

5018

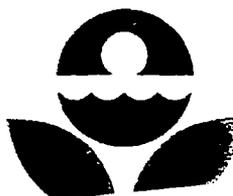
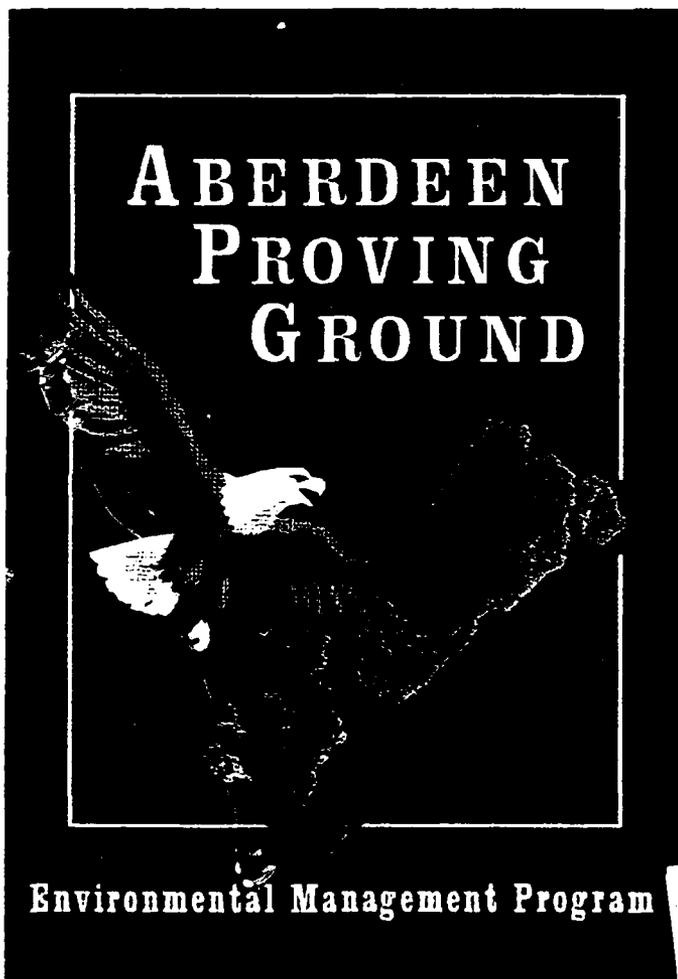
AD-A277 421

①



Canal Creek Study Area
Aberdeen Proving Ground - Edgewood Area, Maryland

GROUNDWATER MONITORING PLAN FINAL HEALTH AND SAFETY PLAN



DTIC

1994

Environmental Management Program

20178 94-08798



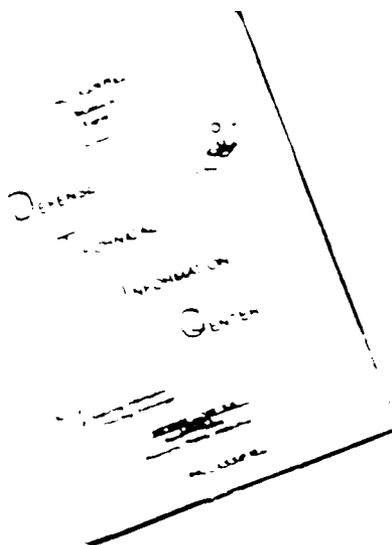
DISTRIBUTION RESTRICTION STATEMENT
APPROVED FOR PUBLIC RELEASE:
DISTRIBUTION IS UNLIMITED.

0235-A-1

JE OCTOBER 1993

94 3 18 079

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST
QUALITY AVAILABLE. THE COPY
FURNISHED TO DTIC CONTAINED
A SIGNIFICANT NUMBER OF
PAGES WHICH DO NOT
REPRODUCE LEGIBLY.

Sign-off sheet will be appended

TABLE OF CONTENTS

Section	Page
1.0 INTRODUCTION	1-1
2.0 ORGANIZATION AND RESPONSIBILITIES	2-1
2.1 PROJECT ORGANIZATION	2-1
2.2 FIELD TEAM PERSONNEL	2-1
2.2.1 Jacobs Engineering Group (JEG) Employees	2-1
2.2.2 Subcontractor's Employees	2-2
2.3 PERSONNEL RESPONSIBILITIES	2-2
2.3.1 Project Personnel	2-2
2.3.2 Line Management - Project Manager (PM), Washington Operations Manager (WOM)	2-4
2.3.3 Corporate Health and Safety Professionals	2-4
2.4 EMPLOYEE MEDICAL SURVEILLANCE AND TRAINING	2-5
2.5 COMMUNICATIONS	2-5
2.5.1 Hazard Communication	2-5
2.5.2 Employee Health and Safety Briefing	2-5
2.5.3 Daily Meetings	2-6
3.0 HAZARD CONTROL AND SAFETY	3-1
3.1 SITE ACCESS AND DESCRIPTION	3-1
3.1.1 Historical Background	3-1
3.1.2 Specific Investigation Sites	3-4
3.2 CHEMICAL HAZARDS AND CONTROL	3-4
3.2.1 Hazardous Chemical Substances of Occupational Health Concern	3-4
3.3 DETAILED BIOLOGICAL AND PHYSICAL HAZARDS AND CONTROLS	3-14
3.3.1 Temperature Extremes	3-14
3.3.1.1 Heat Stress	3-14
3.3.1.2 Cold Stress	3-17
3.3.2 Sharp Objects	3-18
3.3.3 Poisonous Plants	3-18
3.3.4 Insects and Ticks	3-20
3.3.5 Poisonous Snakes	3-23



