of the contaminant, which results in a meter deflection proportional to the concentration of the contaminant. In the PID, ionization is caused by a UV light source. The strength of the UV, measured in electron volts (eV), determines which contaminants can be ionized. The HNU can use three different-strength UV sources, including 9.6, 10.2, and 11.7 eV; only the 10.2- and 11.7-eV probes are currently available for field use. The TIP operates using a UV light source of 10.6 eV. Calibration and maintenance will be performed in accordance with the manufacturer's instructions.

7.1.6 Detector Tubes (MSA and Draeger™) A colorimetric detector tube is a direct-reading instrument consisting 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 because reliability of the results depends on the proper pump calibration, the degree of stability of the reacting chemical, and the ambient temperature. Interfering gases or vapors can also positively or negatively affect measured results. Calibration and maintenance will be performed in accordance with the manufacturer's instructions.

7.2 PERSONAL MONITORING: EQUIPMENT, CALIBRATION, AND MAINTENANCE. Personal monitoring will be undertaken to characterize exposure of high-risk employees to hazardous substances encountered on-site.

7.2.1 Personal Sampling Pumps These devices can be worn by an employee to draw air samples through appropriate collection media. The units can be used to draw volumes from 2 to 3 liters per minute. Calibration will be conducted using standard industrial hygiene protocols before and after each sampling session (i.e., each day's use).

7.2.2 Passive Dosimeters or Gas Badges These devices are nonmechanical collection devices used to monitor for organic vapors and various gases. The device is worn by an employee and then sent to an industrial hygiene laboratory for analysis.

7.2.3 Thermoluminescent Dosimetry Body Badges These devices are nonmechanical collection devices used to monitor for x-ray, beta, and gamma radiation exposure. The badges are worn by ABB-ES employees and sent quarterly to Tech/Ops Landauer, Inc., for analysis.

## CHAPTER 8. ZONATION

The site itself will normally be divided into three zones: (1) the majority of the work area, considered the Exclusion Zone; (2) limited areas serving as the Support Zone; and (3) an area for decontamination called the Contamination Reduction Zone (CRZ).

**8.1 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 by the Hot Line (i.e., a tape line or physical barrier). Personnel entering the Exclusion Zone must (1) enter through the CRZ; (2) wear the prescribed level of protection; and (3) be otherwise authorized to enter the Exclusion Zone. Any personnel, equipment, or materials exiting the Exclusion Zone will be considered contaminated. Personnel will be subject to decontamination; equipment and materials will either be subject to decontamination or 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 that includes a minimum 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. Access for emergency services to areas of specific site operations will be established.

**8.2 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 process, they become less contaminated; when they reach the Contamination Control Line, they are clean and can exit the CRZ without spreading contamination.

Within the CRZ is the Contamination Reduction Corridor, 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 (e.g., emergency eye wash, fire extinguisher, stretcher, and first aid kit) are staged in this zone.

**8.3 SUPPORT ZONE.** The Support Zone is the outermost zone of the site, separated from the CRZ by the Contamination Control Line; it is considered a clean area. Movement of personnel and materials from the Support Zone into the CRZ is generally unrestricted, except as required through access points controlled for administrative purposes. However, only uncontaminated or decontaminated personnel or materials may enter the Support Zone from the CRZ.

The Support Zone contains the necessary support facilities (including personal hygiene facilities) for site operations. It also serves as the communications center and source of emergency assistance for operations 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 the site designee.

## CHAPTER 9. WORK PRACTICES

**9.1 GENERAL.** Workers will be expected to adhere to the established safe work practices for their respective specialties (e.g., drilling, laboratory analysis, and 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 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.
- Use the buddy system. Under no conditions will any person be permitted to enter the Exclusion Zone alone. Establish and maintain communications. In addition to radio communications, it is advisable to develop a set of hand signals, because 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 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.
- Disposable items will be used, when possible, to minimize risks during decontamination and possible cross-contamination during sample-handling.
- Smoking, eating, or drinking in the work area and before decontamination will not be allowed. Oral ingestion of contaminants is a likely means of introducing toxic substances into the body.
- Avoid heat and other work stresses related to wearing protective gear. Work breaks should be planned to prevent stress-related accidents or fatigue.
- Maintain monitoring systems. Conditions can change quickly if subsurface areas of contamination are penetrated.
- Conflicting situations that may arise concerning safety requirements and working conditions must be addressed and resolved rapidly by the HSO to avoid any motivation or pressure to circumvent established safety policy.
- To the extent feasible, handling of contaminated materials should be done in a remote area, particularly when drummed or other containerized hazardous waste materials are found on-site. Every

effort should be made to identify the contents of containers found on-site before they are subject to material-handling applications.

- Personnel must be observant of not only their 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 while using personnel protective gear because vision, hearing, and communication can be restricted.
- Contact lenses are not allowed to be worn on-site; if corrosive or lachrymose substances enter the eyes, proper flushing is impeded.
- All facial hair that interferes with the face piece fit must be removed before donning a respirator at all sites requiring Level C or Level 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 while ill during field investigation assignments.
- The site leader, HSO, and sampling personnel will maintain project records in a bound notebook (e.g., daily activities, meetings, incidents, and data). Notebooks will remain on-site for the project duration so that replacement personnel may add information, thereby maintaining continuity. The notebooks and daily records will become part of the permanent project file.
- Appropriate provisions of the U.S. Army Corps of Engineers "Safety and Health Requirements Manual" (EM385-1-1) will be followed.

9.2 SITE ENTRY PROCEDURES. In most cases, ABB-ES teams are not the first on-site investigators. Considerable knowledge of site history and current status allows 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 following steps.

1. Recognize that ABB-ES'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, consisting of the following activities:
  - establish a CRZ (decontamination area),

- survey the site at the highest level of protection practicable, beginning with a perimeter survey and gradually covering all areas of proposed activity with the following (as appropriate):
    - HNU PID
    - OVA
    - radiation survey meter
    - personal air sampling pumps
    - chemically reactive indicator tubes
    - oxygen-deficiency meter
    - explosive mixture meter,
  - Establish a "hot zone,"
  - Review data, assess risk, and select the appropriate level of protection.
3. Prepare a summary site HASP and document all data acquired.

## CHAPTER 10. CONFINED-SPACE ENTRY PROCEDURES

10.1 CONFINED SPACE CLASSIFICATION. Confined spaces are classified according to existing or potential chemical and physical hazards. Classification is based on characteristics of the confined space, oxygen level, flammability, and toxicity. Table 10-1 defines the parameters of each classification. If any hazard presents a situation that is IDLH, the confined space is classified as Class A. Classification is determined by the most hazardous condition of entering, working in, and exiting a confined space. Class B confined spaces have the potential for causing injury and illness but are not IDLH. Class C entry is one in which the chemical hazard potential is minimal and does not require any special modification in work procedures.

### 10.2 ENTRY PROCEDURES

10.2.1 Team Size A minimum of three workers is required for each confined space activity; that is, two entry and one standby, or one entry, one rescue, and one standby. If the former arrangement is used, all three workers must be ABB-ES employees. If the latter arrangement is used, the standby could be a non-ABB-ES team member, assuming he or she has comparable training, is proficient in the assigned duties, and is capable of using all safety equipment.

The one entry, one rescue, one standby arrangement should only be used when the confined space is relatively small or the entry person will be in the line of sight at all times. In this instance, the rescue person acts as the second person in the "buddy system."

The two entry, one standby arrangement is used when the area of the confined space is larger, and the tasks may take the worker away from the entryway. Again, care must be taken using this arrangement because the standby person cannot enter the confined space and attempt rescue unless adequately protected (i.e., respiratory and dermal) and replaced by another qualified standby person.

Three workers is the minimum number required for these activities and, in most cases, should only be used for relatively nonhazardous confined spaces. Additional crew may be needed if entering a Class A or Class B confined space, including rescue, decontamination, and line-of-sight personnel.

10.2.2 General Entry Procedures The following steps must be taken when entering a confined space.

1. Inspect all pieces of equipment to ensure they are in good working order. DO NOT ENTER CONFINED SPACE WITH DEFECTIVE EQUIPMENT.
2. Conduct a background check to identify all potential hazards that may be encountered in the confined space. Determine whether there is potential for fire or explosion hazards, as well as a toxic or oxygen-deficient atmosphere.
3. Before entry, the atmosphere inside the confined space must be tested. An attempt should be made to test the atmosphere without opening the entryway (i.e., through a vent line or a small opening). If the entryway must be opened to test and only low levels are expected in the confined space,

Table 10-1 Confined Space Classification Table

PARAMETERS	CLASS A (LEVEL A OR B PPE)	CLASS B (LEVEL B OR C PPE)	CLASS C (LEVEL D PPE)
Characteristics	Immediately dangerous to life; Rescue procedures require the entry of more than one individual fully equipped with life-support equipment; maintenance of communication requires an additional standby person stationed within the confined space.	Dangerous, but not immediately life-threatening; Rescue procedures require the entry of no more than one individual fully equipped with life-support equipment; indirect visual or auditory communication with workers.	Potential hazard requires no modification of work procedures; Standard rescue procedures, direct communication with workers from outside the confined space.
Oxygen	19.4 percent or less *(122-mm Hg) or greater than 25 percent *(190 mm Hg)	19.5 to 21.4 percent *(122- to 147-mm Hg) or 21.5 to 25 percent (163- to 190-mm Hg)	19.5 to 21.4 percent *(148- to 163-mm Hg)
Flammability Characteristics	20-percent or greater LEL	10- to 19-percent LEL	10-percent LEL or less
Toxicity	**IDLH	Between the TLV/PEL and the **IDLH. If air-purifying respirators are used, maximum level based on breakthrough time (1,000 ppm maximum).	Less than the TLV/PEL
Respiratory Protection	SCBA or supplied air, respirator with escape bottle.	SCBA, supplied air respirator with escape bottle or air-purifying respirator.	None.

\* Based on total atmospheric pressure of 760-mm Hg (sea level).

\*\* Immediately Dangerous to Life or Health, as referenced in NIOSH Registry of Toxic and Chemical Substances, Manufacturing Chemists data sheets, industrial hygiene guides, or other recognized authorities.

NOTES: Hg = mercury; LEL = Lower Explosive Limit; PEL = Permissible Exposure Limit;  
SCBA = Self Contained Breathing Apparatus; TLV = Threshold Limit Value  
PPE = Personal Protective Equipment

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crack open the entryway, test the breathing zone first, and then test the confined space. If potentially high levels are expected in the breathing zone, respiratory protection should be worn before opening the entryway cover.

4. If an explosive, toxic, or oxygen-deficient atmosphere is detected, purge or ventilate the confined space prior to entry. Retest the atmosphere three times at 5-minute intervals. A person can enter the confined space without respiratory protection only if all three test results are below the Permissible Exposure Limit/Threshold Limit Value (PEL/TLV), 10 percent of the LEL, and above 19.5-percent oxygen (all three conditions must be met). (NOTE: Any downward deflection of the readings on the oxygen meter from background [i.e., 20.9 percent] should be viewed as potential for an IDLH atmosphere. Unless contaminants are known to be nontoxic, do not enter the confined space without respiratory protection if the oxygen level is below background.)
5. Install a blank or a block, or otherwise isolate, lockout, and tag all chemical, physical, and/or electrical hazards wherever possible.
6. If using an air-purifying respirator or if an IDLH and/or explosive atmosphere exists, air monitoring must be on a continuous basis. If respiratory protection is not used and there is potential for atmospheric conditions to change due to work practices or conditions, air monitoring should be done periodically. In all these cases, a 5-minute escape pack must be used.
7. Record all results of the tests for hazardous conditions including the location, time, date, and weather (if applicable); and readings on the PID, combustible gas meter, oxygen-deficiency meter, Draeger tubes, and any other equipment used on the Confined-Space Entry Checklist-General Entry form (Appendix A). Send a copy of the completed form to the HSM or the HSS.
8. Wear appropriate clothing for site conditions, as determined by the HSO.  
  
A safety belt or harness with lifeline must be worn if hazardous conditions exist, although good safety precautions dictate their use regardless of "existing" conditions. If the diameter of the entryway is less than 18 inches, the wrist-type harness must be used and special provisions made if a supplied-air respirator is necessary.
9. One person (i.e., standby) must remain at the entryway at all times and must keep continuous contact with the person entering the confined space. Contact can be maintained by line of sight, listening for sounds, the safety line, and/or radio. The standby person must not enter the confined space unless another trained person is available to act as standby, and he or she is equipped with adequate respiratory and dermal protection. (In most cases, respiratory protection would be an airline respirator or SCBA.)
10. Do not smoke when working in or near confined spaces and do not take flash-lit photographs when explosive gases are known or suspected to be present.

11. Do not rely on permanent ladders because they are often in poor condition. If they must be used, be sure of footing. Inspect permanent ladders for deterioration before entering and while descending. Try each step with one foot, while standing on the step above. When in doubt, use either a portable ladder of adequate height to reach 3 feet above opening or a rope ladder, or lower the entry person using the tripod. If a portable ladder is used, it should be tied off, if possible; otherwise, it should be held in place by the standby person.
12. Do not work without adequate lighting. Use only "explosion-proof" lights or hand lamps if combustible atmospheres are possible.
13. The entry person must not remain in the confined space if he or she becomes even slightly drowsy, faint, dizzy, or otherwise uncomfortable. Many of the gases that cause the most problems are odorless, tasteless, and invisible.

10.2.3 Manhole/Sewer Entry When preparing to enter a manhole/sewer, the following safety measures must be taken.

1. Inspect all pieces of equipment to ensure they are in good working order. DO NOT ENTER CONFINED SPACE WITH DEFECTIVE EQUIPMENT.
2. Park the vehicle near the manhole (DO NOT leave the vehicle running). If the manhole is in the street, it is best to park so as to detour oncoming traffic around the manhole. The vehicle's emergency flashers and portable yellow warning beacon must be ON. The vehicle serves as protection from oncoming traffic, can be used to store emergency equipment (e.g., SCBA and first aid kit), and can be used in an extreme emergency to slowly pull an injured person from the confined space if a tripod with hoist attachment is unavailable or inoperative.
3. Erect portable barricades or cones around the manhole and in front of the vehicle to see that traffic is adequately diverted and to prevent pedestrians from falling in. Reflective vests should be worn so that workers are visible to approaching traffic.
4. If there are openings large enough to admit sampling tubes, test for the presence of explosive and toxic gases before removing each manhole cover. Otherwise, raise one side of the cover using the cover hook or pick, prop it slightly open, and conduct the tests.
5. If toxic or explosive gases are detected in the sewer, report this immediately to the local fire department and/or department of public works.
6. Using the Manhole/Sewer Entry Log Form, record the results of tests for hazardous conditions, including location, manhole number (if applicable), time, date, weather (if applicable), and readings on the PID, combustible gas meter, oxygen-deficiency meter, and Draeger tube (Appendix A). Send a completed copy of the form to the HSS.
7. Remove manhole covers with a cover hook or pick; do not improvise. Be careful of fingers and toes; the cover is usually heavy and difficult to handle. Unless the cover is extremely heavy, it is safer for only one worker to handle it.