TABLE OF CONTENTS (Continued)

Section	Page
3.3.6 Animal Bites	3-25
3.3.7 Chemical Agents	3-26
3.3.7.1 Nerve Agents.	3-26
3.3.7.2 Blood Agents.	3-27
3.3.7.3 Choking Agents.	3-28
3.3.7.4 Incapacitating Agents	3-29
3.3.7.5 Irritant or Riot Control Agents.	3-30
3.3.7.6 Vomiting Agents.	3-30
3.3.7.7 Blistering Agents	3-30
3.3.8 Unexploded Ordnance	3-31
3.3.9 Slips, Trips and Falls	3-31
3.3.10 Noise	3-32
3.3.11 Precariously Positioned Objects	3-32
3.3.12 Utility Lines	3-34
3.3.13 Walking and Working in Open Terrain	3-34
3.3.14 Lightning	3-34
3.4 PHYSICAL (SAFETY) HAZARDS AND CONTROLS	3-35
3.5 DESCRIPTION OF FIELD ACTIVITIES	3-36
4.0 TRAINING	4-1
5.0 MEDICAL SURVEILLANCE	5-1
6.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)	6-1
6.1 EQUIPMENT SPECIFICATION	6-1
6.1.1 All Sites	6-1
6.2 REASONS TO UPGRADE OR DOWNGRADE LEVEL OF PROTECTION	6-3
7.0 AIR MONITORING	7-1
7.1 ENVIRONMENTAL	7-1
7.1.1 Equipment Specifications	7-1
7.1.2 Calibration Specification	7-3
7.2 PERSONAL	7-3



TABLE OF CONTENTS (Continued)

Section	Page
8.0 SITE CONTROL	8-1
8.1 SITE CONTROL PROCEDURES	8-1
8.2 WORK PRACTICES	8-1
8.3 DISPOSAL OF WASTE MATERIALS GENERATED ONSITE	8-2
9.0 DECONTAMINATION	9-1
9.1 DECONTAMINATION PROCEDURES	9-1
9.1.1 Samples and Equipment	9-1
9.1.2 Personnel	9-1
9.1.3 Equipment and Supplies	9-4
10.0 EMERGENCY RESPONSE/CONTINGENCY PLAN	10-1
10.1 PRE-EMERGENCY PLANNING	10-1
10.2 EMERGENCY EQUIPMENT AND SUPPLIES	10-1
10.3 EMERGENCY MEDICAL TREATMENT	10-2
10.4 EVACUATION	10-2
10.4.1 Evacuation Routes and Assembly Points	10-3
10.5 EMERGENCY RESPONSE CONTACTS	10-3
10.5.1 Emergency Phone Numbers	10-3
10.5.2 Agent and Life-Threatening Emergencies	10-4
10.5.3 Nonagent and Non Life-Threatening Emergencies	10-4
10.6 Post-Incident or Emergency Notifications and Recordkeeping	10-9
10.6.1 List of Contacts	10-9
11.0 HAZARD COMMUNICATION	11-1



LIST OF FIGURES

Figure	Page
Figure 3-1. Edgewood/Canal Creek Area Regional Location Map	3-2
Figure 3-2. Canal Creek Groundwater Monitoring Area	3-3
Figure 3-3. Windchill Chart	3-19
Figure 3-4. Common UXO	3-33
Figure 9-1. Groundwater Sampling—Levels C and D Personnel Decontamination Procedure .	9-2
Figure 10-1. Evacuation Routes from Evacuation Zone 1	10-5
Figure 10-2. Evacuation Routes from Evacuation Zone 2	10-6
Figure 10-3. Evacuation Routes from Evacuation Zone 3	10-7
Figure 10-4. Emergency Medical Facility	10-8

LIST OF TABLES

Table	Page
Table 3-1. Contaminants Identified in Historical Data	3-5
Table 3-2. Symptoms and Effects of Groundwater Contaminants	3-8
Table 6-1. PPE Considerations	6-2
Table 7-1. Monitoring Equipment Specifications	7-1
Table 7-2. Calibration Specifications	7-3
Table 9-1. Decontamination Procedures	9-3

Appendices

- Appendix A — Record Keeping**
- Appendix B — Attachments to Plan**



1.0 INTRODUCTION

Canal Creek Area, APG-EA, Maryland

Groundwater Monitoring Plan, Volume III

This Health and Safety Plan (HASP) has been written for use by Jacobs Engineering Group (JEG) personnel and any other individuals authorized to access areas where site control is established for purposes of conducting or observing field work in accordance with this HASP. This HASP shall be kept onsite during field activities and shall be reviewed and updated as necessary to reflect current site conditions and operations. This HASP adopts the following regulations and procedures with which the Site Health and Safety Coordinator (SHSC) is familiar:

- Applicable federal, state, and local regulations including those set forth in 29 CFR 1910.120, 29 CFR 1910.1200 and 29 CFR 1910.134.
- Procedures contained in the work plan for this project.

CLIENT OR OWNER: United States Army

PROJECT NO: 35-E356-02

PROJECT MANAGER: Francine Gordon, JEG

OFFICE: Washington, DC

SITE NAME: Aberdeen Proving Ground, Edgewood Area (APG-EA)

SITE LOCATION: Aberdeen Proving Ground, MD (Figure 1-1)

DATE HEALTH AND SAFETY PLAN PREPARED: October 1992

DATE(S) OF INITIAL VISIT: To Be Determined

DATE(S) OF SITE WORK: To Be Determined



Jacobs Engineering Group Inc.
Washington Operations

2.1 PROJECT ORGANIZATION

Project Manager (PM):	Francine Gordon
Task Manager (TM):	Robert Paquette
Local Contact:	John Wrobel
Corporate Health and Safety Director (CHSD):	Terry Briggs
Site Health and Safety Coordinator (SHSC):	George Moore
Field Team Leader:	To be determined
Field Team Personnel:	To be determined

2.2 FIELD TEAM PERSONNEL

The following field team personnel are qualified per Subsection 2.4 to perform work of this HASP.

2.2.1 Jacobs Engineering Group (JEG) Employees

Employees listed below have received 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated "SHSC" have received an additional 8 hours of supervisor and 8 hours of instrument training, and are qualified to act as Site Health and Safety Coordinator (SHSC) for work conducted at the level of personal protection specified in Section 6.0. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. There must be at least one SHSC and one FA-CPR designated employee present during any task performed onsite with the potential for exposure to safety and health hazards.



Canal Creek Area, APG-EA, Maryland

Groundwater Monitoring Plan, Volume III

<u>Employee Name</u>	<u>Office</u>	<u>Responsibility</u>	<u>SHSC/FA-CPR</u>
Francine Gordon	Wash.,DC	Project Manager	FA-CPR
Robert Paquette	Wash.,DC	Task Manager	FA-CPR
To Be Determined	Wash.,DC	Team Leader	FA-CPR
To Be Determined	Wash.,DC	Team Leader	FA-CPR
George Moore	Wash.,DC	SHSC	SHSC/FA-CPR
To Be Determined	Wash.,DC	Environmental Scientist	FA-CPR
To Be Determined	Wash.,DC	Environmental Scientist	FA-CPR
To Be Determined	Wash.,DC	Environmental Scientist	FA-CPR

2.2.2 Subcontractor's Employees

The cement bond logging contractor's (Walenco geophysical Services) Health and Safety Plan (Manual for Control of Radiation), NRC license and the authorization of the Deputy Installation Commander are included in Appendix B.

<u>Employee Name</u>	<u>Employer</u>	<u>Responsibility</u>	<u>SHSC/FA-CPR</u>
To Be Determined			NA
To Be Determined			NA

2.3 PERSONNEL RESPONSIBILITIES

2.3.1 Project Personnel

Task Manager (TM)

- Coordinates overall planning of work.
- Coordinates supervision of work.



Jacobs Engineering Group Inc.
Washington Operations

Field Team Leader (FTL)

- Plans technical and administrative aspects of field work.
- Authorizes field team members to initiate field work.
- Supervises technical and administrative aspects of field work.

Site Health and Safety Coordinator (SHSC)

The Site Health and Safety Coordinator (SHSC) is selected based on demonstrated experience in conducting site safety operations to the level of protection anticipated for the site. The individual is an experienced industrial hygienist whose primary responsibility is to oversee field team site-specific Health and Safety Plan (HASP) compliance. The SHSC:

- Implements the HASP and informs the Task Manager of any conditions or modifications that may be appropriate
- Performs monitoring as required by the HASP.
- Verifies with the Task Manager that assigned personnel have current "Fit-For-Duty" medical authorizations and have received appropriate training.
- Determines that equipment is used properly and is calibrated in accordance with manufacturer's instructions or other standard protocols, and that the results are properly recorded and filed.
- Provides ongoing review of protective level needs as project work is performed, and informs the Task Manager of the need to upgrade/downgrade protection levels.
- Corrects unsafe or potentially unsafe working conditions, or stops work in emergencies until such conditions are corrected. Consults with Task Manager and Project Manager regarding circumstances and conditions dictating these actions.
- When not on site, assigns site health and safety responsibilities to qualified individual.
- Conducts initial and daily site safety briefings.
- Insures that the hazard communication program is carried out onsite.
- Insures that all required safety equipment is on-site, clean and operable.
- Determines and posts the locations of medical facilities, telephone numbers of emergency personnel, and arranges emergency transportation to medical facilities as required.
- Conducts preliminary site survey to detect the presence of any obvious hazards.



- Conducts on-site air monitoring and assists independent testing laboratories when laboratory personnel are on-site.
- Notifies appropriate emergency personnel in the event of an accident, fire or explosion.
- Has the authority to cease any operations not in compliance with the health and safety plan, which threaten the health or safety of on-site personnel or the general public, or which may cause significant impact to the environment.
- Completes and submits recordkeeping forms per this HASP and corporate SOPs.