8. Test the atmosphere; if a toxic, flammable, or oxygen-deficient atmosphere exists, ventilate the sewer. Depending on the hazard, ventilation can be accomplished in various ways, for example: (1) remove and vent the adjoining upstream and downstream manhole covers, as soon as possible and well in advance of entering the manhole (high hazard); and (2) vent the manhole in which entry will occur (very low hazard). If a blower is used, it is desirable to establish a flow of air in the sewer, in one manhole and out another. Ensure that the air intake is well away from automobile exhaust, and combustible and/or toxic atmospheres. Appropriate traffic control measures must be taken by barricading or otherwise marking the open manholes.
9. After ventilating, test for explosive and toxic gases and oxygen deficiency in the manhole at ground level and at the bottom; record the results. If entering the sewer itself, make the same tests at the manholes at either end. If ventilation is necessary, monitor the atmosphere in the manhole while work progresses, or continue operation of the blower. Continuous monitoring (i.e., equipment ON during entire entry) is imperative because conditions within the sewer may change rapidly. Do not enter a manhole while there is an oxygen deficiency without a pressure-demand, air-supplied breathing apparatus. If the oxygen level is below background, i.e., less than 20.9 percent, caution must be taken because an IDLH atmosphere may exist.
10. When entering manholes or tanks, wear hardhats, protective clothing, and unless inappropriate, respiratory protection and safety belt or harness with lifeline. If the manhole is less than 18 inches in diameter, a wrist-type harness must be used and special provisions made if air-supplied respirators are necessary. When working in manholes greater than 12 feet deep, in the sewer itself, or where potential exists for gases to appear unexpectedly, a 5-minute emergency egress air supply is required (unless the time required to don the emergency respirator is greater than what would be needed to exit the manhole).
11. At least one person (i.e., standby) must remain at the manhole at all times and must keep continuous contact with the person entering the sewer. Contact can be maintained by line of sight, listening for sounds, and the safety line and/or radio. The standby person must not enter the manhole unless another trained person is available to act as standby and has adequate respiratory and dermal protection available. (In most cases, respiratory protection will be an airline respirator or SCBA.) The standby/rescue person should be suited up (but not yet on air) before the work crew enters the confined space.
12. Do not smoke when working in or near manholes. Do not take flash-lit photographs when explosive gases are known or suspected to be present.
13. Do not rely on the manhole ladders because they are often in poor condition. If they must be used, be sure of footing. Inspect manhole ladders for deterioration before entering and while descending. Try each step with one foot, while standing on the step above. When in doubt, use a portable ladder of adequate height to reach 3 feet above the manhole opening, a rope ladder, or lower the entry person using the tripod. If a portable ladder is used, it should be tied off if possible; otherwise, it should be held in place by the standby person.

14. Do not work without adequate lighting. Use only "explosion-proof" lights or hand lamps in the manhole or sewer.
15. The entry person must not remain in the manhole or sewer if he or she becomes even slightly drowsy, faint, dizzy, or otherwise uncomfortable. Remember that carbon monoxide, carbon dioxide, methane, and hydrogen sulfide, which cause the most trouble, are odorless (hydrogen sulfide has a distinct odor only during initial exposure), tasteless, and invisible.

## CHAPTER 11.0 EXCAVATION AND TRENCHING

11.1 EXCAVATION PROCEDURES. Because excavations and trenches pose a hazard to employees, structures, and equipment, all excavations created during site operations will be done in accordance with 29 CFR 1926 Subpart P. The following steps summarize the excavation procedures that will be followed by all ABB-ES personnel.

- Prior to excavating or trenching, all surface encumbrances located so as to create a hazard to the employees will be removed or supported, and all underground utilities will be determined and located.
- Entry into excavations will be avoided whenever possible. If entry is unavoidable, the excavation will be considered a confined space; as such, entry will be done in accordance with the Confined Space Entry Program (see Chapter 10.0).
- Under no circumstances will site personnel enter excavations that are not adequately protected from cave-ins by shoring or sloping.
- Stairways, ladders, or ramps will be located in trenches deeper than 4 feet and situated to require no more than 25 feet of lateral travel.
- Excavations below the base of a building or structure will not be permitted unless the building or structure is adequately supported or a registered professional engineer determines that the excavation will not pose a hazard to the employee.
- All equipment will be kept at least 2 feet from the edge of the excavation.
- Any excavation left open and unattended will be barricaded or covered until it can be backfilled.

11.2 SLOPING. Acceptable options for sloping or benching include the following:

Option 1. a slope of 1½ horizontal to 1 vertical (34 degrees measured from the horizontal);

Option 2. determination of the maximum allowable slope based on soil conditions and in accordance with the conditions and requirements set forth in 29 CFR 1926 Subpart P, Appendices A and B;

Option 3. designs of sloping or benching systems using tabulated data approved by a registered professional engineer; and

Option 4. other systems designed by a registered professional engineer;

11.3 SHORING. Acceptable options for shoring include the following:

Option 1. designs using Appendices A, C, and D of 1910.126 Subpart P;

Option 2. designs using manufacturers tabulated data;

Option 3. designs using tabulated data approved by a registered professional engineer, and

Option 4. other support systems designed by a registered professional engineer.

## CHAPTER 12. TEMPERATURE EXTREMES

12.1 HEAT STRESS. Due to the increase in ambient air temperatures and the effects of protective outer wear decreasing body ventilation, there is increased 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.

### 12.1.1 Identification and Treatment

#### 12.1.1.1 Heat Exhaustion

Symptoms Heat exhaustion usually begins with muscular weakness, dizziness, nausea, and a staggering gait. Vomiting is frequent. The bowels may move involuntarily. The victim is very pale, the skin is clammy, and he or she may perspire profusely. The pulse is weak and fast; breathing is shallow. The victim may faint unless he or she lies down. This may pass; however, sometimes it persists and, while heat exhaustion is generally not considered life threatening, death could occur.

First Aid Immediately remove the victim to the CRZ in a shady or cool area with good air circulation. Remove all protective outer wear. Call a physician. Treat the victim for shock (i.e., have the victim lie down, raise the feet 6 to 12 inches, and maintain body temperature but loosen all clothing). If the victim is conscious, it may be helpful to give sips of water. Transport the victim to a medical facility.

#### 12.1.1.2 Heat Stroke

Symptoms This is the most serious of heat casualties because the body excessively overheats. Body temperatures often are between 107 and 110° F. The victim will have a red face and may not be sweating. First there is often pain in the head, dizziness, nausea, oppression, and 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.

First Aid Immediately evacuate the victim to a cool and shady area in the CRZ. Remove all protective outer wear and all personal clothing. Lay the victim on his or her 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 or ice bags to the head and groin. Sponge off the bare skin with cool water or rubbing alcohol, if available, or even place the victim in a tub of cool water. The main objective is to cool without chilling. Do not give stimulants. Transport the victim to a medical facility as soon as possible.

12.1.2 Prevention of Heat Stress One of the major causes of heat casualties is the depletion of body fluids and salts through sweating. Fluids should be maintained in the Support Zone. Salts can be replaced by either a 0.1 percent salt solution, more heavily salted foods, or commercial mixes such as Gatorade™. The commercial mixes are advised for personnel on low-sodium diets.

During warm weather, a work schedule will be established that allows most work to be conducted during the morning hours, before ambient air temperature levels reach highs.

A work rest schedule will be implemented for personnel required to wear Level B or C protection (i.e., an impervious outer garment) with sufficient time allowed for personnel to "cool down" (this may require working in shifts). Two hours is the maximum time between breaks at Level B or C, regardless of temperature. At elevated temperatures, breaks should be scheduled as follows:

<u>Ambient Temperatures</u>	<u>Maximum Time Between Cool Down Breaks</u>
Above 90 °F	¼ hour
85 to 90 °F	½ hour
80 to 85 °F	1 hour
70 to 80 °F	1½ hours

**12.1.3 Heat Stress Monitoring** Monitoring of personnel wearing impervious clothing should commence when the ambient temperature reaches 70 °F, with increased frequency if 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. As a screening mechanism of the body's recuperative ability to excess heat, one or more of the following techniques should be used.

1. Measure the heart rate (HR) for 30 seconds, by radial pulse, as early in the resting period as possible. At the beginning of the rest period, the HR should not exceed 110 beats per minute. If the HR is higher, the next work period should be shortened by 10 minutes (or 33 percent), with the length of the rest period staying the same. If the pulse rate is still above 110 beats per minute at the beginning of the next rest period, the following work cycle should again be shortened by 33 percent.
2. Measure oral body temperature with a clinical thermometer, as early as possible in the resting period. At the beginning of the rest period, oral temperature (OT) should not exceed 99 °F. If OT exceeds 99 °F, the next work period should be shortened by 10 minutes (or 33 percent), with the length of the rest period staying the same. If the OT again exceeds 99 °F at the beginning of the next period, the following work cycle should be further shortened by 33 percent. OT should also be measured at the end of the rest period to ensure that it has dropped below 99 °F.
3. Maintain good hygienic standards by changing clothes frequently, showering daily, and allowing clothing to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

**12.2 COLD STRESS.** Cold weather may often cause problems for personnel working outside, even at temperatures above freezing. As temperatures drop below freezing, the potential for cold weather injuries increases dramatically, as does the potential for equipment failure. Because of the considerable danger to personnel, outdoor work should be suspended if the ambient temperature drops below 0 °F (-18 °C) or if the windchill factor drops below -29 °F (-34 °C). These levels represent guidelines that should be used as an action level unless

the HSO determines and documents otherwise. Table 12-1, which shows equivalent temperatures (i.e., windchill) for a range of ambient conditions, should also be referred to.

Snow and ice increase the risks to personnel and operations through reduced visibility, increased potential for falling injuries, reduced on-site mobility, and the increased time required to access the site (or off-site support services).

In view of these factors, it is critical that the HSO establish site-specific safety and operating protocols, and that all on-site personnel be made aware of the risks.

12.2.1 Local Cold Injuries Local cold injuries affect specific areas of the body (e.g., fingers, ears, or toes), including the more commonly recognized injuries described in the following subsections.

12.2.1.1 Chilblains Chilblains is a chronic condition affecting the skin and peripheral capillary circulation, resulting from prolonged exposure of the bare skin, primarily in the extremities, to temperatures at or below 60 °F. The best method of preventing and treating chilblains is to cover and protect the skin, thereby avoiding prolonged exposure to the cold.

12.2.1.2 Frostbite Frostbite is freezing of the hands, feet, ears, and exposed parts of the face as a result of exposure to very low temperatures. Frostbite occurs when ice crystals form in the fluid in cells of the skin and tissue. As long as blood circulation remains good, frostbite will not occur.

There are three stages of frostbite: incipient frost bite (frostnip), superficial frostbite, and deep frostbite. The classification depends on severity and can range from incipient frostbite (frostnip), which affects the skin; to superficial frostbite, which involves the skin and the tissues immediately beneath it; to deep frostbite, which is much more serious with damage that may affect deeper tissue and even bone.

Symptoms. Symptoms for each of the three stages of frostbite are described as follows.

- Frostnip. Skin first turns red and then later becomes pale or waxy white. There may be tingling, stinging, aching, an uncomfortable sensation of coldness or numbness, or no noticeable symptoms.
- Superficial Frostbite. The skin turns white or gray-white and is waxy in appearance. It is firm to touch (i.e., does not move easily) and the tissue beneath the skin is soft and resilient. There is a lack of sensation in the area.
- Deep Frostbite. The tissue is pale, cold, and solid with possible blisters and swelling. The hands and feet are especially susceptible to deep frostbite.

Emergency Treatment of Frostbite. Frostnip is easily treated in the field by the application of body heat, which should be applied before the affected area becomes numb. If frostnip affects your fingers and hands, place them against the

Table 12-1 Cooling Power of Wind on Exposed Flesh Expressed as an Equivalent Temperature  
(Under Calm Conditions)

ESTIMATED WIND SPEED (in mph)	ACTUAL TEMPERATURE READING (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	EQUIVALENT CHILL TEMPERATURE (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER In <hour with dry skin. Maximum danger of false sense of security.			INCREASING DANGER Danger from freezing of exposed flesh within 1 minute.				GREAT DANGER Flesh may freeze within 30 seconds.				

Trenchfoot and immersion foot may occur at any point on this chart.

Source: Developed by U.S. Army Research Institute of Environmental Medicine, Natick, Massachusetts.

skin of your chest or in your armpits. To warm your face, hold a mitten or scarf over the lower part of your face and breathe into it. Thaw frozen spots immediately. Do not rub affected areas.

Superficial frostbite usually responds to the application of body heat, as described previously. If the skin does not respond to body heat or if it resembles the early stages of deep frostbite, follow the emergency treatments listed in the following paragraphs. DO NOT rub affected areas.

For deep frostbite, if possible, the injured person should be taken to a heated shelter to avoid further frostbite. If it can be done without the danger of further frostbite, remove all constricting items (e.g., boots, gloves, and socks) from the injured area. RAPID REWARMING WILL MINIMIZE TISSUE LOSS. If possible, warm the extremities in a carefully controlled water bath (104 to 106 °F) until tips of the fingers or toes turn pink and feeling is restored. If a water bath is not available, either apply wet packs (100 to 112 °F) to the person's body, or gently wrap frostbitten area in blankets or some other warm material.

DO NOT attempt to thaw the affected parts by exercising them or heating them in front of an open fire, heat lamp, radiator, or stove. The person could receive a heat injury as a result of sensation loss.

DO NOT use snow to thaw frostbite. DO NOT rub, massage, or use pressure on the affected areas. Keep the frostbitten parts elevated if possible. Watch to see if CPR is necessary. Give the victim warm drinks such as tea, coffee, or soup. DO NOT GIVE ALCOHOLIC BEVERAGES. Have the victim exercise fingers or toes as soon as possible, but only after they are warmed. DO NOT allow a person with frostbitten feet to walk; walking may cause additional damage.