Field Team Members

The field team includes those project personnel who have the potential to be exposed to hazardous or toxic substances or environments during the course of field activities. Each member of the team:

- Performs the work of this plan as directed by the FTL and SHSC.
- Signs the Plan Acceptance Form, thereby indicating that he/she has read, understands, and will abide by the project site-specific Health and Safety Plan.
- Takes all reasonable precautions to prevent injury to himself/herself and to fellow workers.
- Reports deviations from conditions anticipated in the safety plan and reports accidents or unsafe conditions to the SHSC for action.

2.3.2 Line Management - Project Manager (PM), Washington Operations Manager (WOM)

- Provide TM with resources to execute work.
- Assure work is performed in accordance with JEG program policies and procedures.

2.3.3 Corporate Health and Safety Professionals

Corporate Health and Safety Director (CHSD)

- Develops and implements JEG corporate Health and Safety Program.
- Reviews and approves site-specific Health and Safety Plans.
- Conducts site health and safety audits.

JEG Occupational Medical Consultant (OMC):

- Prescribes and interprets results of medical examination protocols and testing for employees who participate in the Occupational Medical Program.
- Provides emergency medical consultation.

2.4 EMPLOYEE MEDICAL SURVEILLANCE AND TRAINING

The SHSC shall authorize individuals to access areas where site control is established for purposes of conducting field work in accordance with this HASP only if current certification of their medical fitness, training, and respirator fit test are in accordance with 29 CFR 1910.120

2.5 COMMUNICATIONS

- Health and safety concerns in the field shall be brought to the attention of the SHSC first.
- Health and safety concerns in the field which the SHSC is unable to address satisfactorily shall be brought to the attention of the CHSD.
- In the event of an accidental incident or emergency, notify responsible personnel per Subsection 10.6 of this HASP.

2.5.1 Hazard Communication

To satisfy the training and hazard communication requirements of applicable federal and state regulations, field team members shall be provided a copy of this HASP and agree to abide by it by signing Attachment 1.

2.5.2 Employee Health and Safety Briefing

The SHSC shall conduct a health and safety briefing prior to authorizing individuals access to areas where site control is established. The SHSC shall document attendance and the topics discussed, including at least the following:

- Work plan and individual assignments.



- Potential hazards of the work to be performed (Section 3.0 and Attachments 5 and 7).
- Site controls and air monitoring action levels that will be in effect onsite.
- Personal protective equipment to be used.
- Communication procedures, including evacuation/emergency signals.
- Emergency response/contingency plan and rescue operations.

2.5.3 Daily Meetings

The SHSC shall conduct daily health and safety meetings prior to authorization being given by the FTL for field team personnel to perform field work. The SHSC shall document attendance and the topics discussed, including at least the following:

- Any potential hazards of the work to be performed not discussed previously.
- Discussion and resolution of any health and safety concerns or problems since the previous meeting.



3.1 SITE ACCESS AND DESCRIPTION

By land: Land access to APG-EA is via the Maryland Highway 24 exit from Interstate 95. Continue east on Highway 24 to the main gate. Figures 3-1 and 3-2 provide the location of the Canal Creek Area in relation to the APG-EA Main Gate.

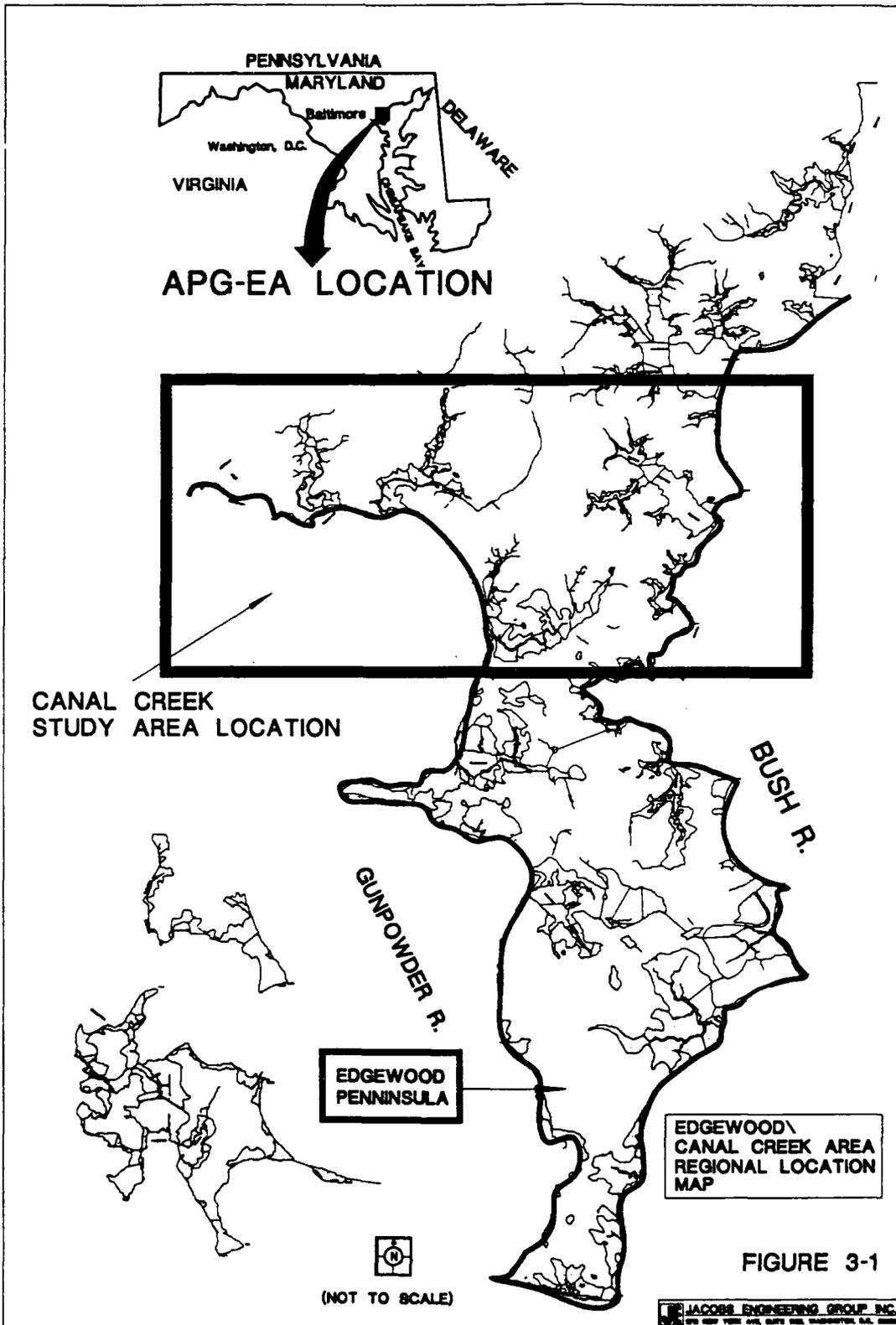
By air: All sites accessible by air.

By Water: Restricted.

APG-EA is located in southern Harford and southeastern Baltimore counties of Maryland, near the head of the Chesapeake Bay. APG-EA is drained by eight rivers, including the Bush and Gunpowder Rivers. The climate at APG-EA is moderated by its proximity to the Chesapeake Bay and the Atlantic Ocean. Winters are generally milder than in the inland areas. The area receives approximately 45 inches of rain per year, with maximum precipitation in August and minimum precipitation in October. The mean daily temperatures range from 34° F in winter to 75° F in summer. Summer temperatures exceeding 90° F (with high humidity) are common.

3.1.1 Historical Background

APG-EA was established in 1917 as the Ordnance Proving Ground and designated a formal military post in 1919 (McMaster 1981). Testing of ammunition and materiel and operation of training schools began in 1918. Prior to World War II, activities at APG-EA were characterized by intense research and development, and large-scale testing of a wide variety of munitions, weapons, and materiel. Just before and during World War II, the pace of weapons, munitions, and materiel testing increased greatly. During the war, personnel strength at the installation exceeded 30,000. Similar but smaller-scale increases in munitions and materiel development and testing activities at APG-EA were experienced during the Korean and Vietnam conflicts.



PENNSYLVANIA
 MARYLAND
 Delaware
 Washington, D.C.
 VIRGINIA
APG-EA LOCATION

**CANAL CREEK
 STUDY AREA LOCATION**

BUSH R.

GUNPOWDER R.

**EDGEWOOD
 PENNINSULA**

**EDGEWOOD
 CANAL CREEK AREA
 REGIONAL LOCATION
 MAP**



(NOT TO SCALE)