#### Medical Treatment of Frostbite.

- Frostnip. Usually does not require medical care.
- Superficial Frostbite. Blisters may require medical care.
- Deep Frostbite. EARLY MEDICAL TREATMENT IS URGENT! Transport the victim to medical care facilities at once.

Prevention of Frostbite. It is far easier to prevent or stop frostbite in earlier stages than to thaw and take care of badly frozen flesh. To protect the body against frostbite, the following precautions should be taken:

- Wear enough clothing to protect against the cold and wind.
- Wear warm gloves and boots.
- Pull a scarf or jacket flap over the lower part of the face or pull a hood tightly around the face.
- Occasionally exercise the face, fingers, and toes to keep them warm and to detect any areas that may have become numb.
- Crew members should watch each other closely, especially the face, for signs of frostbite.

12.2.1.3 Immersion Foot. Immersion foot (formerly called trenchfoot) is a cold injury resulting from prolonged exposure to near-freezing temperatures when standing or walking on wet or swampy ground.

Symptoms. In the early stages, the feet and toes are pale, cold, numb, and stiff, and walking is difficult. If preventive action is not taken, the feet will swell and ache; in extreme cases, this may result in irreversible damage to the tissues of the foot or leg.

Emergency Treatment of Immersion Foot. Handle feet very gently. DO NOT rub or massage. If necessary, clean feet carefully with soap and warm water, then dry, elevate, and expose to warm but not hot air.

Prevention of Immersion Foot. Because the early stages of immersion foot are not painful, crew members must be constantly on the alert and check feet often when working in cold, wet conditions. Keep feet dry by wearing waterproof footgear and changing socks frequently because perspiration, trapped inside waterproof boots or heavy footgear, can contribute to immersion foot symptoms. Avoid standing in wet areas. If feet get wet, dry them as soon as possible, warm them with your hands, then use foot powder, and change to dry socks. If you cannot change wet boots and socks, exercise your feet frequently by wriggling your toes and moving your ankles. Never wear tight boots.

12.2.2 Systemic Cold Injuries Systemic injuries are those that affect the entire body system. Severe body cooling, known as systemic hypothermia, can occur at temperatures well above freezing. Hypothermia, which can be fatal, is the progressive lowering of body temperature accompanied by rapid, progressive mental and physical collapse. A large percentage of wilderness deaths are the result of hypothermia.

Hypothermia is caused by exposure to cold, and is aggravated by moisture, cold winds, fatigue, hunger, inadequate clothing or shelter, and excessive perspiration from strenuous exercise followed by too rapid cooling.

Hypothermia often occurs between temperatures of 30 to 50 °F, which most people believe are not dangerous. Crew members should be alert for symptoms of hypothermia, especially when temperatures are dropping rapidly or when they must work in rain, snow, or ice.

Hypothermia may occur on land or following submersion in even moderately cold water (i.e., 65 °F or lower). On land, hypothermia may take a full day or more of exposure to develop; however, if the conditions are extremely severe, death may occur within a few hours of initial symptoms.

In cold water, death may seem to be from drowning; in reality, it is usually the result of hypothermia. In water, skin and nearby tissues chill very fast; in 10 to 15 minutes, the temperature of the heart and brain may drop. When the core (i.e., internal body) temperature reaches 90 °F, unconsciousness may occur; when body temperature drops to 80 °F, heart failure is possible.

12.2.2.1 Symptoms In the early stages of hypothermia, the body begins to lose heat faster than it can be produced, making an effort to stay warm by shivering. When the body can no longer generate enough heat to overcome heat loss and the energy reserves of the body become exhausted, body temperature begins to drop.

This affects the ability of the brain to make judgments and also results in loss of muscular control. As the body temperature drops, hypothermia symptoms become increasingly severe, as shown in the following table:

<u>SYMPTOMS OF HYPOTHERMIA</u>	<u>APPROXIMATE CORE TEMPERATURE</u>
Person is conscious, alert with increased respiration. Shivering may become uncontrollable as core temperature nears 95 °F.	Above 95 °F
Person is conscious but disoriented and apathetic. Shivering is present but diminishes as temperature drops. Below 92 °F, respiratory rate gradually diminishes and pupils begin to dilate.	95 to 90 °F
Person is semiconscious. Shivering is replaced by muscular rigidity. Pupils are fully dilated at about 86 °F.	90 to 86 °F
Unconscious; diminished respiration.	Below 86 °F
Barely detectable or nondetectable respiration.	Below 80 °F

12.2.2.2 **Emergency Treatment of Hypothermia** Move hypothermia victim to shelter and warmth as rapidly as possible. In very mild cases, dry clothing and shelter may be all that is needed. Gently remove all of the victim's wet clothing (so energy is not expended by warming and drying wet clothing) and replace it with a dry set. Give the person something warm to drink. **DO NOT GIVE ALCOHOLIC BEVERAGES.**

ALL OTHER HYPOTHERMIA CASES SHOULD BE CONSIDERED MEDICAL EMERGENCIES. PROVIDE EXTERNAL HEAT IN ANY WAY POSSIBLE! A warm bath (with the water kept between 105 and 110 °F) is the most effective way of warming a victim of hypothermia. NEVER put an UNCONSCIOUS VICTIM in a bathtub.

If it is not possible to give the person a warm bath, use one of the following.

ALTERNATE METHODS.

- Wrap warm moist towels (or other fabric) around the victim's head, neck, sides, and groin. As the packs cool, rewarm them by adding warm water (approximately 105 °F). Check the temperature of the

water with your elbow or the inside of your arm; it should be warm but not hot.

- If you are at a remote outdoor location and cannot use the other method, make a "human sandwich" by placing the unclothed victim in a sleeping bag (or between blankets) with two other undressed persons to provide body-to-body heat transfer. THIS WILL SAVE LIVES. Additional sleeping bags or blankets can be placed over and under the victim.

DO NOT wrap a hypothermia victim in a blanket without an auxiliary source of heat unless it is to protect against any further heat loss before treatment can begin, or you need to go for help and there is no other alternative.

Continue treatment once the victim has stabilized. Give warm liquids and nourishing food if the person is conscious. Check the person for symptoms of frostbite and, if necessary, give treatment.

Handle the patient gently and do not allow him or her to walk. Exertion can circulate cold stagnant blood from extremities to the central body and cause "after-drop," in which the patient's core temperature drops below the level that will sustain life. ALCOHOL CONTRIBUTES TO AFTER-DROP.

**12.2.2.3 Medical Care for Hypothermia** HYPOTHERMIA IS A SEVERE EMERGENCY. GET MEDICAL TREATMENT AS SOON AS POSSIBLE. Even persons with mild hypothermia should see a doctor.

**12.2.2.4 Prevention of Hypothermia** In cold weather, never go into the field without wearing adequate clothing. Take a complete change of warm clothes and one or two extra pairs of socks (in plastic bags). Wear or carry a windproof, water-resistant outer jacket and, in rain or snow, wear adequate raingear.

Stay dry. If your clothing becomes wet from perspiration, rain, snow, or immersion in water, change it as soon as possible. If you start to shiver in a prolonged or violent way, seek shelter at once. Shivering may produce heat but it also uses up energy. Violent shivering may be an early sign of hypothermia.

Avoid accidental immersion in water. Practice boat safety and learn cold water survival techniques. If you fall into water and you are not very close to shore, remain quiet. Keep your head out of water, climb onto the boat, or hold or climb onto any other object that will support you and keep you up out of the water.

**12.2.3 Safety and First Aid Equipment** In view of the causes, results, and appropriate treatment of cold weather injuries discussed previously, as a minimum, the following safety equipment should be included during cold weather operations:

- extra clothing for all personnel
- blankets and/or sleeping bag
- high-energy food and drinking water supply
- toboggan
- tow ropes

In extreme cold conditions, add the following safety items:

- electric blanket (if an electrical source is available)
- portable emergency generator (with fuel, oil, and cords)
- space heater and fuel

**12.2.4 General Winter Operations** Cold weather conditions can severely affect winter operations. The Site Manager and HSO must plan work schedules and project tasks accordingly.

**12.2.4.1 Preliminary Assessment** If you will be working outdoors in cold weather, assess the local weather conditions through the news media (i.e., radio, television, and newspapers) to determine whether work should progress and the amount of preparation needed. Carefully consider questions such as the following.

- What are the typical wind and weather conditions for the period in which you will be working?
- Are the areas in which you will work sheltered or open to the wind?
- Is there a place nearby for periodic warming breaks? Can you obtain or heat warm food and beverages there? Is there a source of drinking water?
- Are there ways to minimize the length of time that crew members will have to work outdoors in the cold?
- If you use a vehicle for a warming area or will use a heater in a closed room, how can you ensure there is adequate ventilation to prevent carbon monoxide poisoning?

**12.2.4.2 Scheduling** Wherever possible, try to schedule work during the least severe weather. Rotate crew members to keep cold exposures short and allow sufficient time for frequent warming breaks. Remember that workers in heavy clothing often need more time to complete the tasks and may become fatigued more easily. Be aware that operations may have to be discontinued if winds increase or the temperature drops.

Because winter days are short, scheduling should allow time for taking care of equipment and supplies before nightfall. Once it becomes dark, it is more difficult to gauge terrain, and temperatures are likely to drop.

**12.2.4.3 Site Access** Snow and ice could make travel on site access roads impossible, or treacherous at best. Personnel should not be allowed to work on-site if conditions could severely hamper the arrival or departure of emergency vehicles. If the route to off-site medical facilities is blocked by snow or ice, an otherwise minor injury could result in a major medical emergency. If conditions warrant, the following provisions should be made:

- snow removal and plowing services for site access roads;

- a dependable, four-wheel-drive vehicle available to on-site personnel for transporting an injured person to an off-site medical facility; and
- sleeping bags, blankets, a food supply, and water kept on-site in the event a sudden storm requires personnel to remain overnight

The HSO is responsible for deciding when weather conditions make site access unsafe, thereby requiring work to stop until conditions improve.

12.2.4.4 Equipment and Supplies Obtain equipment and supplies that will help prevent cold stress and will help in the treatment of cold stress disorders. Required equipment includes a reliable ambient temperature thermometer, a wind gauge, and a windchill chart. If the site is potentially windy due to a lack of natural or manmade windbreaks (e.g., trees, valleys, and structures), try to provide means of shielding workers from the wind. If working at a remote location, carry extra food and water because hunger and dehydration contribute to cold stress. If possible, make provisions for hot food and beverages. Ensure that emergency communication equipment is available and operational for crew members working in the cold, at heights, or in remote locations.

Close attention must be given to the effects of cold weather on field equipment. Batteries can be severely affected by cold resulting in disabled radios, air monitoring equipment, sampling pumps, and vehicles. A supply of fresh batteries, a sufficient number of charging units, and a set of automotive jumper cables should be maintained on-site. In addition, the electronics in many field instruments such as PI, LEL, and oxygen meters, as well as the chemical reactions in detector tubes (e.g., Draeger tubes) can also be adversely affected by the cold. The manufacturers' literature must be consulted for minimum operating temperatures.

If at all possible, monitoring well sampling tasks should not be scheduled during cold weather. These tasks generally require the use of relatively delicate pumps; long, uninsulated stretches of tubing; and significant quantities of decontamination solutions. Unless considerable effort is expended to prevent pumps, hoses, decontamination solutions, and sample containers from freezing, attempting to sample monitoring wells in cold weather may be counter-productive. Portable shelters should be considered if cold weather sampling is necessary.

## CHAPTER 13. DECONTAMINATION

**13.1 PERSONNEL DECONTAMINATION.** Decontamination procedures are followed by all personnel leaving hazardous waste sites. Under no circumstances (except emergency evacuation) will personnel be allowed to leave the site prior to decontamination. A typical personnel decontamination station is shown in Figure 13-1. 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 tape and boots in disposal container.
5. Remove tape from outer gloves and remove gloves; discard tape and gloves in disposal container.
6. If the worker has left the Exclusion Zone to change the air tank on the SCBA or the canister on the air-purifying respirator, this will be the last step in the decontamination procedure. The tank or cartridge should be exchanged, new outer gloves and boot covers donned, and the joints taped; the worker then 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 daily unless there is reason to change sooner. Dual respirator canisters will be changed daily, unless more frequent changes are deemed appropriate by site surveillance data or personnel assessment.

Maximum and minimum decontamination layouts for PPE Levels A through C are shown in Figures 13-2 through 13-6.

Pressurized sprayers or other designated equipment will be available in the decontamination area for washdown and cleaning of personnel, samples, and equipment.