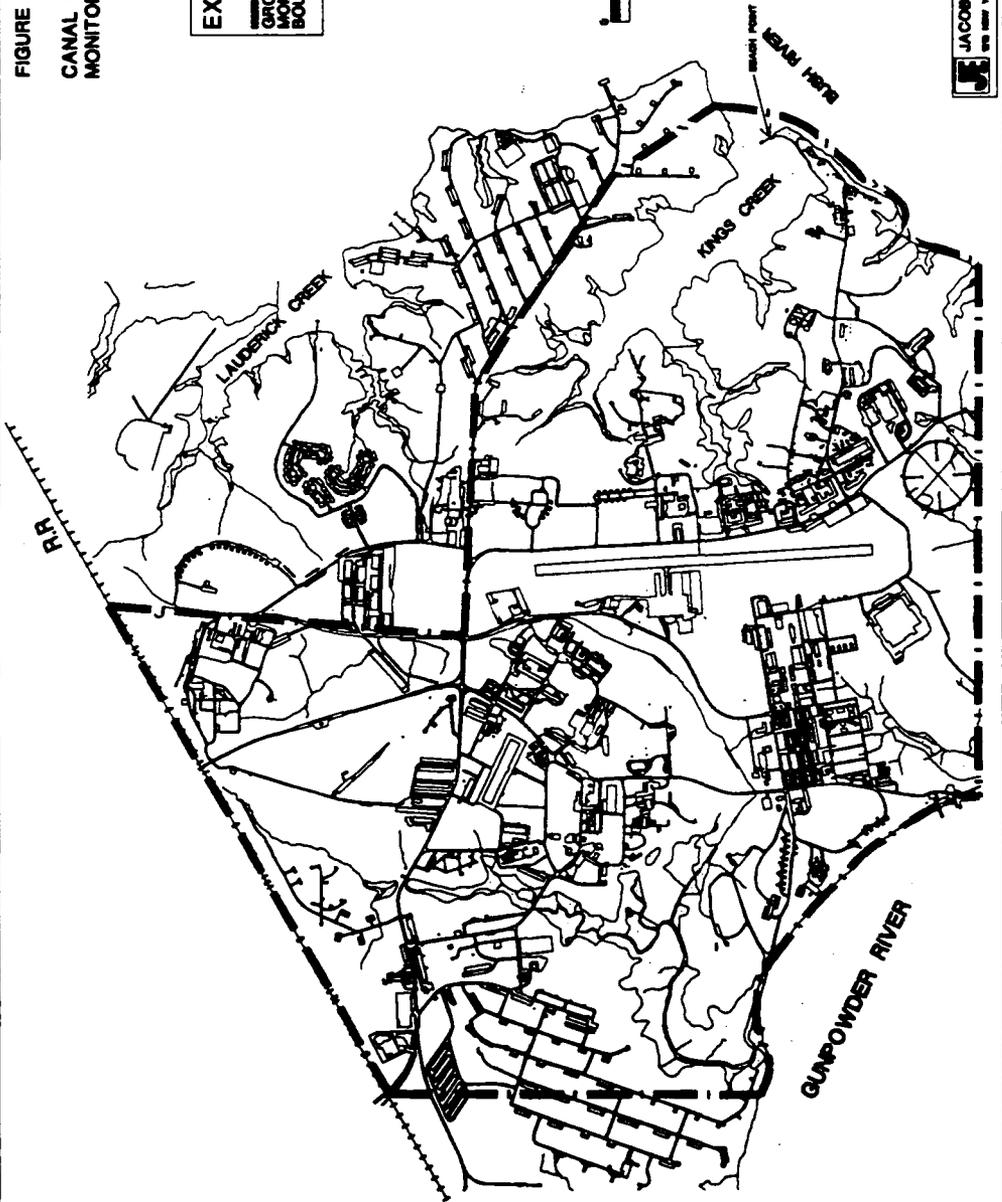
FIGURE 3-1

FIGURE 3-2
CANAL CREEK GROUNDWATER
MONITORING AREA

EXPLANATION
— GROUNDWATER MONITORING AREA
- - - BOUNDARY



JACOBS ENGINEERING GROUP INC.
100 NEW YORK AVE. SUITE 1000 WASHINGTON, D.C. 20001



Throughout its history, APG-EA's primary mission has been and continues to be the testing and development of weapons, munitions, vehicles, and support materiel relevant to military operations.

3.1.2 Specific Investigation Sites

This HASP addresses field activities related to groundwater sampling in the Canal Creek area. The specific investigation sites are described in the Canal Creek RCRA Facilities Assessment and the Program Development Report for the Canal Creek Area of APG-EA.

3.2 CHEMICAL HAZARDS AND CONTROL

Hazardous chemical substances at the site(s) which may pose an occupational health threat are identified in Table 3-1 under Subsection 3.2.1. Generic chemical hazard profiles of these substances by groups (e.g., metals, corrosives, petroleum based hydrocarbons, and spent ordnance residues) are provided as Attachment 6 to this HASP. More detailed MSDS information for the specific chemical substances discussed in the profiles is also provided as Attachment 6 to this HASP. Table 3-2 identifies the symptoms and effects of overexposure to the groundwater contaminants.

3.2.1 Hazardous Chemical Substances of Occupational Health Concern

Table 3-1 identifies contaminants that may pose an occupational health threat. For each contaminant identified, the following information is summarized for quick reference:

- Highest value noted in historical groundwater data.
- Applicable allowable exposure limits.
- Ionization Potential (IP).

Exposure limits and ionization potentials were obtained from a variety of sources including:

- NIOSH publications.
- Dangerous Properties of Industrial Chemicals.
- Chemical dictionaries; and
- American Conference of Governmental Industrial Hygienists publications.



Table 3-1
Contaminants Identified in Historical Groundwater Data

Contaminant	Highest Value in Groundwater (ppb)	Exposure Limit*** (PEL or TLV)	Ionization Potential (Ev)
Benzaldehyde	50.00		
Benzene	396.00	1	9.24
Benzoic Acid	6,190.00		
Benzothiazole	51.50		
Benzyl Alcohol	7.08		
bis-(2-Chloroethyl) ether	6.40		
Bromine	2,000.00	0.1	10.55
4-Bromofluorobenzene	150.00		
Bromodichloromethane	2.50		
Bromoform	1.73	0.5	10.48
Butylbenzyl phthalate	100.00		
Carbon tetrachloride	20,000.00	2	11.47
Carbon disulfide	170.00	1	10.08
Chlorine	977,000.00	0.5	11.48
Chlorobenzene	192.00	75	9.07
Chloroethane	153.00	1000	
Chloroform	82.10	2	11.42
Chloromethane	1.34		
cis -1,3-Dichloropropylene	2.17		
cis -1,2-Dichloroethylene	3,000.00		
Cyclohexane	18.00	300	9.88
Cyclohexene oxide	2.00		
1,2-Dichlorobenzene	43.40	50	9.06
1,3-Dichlorobenzene	0.732		
1,4-Dichlorobenzene	47.20	75	8.98
1,2-Dichloroethane	2,010.00	10	
1,1-Dichloroethylene	1,406.00	200	
1,2-Dichloroethylene	971.00	5	9.65
2,4-Dichlorophenoxyacetic acid	2.46	10 mg/m ³	