FIGURE 13-2  
Maximum Decontamination Layout  
Level A Protection

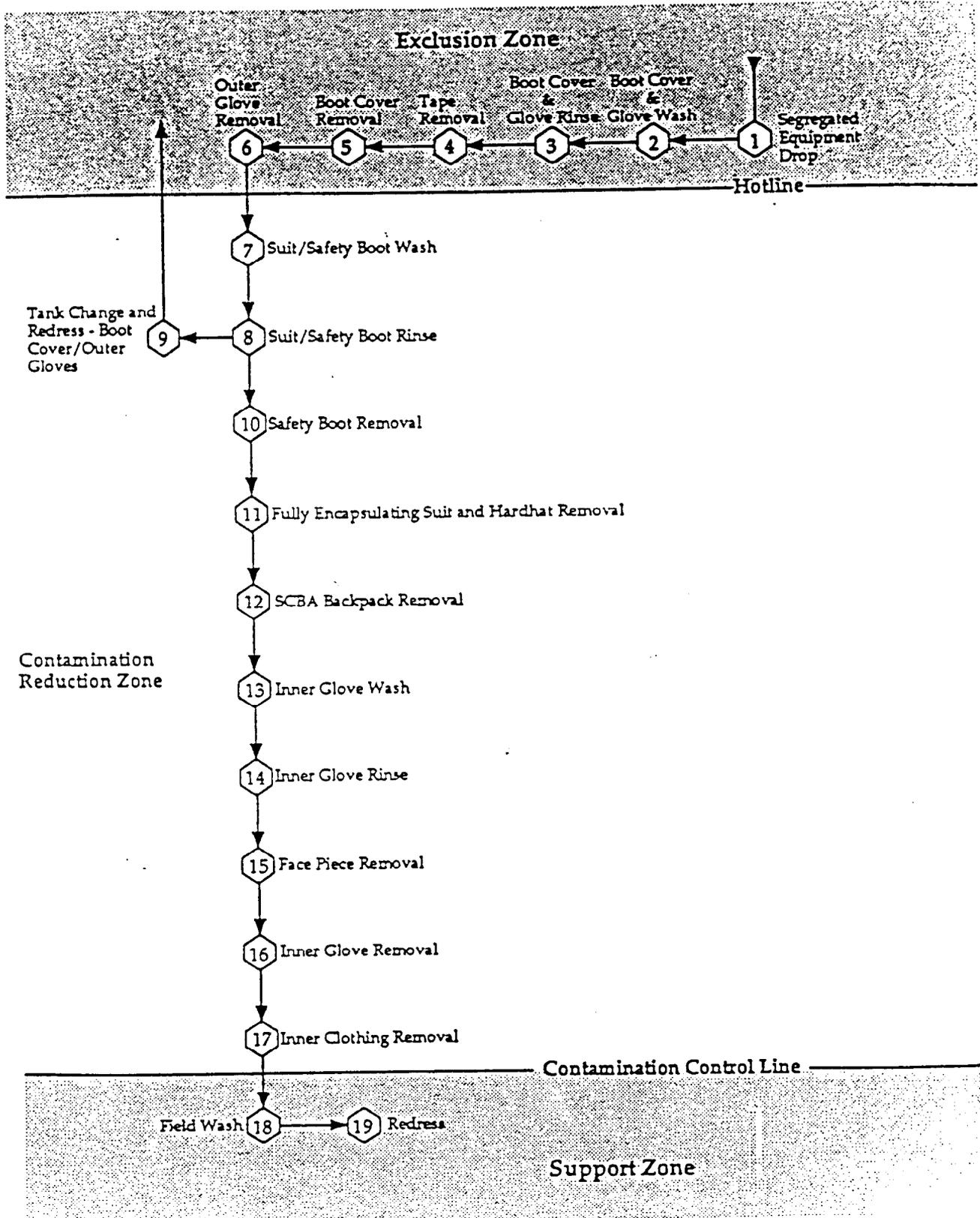


FIGURE 13-3  
Maximum Decontamination Layout  
Level B Protection

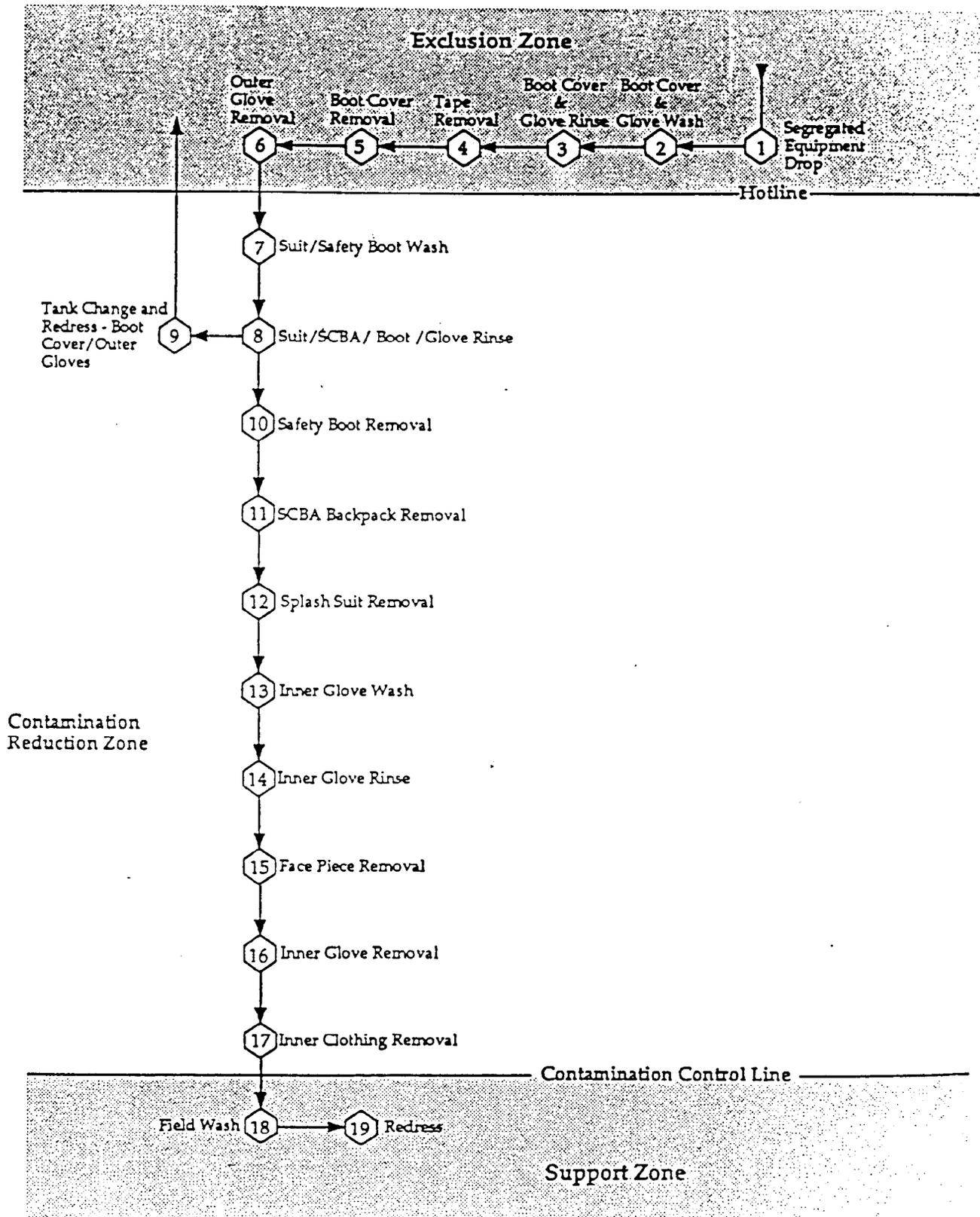


FIGURE 13-4  
 Maximum Decontamination Layout  
 Level C Protection

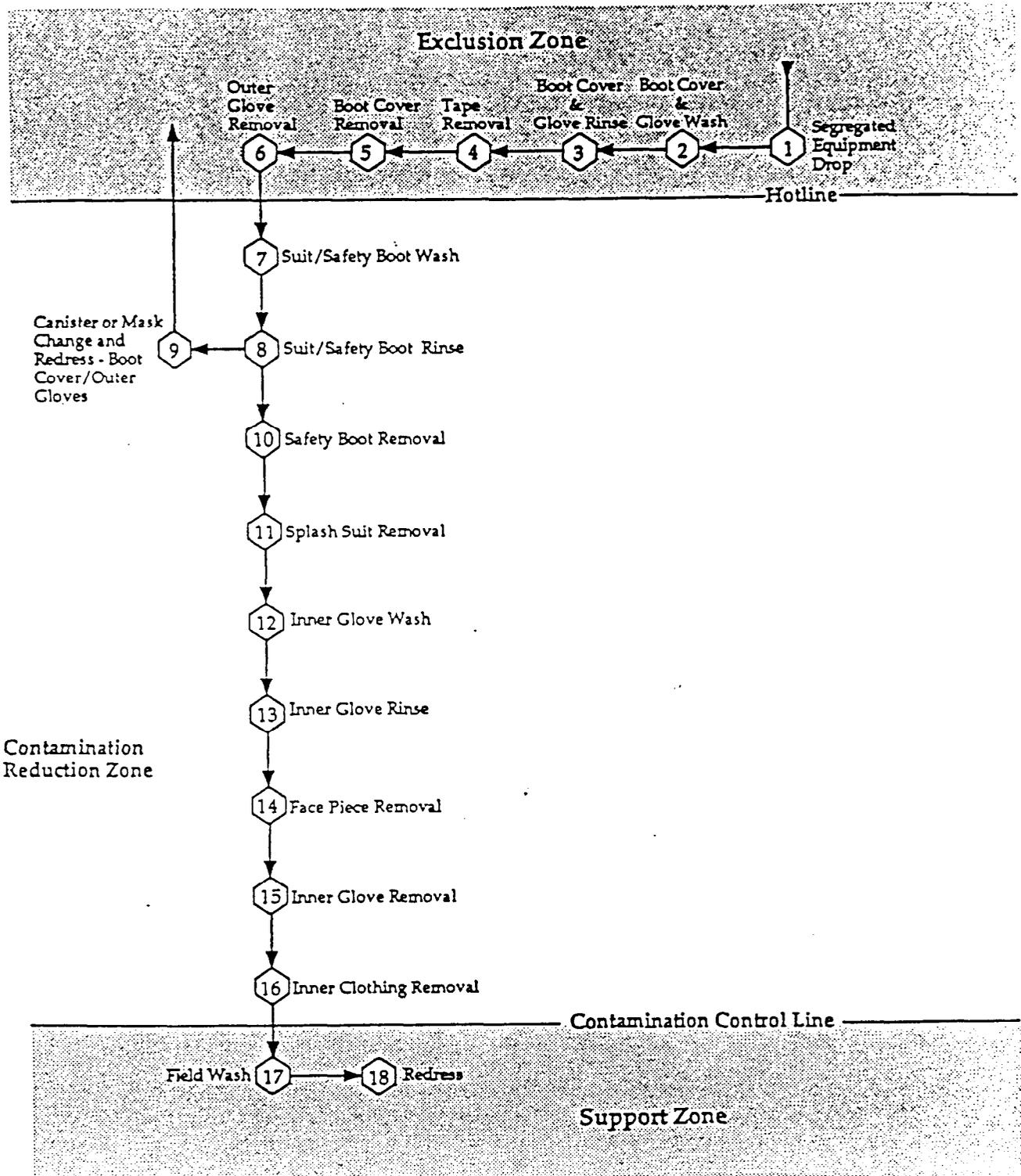


FIGURE 13-5  
Minimum Decontamination Layout  
Levels A and B Protection

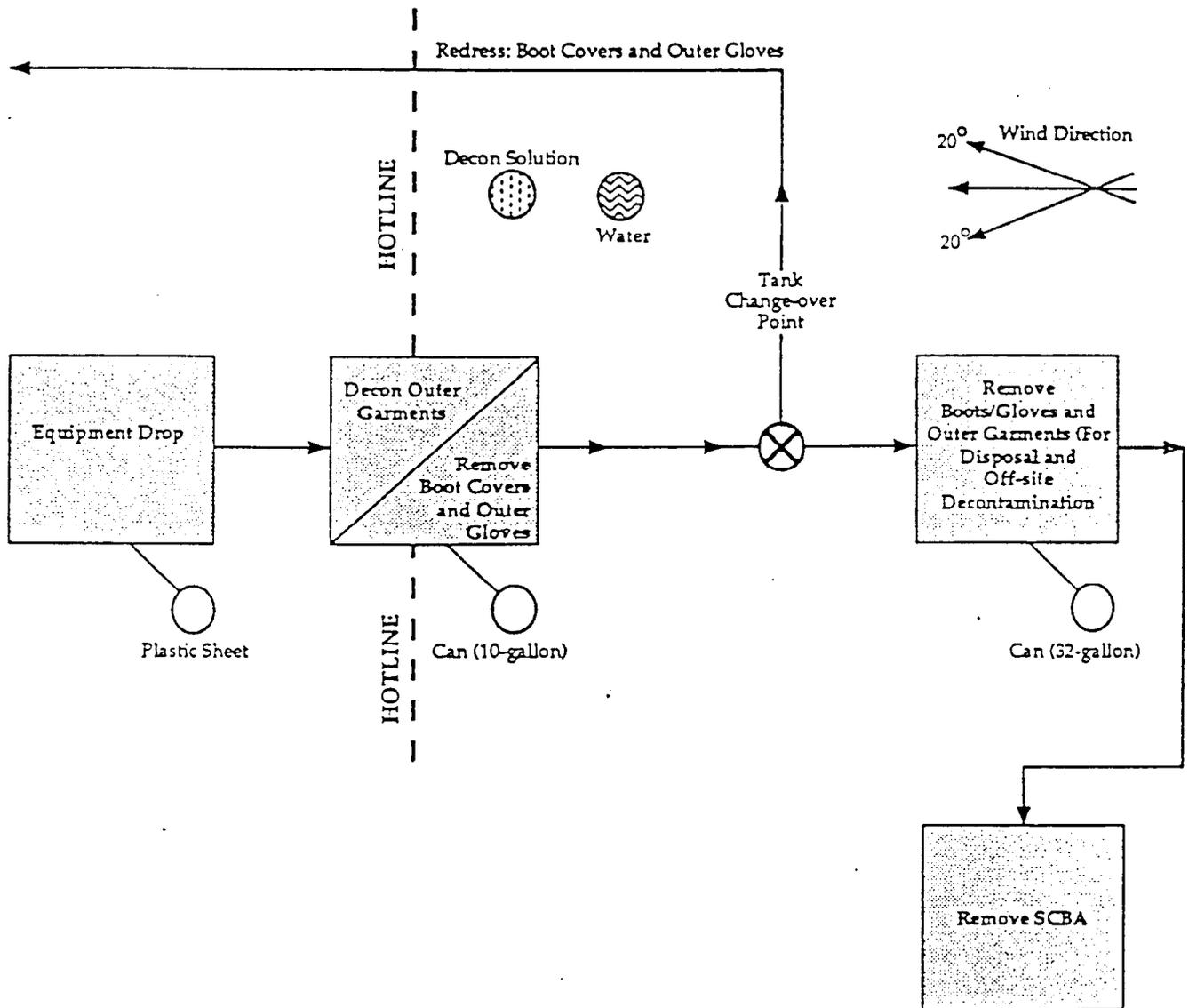
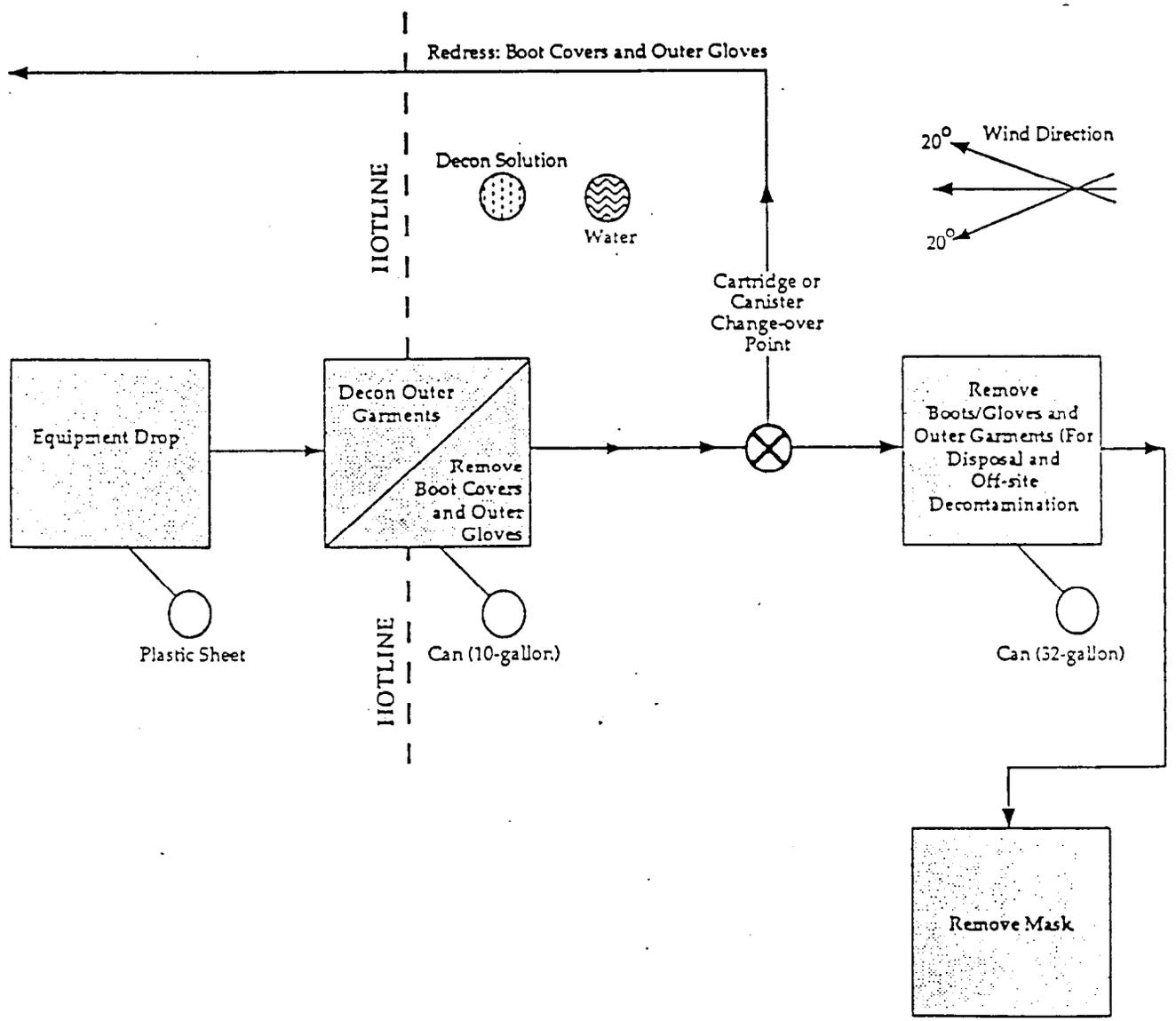


FIGURE 13-6  
 Minimum Decontamination Layout  
 Level C Protection



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 pre-coded (e.g., #1 on all parts of Mask #1). After an appropriate time in the solution, the parts will be removed and rinsed with tap water. Old cartridges will be marked to indicate length of use (i.e., if it is possible to evaluate the remaining utility of the cartridge), or discarded in 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.

13.2 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 operation of the unit. For example, the HNU meter can be placed in a clear plastic bag to allow for reading 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 will be removed and disposed of in 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, and then prepared with new protective coverings.

13.3 HEAVY EQUIPMENT DECONTAMINATION. It is anticipated that drilling rigs and backhoes will become contaminated during borehole and test-pitting activities. They will be cleaned with high-pressure water or steam, followed by a soap and water wash and rinse. Loose material will be removed with a brush. The person performing this activity will usually be at least at the level of protection used during the personnel and monitoring equipment decontamination.

A decontamination pad will be constructed to allow collection and storage of contaminated decontamination fluids in Department of Transportation (DOT)-approved 55-gallon drums.

13.4 DISPOSAL OF DECONTAMINATED MATERIALS. All protective gear, decontamination fluids (for both personnel and equipment), and other disposable materials will be disposed of at each site.

Decontamination fluids (i.e., Liqui-nox™, used to decontaminate sampling equipment such as split spoons and groundwater sampling pumps) will be stored in DOT-approved 55-gallon drums. Disposable materials (e.g., gloves and Tyveks™) will be double-bagged and stored as is, or placed in DOT-approved 55-gallon drums.

## CHAPTER 14. EMERGENCY PLANNING

14.1 EMERGENCY MEDICAL SERVICES. Prior to site investigation or activity on hazardous sites, nearby health facilities will be evaluated to determine their ability to provide for the needs of on-site project staff and notified of site operations as appropriate. Criteria such as emergency department physician coverage, decontamination capabilities, and available medical specialists will be evaluated.

14.1.1 On-Site First Aid An industrial first-aid kit will be provided at the work site; 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 the equivalent.

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, and tools.

14.1.2 Transportation to Emergency Treatment A vehicle will be available at all times to transport personnel to the hospital (in the event an ambulance is unnecessary or unavailable). Stretchers will be located at the work site to transport personnel to the vehicle. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment.

14.2 CONTINGENCY PLANNING. Prior to commencement of on-site activities, the HSO will review safety considerations with the field crew. The HSO has overall responsibility 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 familiar with both the primary and secondary route to the nearest hospital (which may be shown on a figure or a local map), as well as the location of the nearest working telephone or radio communication device. At remote locations a mobile phone or radio will be provided. A list of emergency telephone numbers will be readily available on-site.

When extensive Level B operations are planned, the local hospital and emergency response team will be advised in advance of the work to be performed. The hospital will also be briefed on the availability of personnel health data and technical support through Environmental Medicine Resources, Inc.

Emergency communication will be required to ensure positive preplanned notification of emergency authorities in the event of episodes requiring initiation of contingency plans. Emergency communication will include all or parts of the following.

- Coordinate with local agencies, fire and police departments, the ambulance service, and the hospital emergency room.

- Establish two-way radio communication and a site alarm capable of warning site personnel and summoning assistance (i.e., airhorn).
- Design an emergency evacuation plan for residents of nearby homes. Although evacuation is an unlikely event, as a contingency, the HSO will be designated as on-site coordinator and will be responsible for implementing the plan. The HSO will be made aware of the total number of households within a 2,000-foot radius. The Health and Safety Plan will provide the emergency contacts required and a table will provide a list of residences and identifiable operations in the area in the event that evacuation is deemed a possibility for a particular site.
- Investigate possible routes of evacuation prior to any activity.
- If an accident occurs, a copy of an accident report form, provided in Chapter 15, should be filled out by the HSO and filed with the individual's supervisor, the HSM or HSS, and Human Resources. A copy should also be retained in the project records.

14.3 POTENTIAL HAZARDS. The most common hazards associated with hazardous waste site investigation include (1) accidents; (2) inhalation, contact, or ingestion of hazardous materials; (3) explosion; and (4) fire.

14.3.1 Accidents Accidents must be handled on a case-by-case basis. Minor cuts, bruises, muscle pulls, and the like will still allow the injured person to undergo reasonably normal decontamination procedures before 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. In these cases, arrangements will be made with the medical facility and transporter to allow them to take proper precautions. 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, if on-site access is limited, accident victims may be transported by ABB-ES personnel trained for this response to a point accessible by an ambulance.

14.3.2 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 possible that contact or ingestion of materials may occur. For example, puncture of a buried drum of liquid during drilling operations might cause the drum contents to contact personnel. Standard first-aid procedures should be followed. The drilling rig will have a tank of water that may be useful in some circumstances, particularly to flush contaminants from any exposed skin areas. Eye-wash bottles will also be maintained at the site for emergencies. In cases of ingestion or anything other than minor contact with known substances, the local Poison Control Center and hospital should be notified and the victim taken there immediately for further treatment and observation.

14.3.3 Explosion The drilling crew should be keenly aware of combustible gas meter readings and should withdraw at any indication of imminently hazardous conditions (i.e., greater than 20 percent LEL). The detection of such conditions

will be reported to local agencies for potential execution of the evacuation plan, if the situation is assessed to warrant such response.

14.3.4 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 and 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 in the decontamination area/field office. The fire department, previously informed of site activities, will be called as needed.

14.4 EVACUATION RESPONSE LEVELS. Evacuation responses will occur at three levels: (1) withdrawal from immediate work area (100 feet or more upwind), (2) site evacuation, and (3) evacuation of surrounding area. Anticipated conditions that require these responses are described in the following subsections.

14.4.1 Withdrawal Upwind (100 Feet or More) Withdrawing upwind (100 feet or more) will be required when (1) ambient air conditions contain greater contaminant concentrations than guidelines allow for the type of respiratory protection being worn (the work crew may return after donning greater respiratory protection and/or assessing the situation as transient and past); (2) a breach in protective clothing or minor accident occurs (the work crew may return when the tear or other malfunction is repaired and first aid or decontamination has been administered); or (3) the respirator malfunctions requiring replacement.

14.4.2 Site Evacuation Evacuation of the site will be required when (1) ambient air conditions contain explosive and persistent levels of combustible gas or excessive levels of toxic gases; (2) a fire or major accident occurs; or (3) explosion is imminent or has occurred.

14.4.3 Surrounding Area Evacuation The area surrounding the site will be evacuated when persistent, unsuppressible toxic or explosive vapors from test pits or borings (e.g., pressure release from punctured drum) are released, or air quality monitored at several points downwind assess danger to the surrounding area.

#### 14.5 EVACUATION PROCEDURES

14.5.1 Withdrawal Upwind The work crew will continually observe general wind directions while on-site. (A simple wind sock may be set up near the work site for visual determinations.) Upon observing conditions that warrant moving away from the work site, the crew will relocate upwind a distance of approximately 100 feet or farther, 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 whether the conditions noted were transient or persistent. If persistent, 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 decrease emissions only if greater respiratory protection is donned. The HSM, HSS, and client will be notified of conditions. When access to the site is restricted and escape is thereby 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.

14.5.2 Site Evacuation After determining that site evacuation is warranted, the work crew will proceed upwind of the work site and notify the security force, HSO, and field office of site conditions. If the decontamination area is upwind and more 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, where the respirators may be removed (if instrumentation indicates an acceptable condition). As more facts are determined from the field crew, they will be relayed to the appropriate agencies. The advisability and type of further response action will be coordinated and implemented by the HSO.

14.5.3 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.

CHAPTER 15. HEALTH AND SAFETY FORMS AND DATA SHEETS

This chapter contains examples of ABB-ES's Health and Safety Audit Form, Accident Report Form, HSO checklist for Field Operations, Material Safety Data Sheets for Liqui-nox™ and trisodium phosphate, OSHA's Job Safety and Health Protection notice, and ABB-ES's Daily Health and Safety Audit Form.

15.1 HEALTH AND SAFETY AUDIT FORM

Site Name: \_\_\_\_\_ Date \_\_\_\_\_

Auditor: \_\_\_\_\_

SEND A COPY OF COMPLETED FORM TO THE HEALTH AND SAFETY MANAGER.

<u>GENERAL</u>	<u>YES</u>	<u>NO</u>	<u>COMMENTS</u>
HASP on-site?	_____	_____	_____
HASP completely signed off and approved?	_____	_____	_____
OSHA poster posted in trailer?	_____	_____	_____
Emergency telephone numbers posted in trailer?	_____	_____	_____
Emergency eyewash on-site?	_____	_____	_____
Emergency shower on-site?	_____	_____	_____
Stretcher on-site?	_____	_____	_____
First-aid kit on-site?	_____	_____	_____
Adequately stocked?	_____	_____	_____
Proper sanitation facilities?	_____	_____	_____
<u>DOCUMENTATION AND RECORDKEEPING</u>			
Only personnel listed and approved in HASP on-site?	_____	_____	_____
All personnel properly trained?	_____	_____	_____
All personnel in health monitoring program?	_____	_____	_____
Daily field records kept by the Site Manager?	_____	_____	_____
Levels of PPE recorded?	_____	_____	_____
Contaminant levels recorded?	_____	_____	_____
Site surveillance records kept by HSO?	_____	_____	_____

DOCUMENTATION AND RECORDKEEPING  
(Cont)

YES NO

COMMENTS

Calibration records maintained? \_\_\_\_\_

Accident/incident forms on-site? \_\_\_\_\_

Field team review sheets signed? \_\_\_\_\_

Medical data sheets completed? \_\_\_\_\_

Spare hospital directions  
available? \_\_\_\_\_

Visitors logbook completed? \_\_\_\_\_

MSDSs for chemicals on-site? \_\_\_\_\_

HASP revisions recorded? \_\_\_\_\_

First-aid kit inspected weekly? \_\_\_\_\_

Are daily safety meetings held? \_\_\_\_\_

Emergency procedures discussed  
during safety meetings? \_\_\_\_\_

EMERGENCY RESPONSES

Vehicle available on-site for  
transportation to the hospital? \_\_\_\_\_

Fire extinguishers on-site? \_\_\_\_\_

At least two persons trained in CPR  
and first-aid on-site at all times? \_\_\_\_\_

All personnel know who is trained? \_\_\_\_\_

PERSONNEL PROTECTIVE EQUIPMENT

Proper PPE being worn as  
specified in the HASP? \_\_\_\_\_

Level of PPE being worn: \_\_\_\_\_

PPE adequate for work conditions? \_\_\_\_\_

If not, give reason: \_\_\_\_\_

Upgrade/downgrade to PPE level: \_\_\_\_\_

PERSONNEL PROTECTIVE EQUIPMENT  
(Cont.)