Table 3-1 (Continued)
Contaminants Identified in Historical Groundwater Data

Contaminant	Highest Value in Groundwater (ppb)	Exposure Limit*** (PEL or TLV)	Ionization Potential (Ev)
cis-1,3-Dichloropropylene	3.00		
1,3-Dimethylbenzene	3.00		
Dimethyl methylphosphonate	105.00		
Diisopropyl methylphosphonate	172.00		
Dithiane	8,400.00		
2,6-DNT	2.26	1.5 mg/m ³	
2-Ethyl-1-hexanol	3.00		
2-Ethylhexanoic acid	8.00		
Ethylbenzene	13.3	100	8.76
Fluorine	1,052.00	0.10	15.70
2-Fluorophenol	10.00		
Hexachloroethane	2.57	1	11.22
Hydrochloric acid	**	7 mg/m ³	12.74
4-Hydroxy-3-methoxybenzaldehyde	30.00		
Lead	41.00	0.10 mg/m ³	
Mercury	3.03	0.01 mg/m ³	
Methylphosphonic acid	1,390.00		
Methyl isobutyl ketone	100.00		
Methyl ethyl ketone	12.00	200	9.54
Methylene chloride	143.00	500	11.32
2-Methylnaphthalene	4.13		
2-Methylphenol	13.40	5	
Nitrobenzene	200.00	1	9.92
1,4-Oxathiane	720.00		
p-chlorophenylmethyl sulfide	22.00		
Pentachloroethane	40.00	5	
Phenol	25.10	5	8.50



Table 3-1 (Continued)
Contaminants Identified in Historical Groundwater Data

Contaminant	Highest Value in Groundwater (ppb)	Exposure Limit*** (PEL or TLV)	Ionization Potential (Ev)
2-Propanol	200.00	400	10.10
Naphthalene	14.70	10	8.12
Nickel		1 mg/m ³	
Nitric Acid	**	5 mg/m ³	11.95
RDX	1.18		
Sodium hydroxide	**	2 mg/m ³	
Sulfuric acid	**	1 mg/m ³	
1,2,3-Trichlorobenzene	18.50	5	
Tetrachloroethylene	4,720.00	25	9.32
Thiodiglycol [†]	110,000.00		
2,4,6-TNT	2.94	0.5 mg/m ³	10.59
Toluene	17,800.00	100	8.82
trans-1,3-Dichloropropylene	0.845		
trans-1,2-Dichloroethylene	100.00	200	9.65
2,4,5-Tribromophenol	30.00		
2,4,6-Tribromophenol	50.00		
1,2,4-Trichlorobenzene	6.94	5	
Trichlorofluoromethane	2.10	1,000	
1,1,1-Trichloroethane	106.00	350	
1,1,2-Trichloroethane	106.00	10	11.00
Trichloroethylene	8,710.00	25	9.45
Vinyl chloride	248.00	1	9.99
Xylene	19,400.00	100	8.44-8.56

[†] Chemical agent degradation product

** Sample preservative

***PPM except where noted



**Table 3-2
Symptoms and Effects of Groundwater Contaminants**

CONTAMINANT	SYMPTOMS AND EFFECTS
Benzaldehyde	An allergen; mild local anesthetic; skin irritant causing contact dermatitis; central nervous system depressant in small doses and convulsions in larger doses.
Benzene	Narcotic; euphoria; somnolence; fatigue; nausea; giddiness; headache; mucous membrane irritation; anorexia; bone marrow depressant; carcinogen and human poison by inhalation and perhaps skin contact.
Benzoic acid	Skin irritant; severe eye irritant; dyspnea; allergic dermatitis; moderately toxic by ingestion and skin.
Benzothiazole	Poison by intraperitoneal, intravenous, and other routes.
Benzyl alcohol	Moderate skin and severe eye irritant; poison by ingestion; moderately toxic by inhalation and skin contact.
bis-(2-Chloroethyl) ether	Narcotic; dizziness; drowsiness; headache; nausea; mucous membrane, eye and skin irritant; poison by inhalation, ingestion, and skin contact; experimental carcinogen and tumorigen.
Bromine	Lachrymator; dizziness; headache; cough; pulmonary edema; abdominal pain; measles-like eruptions; depression; severe skin, eye, mucous membrane irritant; toxic by ingestion, inhalation and skin contact.
4-Bromofluorobenzene	Lachrymator; anesthetic; dizziness; nausea; eye and skin irritant; toxic by inhalation, ingestion, and skin contact.
Bromodichloromethane	Sedation; flaccid muscle tone; ataxia; sleepiness; tremors; toxic by inhalation and ingestion; experimental carcinogen.
Bromoform	Lachrymator; anesthetic; dizziness; nausea; eye and respiratory system irritant; central nervous system depressant; toxic by ingestion and inhalation; experimental neoplastigen.
Butylbenzyl phthalate	Skin, eye, and respiratory system irritant; toxic by ingestion, inhalation, and skin contact.
Carbon tetrachloride	Nausea; skin and eye irritant; pupillary constriction; coma; tremors; CNS depressant; poison by ingestion; toxic by inhalation; experimental carcinogen, neoplastigen, tumorigen, teratogen.
Carbon disulfide	Skin burns; dermatitis; dizziness; headache; fatigue; psychosis; Parkinson-like symptoms; ocular changes; gastritis; poison by ingestion and toxic by inhalation.