YES NO

COMMENTS

Has facial hair that would interfere with fit of respirators been removed?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

If not, willing to shave if necessary?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Fit-tested within the last year?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

If Level B, back-up/emergency person suited up (except for air)?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

HSO periodically inspects PPE and equipment?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

PPE not in use properly stored?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

MONITORING EQUIPMENT

All equipment listed in HASP on-site?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Properly calibrated?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

In good condition?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Used properly?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Other equipment needed?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

List: \_\_\_\_\_

Monitoring equipment covered with plastic to minimize contamination?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

DECONTAMINATION

Decon line set up properly?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Proper cleaning fluid used for known or suspected contaminants?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Proper decon procedures used?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Decon personnel wearing proper PPE?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Equipment decontaminated?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Samples decontaminated?  
Disposable items changed twice a day or more often if needed?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

\_\_\_\_

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

WORK PRACTICES

YES NO

COMMENTS

Proper collection and disposal of contaminated PPE?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Proper collection and disposal of decon fluid?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Water available for decon?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Buddy system used?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Equipment kept off drums and ground?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Kneeling or sitting on drums or ground not allowed?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Personnel avoid standing or walking through puddles or stained soil?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Zones established?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

If night work to be conducted, adequate illumination?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Smoking, eating, or drinking in the Exclusion Zone or CRZ not allowed?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

To the extent feasible, contaminated materials handled remotely?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Contact lenses not allowed on-site?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

Entry into excavations not allowed unless properly shored or sloped?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

All unusual situations on-site listed in HASP?

\_\_\_\_

\_\_\_\_

\_\_\_\_\_

If not, what? \_\_\_\_\_

Action taken? \_\_\_\_\_

HASP revised? \_\_\_\_\_

CONFINED SPACE ENTRY

All confined spaces identified?

If not, list: \_\_\_\_\_

CONFINED SPACE ENTRY

YES NO

COMMENTS

All appropriate equipment available  
and in good working order?

\_\_\_ \_\_\_

\_\_\_\_\_

Equipment properly calibrated?

\_\_\_ \_\_\_

\_\_\_\_\_

Confined Space Checklists used?

\_\_\_ \_\_\_

\_\_\_\_\_

Checklists completely and correctly  
filled out?

\_\_\_ \_\_\_

\_\_\_\_\_

15.2 ACCIDENT REPORT FORM

Site: \_\_\_\_\_ Project No.: \_\_\_\_\_

Location: \_\_\_\_\_

Location of Accident if different from above: \_\_\_\_\_

Name and Address of Injured: \_\_\_\_\_

SSN: \_\_\_\_\_ DOB: \_\_\_\_\_ Sex: \_\_\_\_\_

Years of Service: \_\_\_\_\_ Time on Current Job: \_\_\_\_\_ Dept. 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

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> Fracture              | <input type="checkbox"/> Heat Burn         | <input type="checkbox"/> Cold Exposure   |
| <input type="checkbox"/> Dislocation           | <input type="checkbox"/> Chemical Burn     | <input type="checkbox"/> Heat Stroke     |
| <input type="checkbox"/> Sprain                | <input type="checkbox"/> Radiation Burn    | <input type="checkbox"/> Faint/Dizziness |
| <input type="checkbox"/> Abrasion              | <input type="checkbox"/> Concussion        | <input type="checkbox"/> Blister         |
| <input type="checkbox"/> Laceration            | <input type="checkbox"/> Toxic-Respiratory | <input type="checkbox"/> Bruise          |
| <input type="checkbox"/> Puncture              | <input type="checkbox"/> Toxic-Ingestion   | <input type="checkbox"/> Poison Ivy      |
| <input type="checkbox"/> Bite                  | <input type="checkbox"/> Toxic-Dermal      | <input type="checkbox"/> Headache        |
| <input type="checkbox"/> Respiratory Allergy   |  |  |
| <input type="checkbox"/> Other (explain) _____ |  |  |

Parts of Body Affected: \_\_\_\_\_

Degree of Disability: \_\_\_\_\_

Date Medical Care Received: \_\_\_\_\_ Emergency Service?: \_\_\_\_\_

Name and Address of Medical Facility: \_\_\_\_\_

Follow-up Exam Required?: \_\_\_\_\_ Estimated No. of Days Away from Job: \_\_\_\_\_

ACCIDENT LOCATION (use other side of sheet as needed)

Causative agent most directly related to accident (i.e., object, substance, material, machinery, equipment, and conditions):

Was weather a factor? How?

Unsafe mechanical/physical/environmental condition at time of accident (be specific):

Unsafe act by injured person 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 person 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 (i.e., modification of machine, mechanical guards, modification of work practices, training)?:

DETAILED NARRATIVE DESCRIPTION (How did accident occur and why; objects, equipment, tools used, circumstances, 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 MANAGER OR SUPERVISOR.

## 15.3 HSO CHECKLIST FOR FIELD OPERATIONS

The following is a list of the minimum equipment and materials needed to fulfill the requirements for health and safety at a site. This list does not include monitoring equipment, decontamination equipment, or personal health and safety equipment (e.g., respirators, tyveks, and boots).

Need	Posted?	Paperwork
<input type="checkbox"/>		Health and Safety Plan
<input type="checkbox"/>		Health and Safety Plan Appendix
<input type="checkbox"/>		Field Team Review Sheets
<input type="checkbox"/>		Medical Data Sheets
<input type="checkbox"/>	<input type="checkbox"/>	OSHA Job Safety & Health Protection Poster
<input type="checkbox"/>	<input type="checkbox"/>	Emergency Information Sheet
<input type="checkbox"/>	<input type="checkbox"/>	Spare Hospital Directions
<input type="checkbox"/>		Blank Accident Report Forms
<input type="checkbox"/>		Visitors Logbook
<input type="checkbox"/>		H & S Audit Form
<input type="checkbox"/>		Confined Space Entry Forms
<input type="checkbox"/>		Site-specific HASP Attachments
<input type="checkbox"/>		MSDSs for Chemicals Taken On-site (other than those in HASP Appendix)
<input type="checkbox"/>		1. <input type="text"/>
<input type="checkbox"/>		2. <input type="text"/>

Need	Quantity	Equipment
<input type="checkbox"/>	<input type="checkbox"/>	First Aid Kit
<input type="checkbox"/>	<input type="checkbox"/>	Emergency Eye Wash Station
<input type="checkbox"/>	<input type="checkbox"/>	Fire Extinguisher
<input type="checkbox"/>	<input type="checkbox"/>	Emergency Horn
<input type="checkbox"/>	<input type="checkbox"/>	Emergency Stretcher/Backboard

15.4 MATERIAL SAFETY DATA SHEETS

15.4.1 LIQUI-NOX

15.4.2 TRISODIUM PHOSPHATE

15.5 OSHA POSTER

15.6 DAILY HEALTH AND SAFETY AUDIT FORM

File #

**ALCONOX Inc.**

Quality Management for Laboratories, Hospitals, Industries  
215 PARK AVENUE NEW YORK, N.Y. 10011

TO: CE Environmental

DATE: 11/19/90

ATTN: Bill Thurston

PAGE 1 OF 1

TEL: 207-773-0011

FROM: Makolma

**Material Safety Data Sheet**

May be used to comply with  
OSHA's Hazard Communication Standard,  
29 CFR 1910.1200. Standard must be  
reworked for specific requirements.

U.S. Department of Labor  
Occupational Safety and Health Administration  
(Non-Mandatory Form)  
Form Approved  
OSHA No. 1118-0012



IDENTITY (As Used on Label and Tag)

LIQUID-MOX

Note: Blank spaces are not provided if any item is not applicable. If an item is not applicable, the space must be marked to indicate this.

**Section I**

Manufacturer's Name

ALCONOX, INC.  
215 PARK AVENUE SOUTH  
NEW YORK, NEW YORK 10003

Emergency Telephone Number

(212) 473-1300

Telephone Number for Information

(212) 473-1300

Date Prepared

JULY 1, 1987

Signature of Preparer (Required)

**Section II - Hazardous Ingredients/Identify Information**

Normal Components (Specify Chemical Name(s), Common Name(s))  
OTHER LISTED RECOMMENDED BY APPROVED

THERE ARE NO INGREDIENTS IN LIQUID-MOX WHICH APPEARED ON THE OSHA STANDARD 29 CFR 1910 SUBPART I.

**Section III - Physical/Chemical Characteristics**

Appearance (Color)	<u>21.0°C</u>	Specific Gravity (4°C = 4°C)	<u>1.025</u>
Smell (AHS - 1)	<u>NO DATA</u>	Boiling Point	<u>N.A.</u>
Other	<u>NO DATA</u>	Freezing Point (4°C = 4°C)	<u>NO DATA</u>

COMPLETELY SOLUBLE IN ALL PROPORTIONS

YELLOW LIQUID - PRACTICALLY ODORLESS

**Section IV - Fire and Explosion Hazard Data**

Flash Point  
NON-FLAMMABLE OPEN CUP

Autoignition  
WATER, DRY CHEMICAL, FOAM, CO<sub>2</sub>, SAND/EARTH

Extinguishers  
FOR FIRES INVOLVING THIS MATERIAL, DO NOT ENTER WITHOUT

PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS.

Hazardous Reactions  
NONE

**Section V - Reactivity Data**

Stability	Unstable	Conditions to Avoid	<u>NONE</u>
	Stable		

Incompatibility (Materials to Avoid) NONE

Flammable Decomposition or Byproducts SO<sub>2</sub> MAY BE RELEASED ON BURNING

Hazardous Polymerization	May Occur	Conditions to Avoid	<u>NONE</u>
	Will Not Occur		

**Section VI - Health Hazard Data**

Routes of Entry: Inhalation NO Liquid YES Ingestion YES

Health Hazards (Acute and Chronic) SKIN CONTACT MAY PRODUCE LOCAL IRRITATING

INGESTION MAY CAUSE DISCOMFORT AND/OR DIARRHEA

Corrosive to Eye	<u>NO</u>	AC Toxicity	<u>NO</u>	OSHA PPE Label	<u>NO</u>
------------------	-----------	-------------	-----------	----------------	-----------

Signs and Symptoms of Exposure PROLONGED SKIN CONTACT MAY CAUSE DRYING AND/OR CHAPPING.

Medical Conditions Generally Aggravated by Exposure NONE

Emergency and First Aid Procedures  
EYES-FLUSH WITH PLenty OF WATER FOR 15 MINUTES. SKIN-FLUSH WITH WATER.

INGESTION-DRINK LARGE QUANTITIES OF WATER. GET MEDICAL ATTENTION FOR PAIN.

**Section VII - Precautions for Safe Handling and Use**

Personal Protective Equipment (PPE) to be Worn by Employees in Handling and Using  
TRAVERSAL GLOVES PROFUSELY RINSED AS MUCH AS POSSIBLE WITH ABSORBENT

MATERIAL AND RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY BIODEGRADABLE

When Disposed Method  
SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE

SHADED UP WITH ABSORBENT MATERIAL AND DISPOSED OF ACCORDING TO LOCAL OR STATE

PROCEDURES IN THE TOWN OF HARTFORD AND BURLINGTON. NONE REQUIRED - VISCOSITY OF MATERIAL INCREASES AT VERY LOW TEMPERATURES.

**Section VIII - Control Measures**

Other Precautions  
NO SPECIAL REQUIREMENTS OTHER THAN THE OSHA INDUSTRIAL HYGIENE AND SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL CHEMICAL

Respiratory Protection (Specify Type)	Level of Exposure	Special
	Normal	M.A.
	Highly Concentrated	M.A.

Protective Clothing  
RECOMMENDED

Eye Protection  
RECOMMENDED

Other Personal Protective Equipment (Specify Type)  
NOT REQUIRED

Special Handling Precautions  
NO SPECIAL PRACTICES REQUIRED

15.4.1 LIQUID-MOX

## Monsanto MATERIAL SAFETY DATA

NER CODE A-III

MONSANTO PRODUCT NAME  
**TRISODIUM PHOSPHATE**  
**CRYSTALLINE**

MONSANTO COMPANY  
 800 N. LINDBERGH BLVD.  
 ST. LOUIS, MO 63167

Emergency Phone No.  
 (Call Collect)  
 314-694-1000

**PRODUCT IDENTIFICATION**

**Synonyms:** TSP/C; Trisodium orthophosphate; Sodium phosphate, tribasic; Phosphoric acid, trisodium salt; Trisodium phosphate dodecahydrate

**Chemical Formula:**  $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O} - 1/4 \text{ NaOH}$  (approximately)

**CAS No.:** 10101-89-0

**DOT Proper Shipping Name:** Sodium Phosphate, Tribasic (see NOTE below)

**DOT Hazard Class/ I.D. No.:** ORM-E/NA9148

**DOT Label(s):** Not Applicable

**Hazardous Substance(s)/ RQ(s):** Yes/5,000 lbs.

**U.S. Surface Freight Classification:** Trisodium Phosphate

**Note:** Bagged material is not regulated.

\*Since hydrated materials could not be reported on the TSCA Initial Inventory List, Trisodium Phosphate Crystalline was reported as anhydrous with the CAS No. 7601-54-9.

**WARNING STATEMENTS**

**DANGER!**  
 CAUSES EYE BURNS  
 CAUSES SKIN IRRITATION

**PRECAUTIONARY MEASURES**

Do not get in eyes, on skin, on clothing.  
 Avoid breathing dust.  
 Keep container closed.  
 Use with adequate ventilation.  
 Wash thoroughly after handling.

**EMERGENCY AND FIRST AID PROCEDURES**

**FIRST AID:** IF IN EYES, immediately flush with plenty of water for at least 15 minutes.  
 Call a physician.

IF ON SKIN, immediately flush with plenty of water. Remove contaminated clothing.  
 Wash clothing before reuse.

**OCCUPATIONAL CONTROL PROCEDURES**

**Eye Protection:** Wear chemical safety goggles to prevent eye contact. Have eye baths immediately available where eye contact can occur.

**Skin Protection:** Wear appropriate impervious gloves and protective clothing to prevent skin contact. Launder contaminated clothing and clean protective equipment before reuse.

**Respiratory Protection:** Use NIOSH approved equipment suitable for nuisance dust when airborne exposure is excessive. Consult respirator manufacturer to determine appropriate type equipment for given application.

**Ventilation:** Provide ventilation to minimize exposure. Local exhaust ventilation preferred.

**Airborne Exposure Limits:** Product: Trisodium phosphate dodecahydrate

Although no specific exposure limit has been established for this material, OSHA and ACGIH have established limits for nuisance dusts:

OSHA PEL/TWA: Total 15 mg/m<sup>3</sup>; Respirable 5 mg/m<sup>3</sup>

ACGIH-TLV/TWA: Total 10 mg/m<sup>3</sup>; Respirable 5 mg/m<sup>3</sup>

Keep exposure below these limits.

**FIRE PROTECTION INFORMATION**

This material is not combustible.

**REACTIVITY DATA**

**Materials to Avoid:** Trisodium Phosphate Crystalline could be corrosive to aluminum surfaces because of high pH. Sealed containers should be kept free of water because of its corrosivity when wet.

**Hazardous Decomposition Products:** None.

**Hazardous Polymerization:** Does not occur.

**PHYSIOLOGICAL EFFECTS SUMMARY**

Oral LD<sub>50</sub> (Rat): 6,500 mg/kg, Practically Nontoxic

Dermal LD<sub>50</sub> (Rabbit): 7,940 mg/kg, Practically Nontoxic

Eye Irritation (Rabbit): (FHSA) Corrosive

Skin Irritation (Rabbit): (FHSA) 3.3 on a scale of 8.0, Moderately Irritating

**PHYSICAL DATA**

**Appearance and Odor:** White, crystalline, free-flowing granules or powder; odorless

**pH (1% solution @ 25°C):** 12.0

**Bulk Density (lbs./cu. ft.):** Powder 61-65  
Granular 58-64

**Solubility (g/100 g H<sub>2</sub>O) (Anhydrous Salt Basis):**

11.6 @	25°C
17.5 @	40°C
35.3 @	60°C
61.3 @	80°C
84.5 @	100°C

**Note:** These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

MATERIAL SAFETY DATA

# Monsanto MATERIAL SAFETY DATA

Page 3 of 3

## SPILL, LEAK & DISPOSAL INFORMATION

**Waste Disposal:** Dispose of in a landfill in accordance with all local, state and federal regulations.

**Spill or Leakage Procedures:**

Sodium phosphate, tribasic, as currently defined, is a hazardous substance in the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (Superfund) and in the current federal regulations 40 CFR, Part 116 (Section 311, Clean Water Act) with a reportable quantity of 5,000 pounds when released to the environment. Since federal, state and local laws may vary, consult your attorney or appropriate regulatory officials for information relating to spill reporting.

Sweep, scoop or vacuum up all spilled material, contaminated soil and other contaminated material and place in containers. If possible, complete cleanup on a dry basis. After all practical dry cleanup has been done, residual contamination can be flushed with plenty of water.

## ADDITIONAL COMMENTS

**Environmental Toxicity Information:**

96-hr LC<sub>50</sub> (Bluegill) : 440 mg/l, Practically Nontoxic  
96-hr LC<sub>50</sub> (Trout) : 260 mg/l, Practically Nontoxic

**DATE:** 6/1/83

**REVISED:** X

**SUPERSEDES:** 5/78

**MSDS NO.:** 010101890

**FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:**

Product Acceptability Coordinator  
Detergent Materials  
Monsanto Industrial Chemicals Co.  
314-694-2096  
(A Unit of Monsanto Company)

Although the information and recommendations set forth herein (hereinafter "information") are presented in good faith and believed to be correct as of the date hereof, Monsanto Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Monsanto Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

This form has been approved by the Occupational Safety and Health Administration as "equivalent to" OSHA Form 20.

# 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 the 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 discriminatory action.

## 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 civil penalties against employers of up to \$7,000 for each serious violation and for optional penalties of up to \$7,000 for each nonserious violation. Penalties of up to \$7,000 per day may be proposed for failure to correct violations within the proposed time period and for each day the violation continues beyond the prescribed abatement date. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$70,000 for each such violation. A violation of posting requirements can bring a penalty of up to \$7,000.

There are also provisions for criminal penalties. Any willful violation resulting in the death of any employee, upon conviction, is punishable by a fine of up to \$250,000 (or \$500,000 if the employer is a corporation), or by imprisonment for up to six months, or both. A second conviction of an employer doubles the possible term of imprisonment. Falsifying records, reports, or applications is punishable by a fine of \$10,000 or up to six months in jail or both.

## 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.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. 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 health such as training.

## VOLUNTARY ACTIVITY

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State labor or Health department or a State university.

## POSTING INSTRUCTIONS

Employees in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.

### 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

(404) 347-3573  
(617) 565-7164  
(312) 353-2220  
(214) 767-4731  
(303) 844-3061  
(816) 426-5861  
(212) 337-2378  
(215) 596-1201  
(415) 744-6670  
(206) 442-5930

Washington, D.C.  
1991 (Reprinted)  
OSHA 2203

Lynn Martin, Secretary of Labor  
**U.S. Department of Labor**  
Occupational Safety and Health Administration

To report suspected fire hazards, imminent danger safety and health hazards in the workplace, or other job safety and health emergencies, such as toxic waste in the workplace, call OSHA's 24-hour hotline: 1-800-321-OSHA.

**15.6 DAILY HEALTH AND SAFETY AUDIT**

Site Name: \_\_\_\_\_ Date: \_\_\_\_\_

Auditor: \_\_\_\_\_

**SEND A COPY OF COMPLETED FORM TO THE HEALTH AND SAFETY MANAGER**

YES	NO	N/A	COMMENTS
-----	----	-----	----------

(Use back of form if more space is needed)

- |   |  |  |  |  |
|---|--|--|--|--|
| 1. Safety meeting held today?   |  |  |  |  |
| 2. Emergency procedures discussed during safety meeting?  |  |  |  |  |
| 3. Vehicle available on-site for transportation to the hospital?  |  |  |  |  |
| 4. At least two persons trained in CPR and first-aid on-site?   |  |  |  |  |
| 5. Proper PPE being worn as specified in the HASP?<br>Level of PPE being worn: _____                                    |  |  |  |  |
| 6. PPE adequate for work conditions?<br>If not, give reason: _____<br>Upgrade/downgrade to PPE level: _____             |  |  |  |  |
| 7. If Level B, back-up/emergency person suited up (except for air)?   |  |  |  |  |
| 8. Monitoring equipment calibrated?   |  |  |  |  |
| 9. Monitoring equipment in good condition?  |  |  |  |  |
| 10. Monitoring equipment used properly?   |  |  |  |  |
| 11. Other monitoring equipment needed?<br>List: _____   |  |  |  |  |
| 12. Monitoring equipment covered with plastic to minimize contamination?  |  |  |  |  |
| 13. Decon line set up properly?   |  |  |  |  |
| 14. Proper cleaning fluid used for known or suspected contaminants?   |  |  |  |  |
| 15. Proper decon procedures used?   |  |  |  |  |
| 16. Decon personnel wearing proper PPE?   |  |  |  |  |
| 17. Equipment decontaminated?   |  |  |  |  |
| 18. Samples decontaminated?   |  |  |  |  |
| 19. Disposable items changed twice a day or more often if needed?   |  |  |  |  |
| 20. Proper collection and disposal of contaminated PPE?   |  |  |  |  |
| 21. Proper collection and disposal of decon fluid?  |  |  |  |  |
| 22. Buddy system used?  |  |  |  |  |
| 23. Equipment kept off drums and ground?  |  |  |  |  |
| 24. Kneeling or sitting on drums or ground not allowed?   |  |  |  |  |
| 25. Personnel avoid standing or walking through puddles or stained soil?  |  |  |  |  |
| 26. Zones established?  |  |  |  |  |
| 27. If night work to be conducted, adequate illumination?   |  |  |  |  |
| 28. Smoking, eating, or drinking in the Exclusion Zone or CRZ not allowed?  |  |  |  |  |
| 29. To the extent feasible, contaminated materials handled remotely?  |  |  |  |  |
| 30. Entry into excavations not allowed unless properly shored or sloped?  |  |  |  |  |
| 31. All unusual situations on-site listed in HASP?<br>If not, what? _____<br>Action taken? _____<br>HASP revised? _____ |  |  |  |  |
| 32. All confined spaces identified?<br>If not, list: _____  |  |  |  |  |
| 33. Confined Space Checklists used?   |  |  |  |  |
| 34. Confined Space Checklists completely and correctly filled out?  |  |  |  |  |

**ALL DEFICIENCIES MUST BE CORRECTED IMMEDIATELY!**

## CHAPTER 16. RESPIRATORY PROTECTION PROGRAM

16.1 INTRODUCTION. This program was developed to govern the selection and use of respiratory protective devices by ABB-ES personnel. The program is intended to comply with 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.

16.2 PERSONNEL REQUIREMENTS. All personnel assigned to field activities at hazardous or potentially hazardous locations are currently required by ABB-ES's health and safety policies to be enrolled in the corporate health monitoring program. Part of this program involves spirometry, a measure of the respiratory system status. No personnel may be assigned to the use of or may withdraw from stock any respiratory protective device without a physician's certification that use of the 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.

Personnel will not be assigned duties that require a respirator when facial hair, skullcaps, or eyeglasses will interfere with a proper fit. Contact lenses may not be worn with any respiratory protective device. Eyeglass frames that fit inside the respirator facepiece are provided as necessary.

16.3 APPLICABLE EQUIPMENT. ABB-ES maintains the following respiratory protective equipment:

- full-face chemical/mechanical air-purifying respirators
- SCBA
- full-face airline-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 ABB-ES personnel. Selection criteria are presented separately; training is required in the use of each type of equipment before drawing from stock.

16.4 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 the following topics:

- 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 in the corporate health and safety program manual.

16.5 PROGRAM ADMINISTRATION AND DOCUMENTATION. Administration of the ABB-ES Respiratory Protection Program is the responsibility of the HSM, and includes the following:

- respirator selection
- personnel training
- fit testing
- respirator maintenance
- documentation
- program evaluation and improvements
- personnel pulmonary testing and certification

Fit testing and respirator maintenance is performed by the equipment manager of ABB-ES's Sample Control and Staging Center in Portland, Maine, and designated, trained employees at the other offices. All fit-testing and respirator maintenance is conducted under the administration of the HSM. Major maintenance is performed by manufacturer-certified technicians only. Personnel training in respiratory protection is one aspect of the HSM'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 the ABB-ES health monitoring program, also administered by the HSM. Medical surveillance is required for all personnel assigned to hazardous or potentially hazardous site activities.

Documentation of the various elements of the ABB-ES respiratory protection program is achieved through several media, as follows:

- Documentation of respirator selection is included in the hazard assessment of each site's HASP.
- Documentation of personnel training is maintained in both hardcopy 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.
- Using the appropriate form, documentation of fit-testing is maintained on file with the equipment manager of the Sample Control and Staging Center and with the HSM or designee.
- 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 by the equipment manager for each respirator, SCBA, and escape respirator.

Inspection and documentation occurs either before each unit is removed from stock and when it is returned, or monthly.

## 16.6 INSPECTION, MAINTENANCE, AND STORAGE

16.6.1 Introduction Respirator maintenance is an integral part of the overall respirator program. Wearing a poorly maintained or malfunctioning respirator, in one sense, is 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 because 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 an emergency escape or rescue. The respirator program includes the following components:

- inspection for defects (including a leak check)
- cleaning and disinfecting
- repair as required
- proper and sanitary storage of equipment

16.6.2 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, and (2) while it is being cleaned. Because the use and cleaning will be performed primarily by the same personnel, these inspections may become concurrent.

16.6.3 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 monthly...." Obviously, emergency escape and rescue devices do not require inspection before each use.

16.6.4 Inspection Procedures Respirator inspection will include checking of the following:

- tightness of the connections
- facepiece
- valves
- connecting tubes
- canisters, filters, or cartridges

In addition, the regulator and warning devices on a SCBA will be checked for proper functions.

16.6.5 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:
  - excessive dirt
  - cracks, tears, holes, or physical distortion of shape from improper storage

- inflexibility of rubber facepiece (stretch and knead to restore flexibility)
  - cracked or badly scratched lenses in full facepieces
  - incorrectly mounted full facepiece lenses, or broken or missing mounting clips
  - cracked or broken air-purifying element holder(s), badly worn threads, or missing gasket(s)
2. Examine the head straps or head harness for:
- breaks
  - loss of elasticity
  - broken or malfunctioning buckles and attachments
  - excessively worn serration on head harness, which might permit slippage (full facepieces only)
3. Examine the exhalation valve for the following after removing the cover:
- foreign material (e.g., detergent residue, dust particles, or human hair under valve seat)
  - cracks, tears, or distortion in the valve material
  - improper insertion of the valve body in the facepiece
  - cracks, breaks, or chips in the valve body, particularly the sealing surface
  - missing or defective valve cover
  - improper installation of the valve in the valve body
4. Examine the air-purifying element(s) for:
- incorrect cartridge, canister, or filter for the hazard
  - incorrect installation, loose connections, missing or worn gasket, or cross-threading in the holder
  - expired shelf-life date on the cartridge or canister
  - cracks or dents in the outside case of the filter, cartridge, or canister indicated by the absence of sealing material, tape, or foil over the inlet
  - identical cartridges if more than one are used

16.6.6 Care and Cleaning of Self-contained Breathing Apparatus The proper care of SCBAs involves the following:

- inspection for defects

- cleaning and disinfecting
- repair
- storage

The following checklist is to be used by personnel whenever they check out a 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:

- high-pressure hose connector is tight on cylinder fitting
- bypass valve is closed
- mainline valve is closed
- there is no cover or obstruction on regulator outlet
- pressure in the tank is at least 1,800 psi

2. Backpack and Harness Assembly.

- Straps
  - visually inspect for complete set
  - visually inspect for frayed or damaged straps that may break during use
- Buckles
  - visually inspect for mating ends
  - check locking function
- Backplate and Cylinder Lock
  - visually inspect backplate for cracks and for missing rivets or screws
  - 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.

- Cylinder
  - physically check cylinder to ensure that it is tightly fastened to backplate
  - check hydrostatic test date to ensure that it is current
  - visually inspect cylinder for large dents or gouges in metal
- Head and Valve Assembly
  - visually inspect cylinder for presence of valve lock
  - visually inspect cylinder gauge for condition of face, needle, and lens
  - 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.

- 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.)
- Regulator and Low-pressure Alarm
  - Cover outlet of regulator with palm of hand. Open mainline valve and read regulator gauge (must read at least 1,800 psi and not more than rated cylinder pressure).
  - 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.
  - 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, establish a slight negative pressure in regulator and hold for 5 to 10 seconds. 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.
  - Open cylinder valve.
  - 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.
  - 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.

- Facepiece
  - Visually inspect head harness for damaged serration and deteriorated rubber. Visually inspect rubber facepiece body for signs of deterioration or extreme distortion.
  - Retaining clamp properly in place, visually inspect lens for proper seal in rubber facepiece, and for cracks or large scratches.
  - Visually inspect exhalation valve for visible deterioration or foreign materials buildup.

- Breathing Tube and Connector
  - Stretch breathing tube and visually inspect for deterioration and holes.
  - Visually inspect connector to ensure good condition of threads and for presence and proper condition of "O" ring or rubber gasket seal.
  - Perform a negative pressure test on facepiece.
    - 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 seconds. If negative pressure leaks down, the facepiece assembly is not adequate and should not be worn.

6. Storage of Units. Check that:

- cylinder is refilled as necessary and unit is cleaned and inspected
- cylinder valve is closed
- high-pressure hose connector is tight on cylinder
- pressure is bled off high-pressure hose and regulator
- bypass valve is closed
- mainline valve is closed
- all straps are completely loosened and laid straight
- facepiece is properly stored to protect against dust, sunlight, heat, extreme cold, excess moisture, and damaging chemicals

16.6.7 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 can be made from readily available household solutions, including the following:

- Hypochlorite solution (50 ppm of chlorine) can be made by adding approximately 2 milliliters of bleach (e.g., Clorox) to 1 liter of water, or 2 tablespoons of bleach per gallon of water. A 2-minute immersion disinfects the respirators.
- Aqueous solution of iodine (50 ppm of iodine) can be made by adding approximately 0.8 milliliter of tincture of iodine per liter of

water, or 1 teaspoon of tincture of iodine per gallon of water. A 2-minute immersion is sufficient to disinfect the respirators.

To prevent damaging the rubber and plastic in the respirator facepieces, the cleaning water should not exceed 140 °F; however, to ensure adequate cleaning, it should not be less than 120 °F.

16.6.8 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 important for preventing dermatitis.

16.6.9 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; however, care must be taken not to damage or distort the facepieces.

16.6.10 Reassembly and Inspection To avoid contamination, the clean, dry respirator facepieces should be reassembled and inspected in an area separate from the disassembly area. The inspection procedures were discussed previously; 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 should be performed.

16.6.11 Maintenance and Repair Replacement or repair should be done only by trained, experienced persons using 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.

16.6.12 Respirator Storage Respirators must be stored properly to protect against the following:

- dust
- sunlight
- heat
- extreme cold
- excessive moisture
- damaging chemicals
- mechanical damage

Damage and contamination of respirators may occur if they are stored on a workbench; in a tool cabinet or toolbox among heavy tools, greases, and dirt; or in a vehicle.

## CHAPTER 17. OTHER CONSIDERATIONS

17.1 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 will not be permitted to begin until lighting is adequate.

17.2 SANITATION. Provisions must be made for sanitation facilities for the site work force. At a minimum, the provision of toilet facilities must meet the requirements of 29 CFR 1910.120(n), which includes one facility for less than 20 employees, or one toilet and one urinal for every 40 employees, up to 200; then one of each for every 50 employees. If it is a mobile crew and they have transport readily available, the requirements do not apply.

17.3 HEALTH AND SAFETY AUDIT PROCEDURES Regular health and safety audits will be conducted to ensure compliance with health and safety policy and procedures. The HSO will perform periodic audits, with the goal of one audit per shift, using the health and safety audit form (see Chapter 15.0). Auditing may be performed on any ABB-ES site by the HSS or the 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 HSM or HSS, with the goal of 10 percent of active sites being subject to audits each quarter.

Results of each site health and safety audit will be summarized in an audit report 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 will retain the original audit report that has been signed by the Project Manager and the HSO to acknowledge receipt of the audit's findings. Any mitigating comments submitted to the HSM or the HSS will be appended to the original report.

## APPENDIX A

**CONFINED SPACE ENTRY PERMIT**  
29 CFR 1910.146

Site Name: \_\_\_\_\_ Site Location: \_\_\_\_\_  
 Purpose of Entry: \_\_\_\_\_  
 Contaminants: \_\_\_\_\_  
 Type of Confined Space: \_\_\_\_\_  
 Date and Time of Entry: \_\_\_\_\_ Date and Time Permit Expires \_\_\_\_\_

**POTENTIAL HAZARDS: (Check all that apply)**

<input type="checkbox"/> Flammable	<input type="checkbox"/> Moving Parts	<input type="checkbox"/> Radioactive	<input type="checkbox"/> Entrapment
<input type="checkbox"/> O <sub>2</sub> Deficiency	<input type="checkbox"/> Valves & Pipes	<input type="checkbox"/> Noise	<input type="checkbox"/> Engulfment
<input type="checkbox"/> Toxic	<input type="checkbox"/> Electrical	<input type="checkbox"/> Heat	<input type="checkbox"/> Other _____

**EQUIPMENT REQUIRED: (Check all that apply)**

<input checked="" type="checkbox"/> LEL/O <sub>2</sub> Meter	<input checked="" type="checkbox"/> Safety Harness	<input type="checkbox"/> Level A	<input checked="" type="checkbox"/> Stand by SCBA
<input type="checkbox"/> PID	<input checked="" type="checkbox"/> Lifeline	<input type="checkbox"/> Level B	<input type="checkbox"/> Ladder
<input type="checkbox"/> FID	<input type="checkbox"/> Hoist	<input type="checkbox"/> Level C	<input type="checkbox"/> Barrier and shield
<input type="checkbox"/> Draeger Tubes	<input type="checkbox"/> Ventilation	<input type="checkbox"/> Mod. Level D	<input type="checkbox"/> Radio
<input type="checkbox"/> Hydrogen Sulfide	<input type="checkbox"/> Lighting	<input type="checkbox"/> Level D	<input type="checkbox"/> Cellular Telephone
<input type="checkbox"/> Other: _____			

**ACCEPTABLE ATMOSPHERIC LEVELS FOR ENTRY:**

>19.5% = Oxygen \_\_\_\_\_ = PID/FID  
 <10%\* = LEL \_\_\_\_\_ = Draeger Tube \_\_\_\_\_  
 <10% = Hydrogen Sulfide Meter \_\_\_\_\_ = Other \_\_\_\_\_

\*May use <20% LEL as long as precautions are taken (e.g., non-sparking tools, intrinsically safe equipment)

**ATMOSPHERE TESTING RESULTS:**

Record time and results of readings at Entryway (prior to opening door or cover), Initial atmosphere (greatest of top, middle or bottom of space), when atmosphere Stabilizes after ventilation (greatest of top, middle, and space), and periodically thereafter in the workers Breathing Zone.

	Entryway	Initial*	Stabilized	Breathing Zone	Breathing Zone	Breathing Zone	Breathing Zone
Time							
% Oxygen							
% LEL							
H <sub>2</sub> S Meter (ppm)							
PID/FID (ppm)							
Draeger Tube (ppm)							
Tube:							
Other (list)							

\*If initial readings are acceptable, workers can enter space in Level D or Modified Level D without ventilation.

**CONFINED SPACE ENTRY PERMIT**  
**29 CFR 1910.146**

Yes No N/A


All identified atmospheric and physical hazards are controlled.  
 All hazards introduced by the work performed are addressed (e.g., welding fumes).  
 Air intake of the ventilation system is located in an area free of contaminants.  
 Valves, pipes, and mechanical and electrical equipment has been locked-out, blocked  
 chocked, disengaged or otherwise disconnected where necessary.


All required equipment and rescue equipment is present and in good working condition.  
 Non-sparking tools and intrinsically safe equipment and lighting are used if required.  
 All monitoring instruments have been properly calibrated.  
 All workers have initial confined space entry training certification.  
 All workers receive site specific confined space entry training.  
 Rescue team members practiced rescue operations in space or similar space.

Practice Date: \_\_\_\_\_


All rescue team members certified in first aid and CPR.  
 Entry coordinated with subcontractors.

**DESCRIPTION OF RESCUE PROCEDURES:**

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**PROBLEMS ENCOUNTERED:**

Was rescue required? \_\_\_\_\_

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**SIGNATURES:**

I have reviewed the work authorized by this permit and the information contained here—in. Written instructions and safety procedures have been received and understood. I understand that this permit is not valid and the permit cannot be approved and entry conducted if any of the above squares are marked "NO" or if required sections are incomplete.

Entrants: \_\_\_\_\_  
 Attendants: \_\_\_\_\_  
 Rescue Team: \_\_\_\_\_  
 Other: \_\_\_\_\_

Permit prepared by: \_\_\_\_\_

Entry Authorized by (HSO): \_\_\_\_\_

**PERMIT CANCELLATION:**

Reason: \_\_\_\_\_

HSO Signature: \_\_\_\_\_

Copy of form sent to Health and Safety Manager, Portland, ME. (mandatory)

**MANHOLE/SEWER ENTRY PERMIT**  
**29 CFR 1910.146**

Site Name: \_\_\_\_\_ Site Location: \_\_\_\_\_  
 Purpose of Entry: \_\_\_\_\_ Date and Time of Entry: \_\_\_\_\_

**ACCEPTABLE ATMOSPHERIC LEVELS FOR ENTRY:**

>19.5% = Oxygen \_\_\_\_\_ = PID/FID  
 <10%\* = LEL \_\_\_\_\_ = Draeger Tube \_\_\_\_\_  
 <10% = Hydrogen Sulfide Meter \_\_\_\_\_ = Other \_\_\_\_\_

\*May use <20% LEL as long as precautions are taken (e.g., non-sparking tools, intrinsically safe equipment)

**EQUIPMENT REQUIRED: (Check all that apply)**

- |  |  |                                       |   |
|--|--|---------------------------------------|---|
| <input checked="" type="checkbox"/> LEL/O <sub>2</sub> Meter | <input checked="" type="checkbox"/> Safety Harness | <input type="checkbox"/> Level A      | <input checked="" type="checkbox"/> Stand by SCBA |
| <input type="checkbox"/> PID                                 | <input checked="" type="checkbox"/> Lifeline       | <input type="checkbox"/> Level B      | <input type="checkbox"/> Ladder                   |
| <input type="checkbox"/> FID                                 | <input checked="" type="checkbox"/> Hoist          | <input type="checkbox"/> Level C      | <input type="checkbox"/> Barrier and shield       |
| <input type="checkbox"/> Draeger Tubes                       | <input type="checkbox"/> Ventilation               | <input type="checkbox"/> Mod. Level D | <input type="checkbox"/> Radio                    |
| <input type="checkbox"/> Hydrogen Sulfide                    | <input type="checkbox"/> Lighting                  | <input type="checkbox"/> Level D      | <input type="checkbox"/> Cellular Telephone       |
| <input type="checkbox"/> Other: _____                        |  |                                       |   |

**ATMOSPHERE TESTING RESULTS:**

Record time and results of readings at Entryway (prior to opening door or cover), Initial atmosphere (greatest of top, middle or bottom of space), when atmosphere Stabilizes after ventilation (greatest of top, middle, and space), and periodically thereafter in the workers Breathing Zone.

	Entryway	Initial*	Stabilized	Breathing Zone	Breathing Zone	Breathing Zone	Breathing Zone
Time							
% Oxygen							
% LEL							
H <sub>2</sub> S Meter (ppm)							
PID/FID (ppm)							
Draeger Tube (ppm)							
Other (list)							

\*If initial readings are acceptable, workers can enter space in Level D or Modified Level D without ventilation.

**DESCRIPTION OF RESCUE PROCEDURES:**

Full chest of body harness with retrieval line connected in the center of back at shoulder level or above entrants head. Retrieval line will be connected to tripod with hoisting device. Non-entry retrieval will be conducted. If entry for rescue is required, workers will don Level B PPE.

**MANHOLE/SEWER ENTRY PERMIT**  
**29 CFR 1910.146**

Yes	No	N/A	
			All identified atmospheric and physical hazards are controlled.
			All hazards introduced by the work performed are addressed (e.g., welding fumes).
			Air intake of the ventilation system is located in an area free of contaminants.
			All required equipment and rescue equipment is present and in good working condition.
			Non-sparking tools and intrinsically safe equipment and lighting are used if required.
			All monitoring instruments have been properly calibrated.
			All workers have initial confined space entry training certification.
			All workers received site specific confined space entry training.
			Rescue team members practiced rescue operations in space or similar space.
			Practice Date: _____
			All rescue team members certified in first aid and CPR.
			Entry coordinated with subcontractors.

**PROBLEMS ENCOUNTERED:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Was rescue required? \_\_\_\_\_

**SIGNATURES:**

I have reviewed the work authorized by this permit and the information contained here--in. Written instructions and safety procedures have been received and understood. I understand that this permit is not valid and the permit cannot be approved and entry conducted if any of the above squares are marked "NO" or if required sections are incomplete.

Entrants: \_\_\_\_\_

Attendants: \_\_\_\_\_

Rescue Team: \_\_\_\_\_

Other: \_\_\_\_\_

Permit prepared by: \_\_\_\_\_

Entry Authorized by (HSO): \_\_\_\_\_

**PERMIT CANCELLATION:**

Reason: \_\_\_\_\_

\_\_\_\_\_

HSO Signature: \_\_\_\_\_

Copy of form sent to Health and Safety Manager, Portland, ME. (mandatory)

**APPENDIX B**  
**OSHA 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 or 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 the 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 discriminatory action.

## 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 civil penalties against employers of up to \$7,000 for each serious violation and for optional penalties of up to \$7,000 for each nonserious violation. Penalties of up to \$7,000 per day may be proposed for failure to correct violations within the proposed time period and for each day the violation continues beyond the prescribed abatement date. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$70,000 for each such violation. A violation of posting requirements can bring a penalty of up to \$7,000.

There are also provisions for criminal penalties. Any willful violation resulting in the death of any employee, upon conviction, is punishable by a fine of up to \$250,000 (or \$500,000 if the employer is a corporation), or by imprisonment for up to six months, or both. A second conviction of an employer doubles the possible term of imprisonment. Falsifying records, reports, or applications is punishable by a fine of \$10,000 or up to six months in jail or both.

## 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.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. 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 health such as training.

## VOLUNTARY ACTIVITY

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State labor or Health department or a State university.

## POSTING INSTRUCTIONS

Employees in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.

## 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

(404) 347-3573  
(617) 565-7164  
(312) 353-2220  
(214) 767-4731  
(303) 844-3061  
(816) 426-5861  
(212) 337-2378  
(215) 596-1201  
(415) 744-6670  
(206) 442-5930

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Lynn Martin, Secretary of Labor  
**U.S. Department of Labor**  
Occupational Safety and Health Administration

To report suspected fire hazards, imminent danger safety and health hazards in the workplace, or other job safety and health emergencies, such as toxic waste in the workplace, call OSHA's 24-hour hotline: 1-800-321-OSHA.