Table 3-2
Symptoms and Effects of Groundwater Contaminants (Continued)

CONTAMINANT	SYMPTOMS AND EFFECTS
Chlorine	Strong irritant to eyes, mucous membranes, skin, and respiratory system; pulmonary edema; cough; lachrymator; nausea, dizziness; toxic by inhalation.
Chlorobenzene	Irritant to skin, eyes, respiratory system; drowsiness; incoordination; narcotic; poison by ingestion; experimental teratogen.
Chloroethane	Irritant to skin, eyes and respiratory system; sleepiness; excitement; pulmonary edema; toxic by inhalation, ingestion, and skin contact
Chloroform	Hallucinations; nausea; fatigue; disorientation; headache, skin and eye irritant; anesthetic; poison by ingestion and inhalation; suspected carcinogen
Chloromethane	Nausea; convulsions; narcotic; mild irritant; dizziness; incoordination; diplopia; confusion; drowsiness; mildly toxic; experimental teratogen.
p-Chlorophenylmethyl sulfide	Eye irritant; poison by ingestion; toxic by skin contact.
Cyclohexane	Irritant to eyes and respiratory system; dermatitis; drowsiness; narcotic; coma; toxic by ingestion and inhalation.
Cyclohexene oxide	Eye, skin and respiratory system irritant; drowsiness; toxic by ingestion, skin contact, and inhalation; experimental tumorigen.
cis-1,2-Dichloroethylene	Narcotic; mild irritant; mildly toxic by inhalation and ingestion.
1,2-Dichlorobenzene	Eye, skin and mucous membrane irritant; poison by ingestion and <i>intervenous</i> ; toxic by inhalation; <i>suspected carcinogen</i> .
1,3-Dichlorobenzene	Eye, skin and respiratory system irritant; systemic effects by ingestion; poison by ingestion; toxic by inhalation; mutagen.
1,4-Dichlorobenzene	Eye, skin and respiratory system irritant; systemic effects by ingestion; decreased motility/constipation; changes periorbital swelling; profuse rhinitis; nausea; anorexia; jaundice; cirrhosis; poison by unspecified route; toxic by inhalation; mutagen.
1,2-Dichloroethane	Flaccid paralysis; somnolence; cough, jaundice; nausea; <i>hypermotility</i> ; <i>diarrhea</i> ; <i>stomach ulcers/bleeding</i> ; <i>changes in heart rate</i> ; cyanosis, coma; poison by ingestion, toxic by inhalation and skin.
1,1-Dichloroethylene	Anesthetic; liver and kidney changes; poison by inhalation and ingestion.



**Table 3-2
Symptoms and Effects of Groundwater Contaminants (Continued)**

CONTAMINANT	SYMPTOMS AND EFFECTS
1,2-Dichloroethylene	Narcotic; irritant to eyes and respiratory system; liver and kidney damage; toxic by inhalation and ingestion; suspected carcinogen.
trans-1,2-Dichloroethylene	Irritant to eyes and respiratory system; central nervous system depressant; toxic by ingestion and inhalation.
2,4-Dichlorophenoxyacetic acid	Skin and severe eye irritant; nausea; somnolence; convulsions; coma; poison by ingestion; toxic by skin contact.
cis-1,3-Dichloropropylene	Anesthetic; narcotic; skin and eye irritant; toxic by ingestion and skin contact.
trans-1,3-Dichloropropylene	Skin and eye irritant; toxic by ingestion and inhalation.
1,3-Dimethylbenzene	Severe eye and skin irritant; ataxia; irritability; changes in motor activity; toxic by inhalation, ingestion, and skin contact.
Dimethyl methylphosphonate	Suspected carcinogen.
Diisopropyl methylphosphonate	Moderately toxic by ingestion.
Dithiane	Irritant to mucous membranes and respiratory system; tremors; ataxia; dyspnea; toxic by inhalation and ingestion.
2,6-Dinitrotoluene	Skin irritant; anoxia; cyanosis; anemia; jaundice; poison by ingestion.
2-Ethyl-1-hexanol	Severe eye and moderate skin irritant; toxic by ingestion, skin, routes.
2-Ethylhexanoic acid	Skin and severe eye irritant; toxic by skin and ingestion.
Ethylbenzene	Eye and skin irritant; eye, sleep and pulmonary changes; toxic by ingestion inhalation, and skin.
Fluorone	Severe irritant to skin, eyes and mucous membranes; pulmonary edema; laryngeal and bronchial spasms; poison gas; toxic by inhalation.
2-Fluorophenol	Irritant to skin, eyes and respiratory system; dyspnea; toxic by inhalation, ingestion and skin contact.
Hexachloroethane	Eye irritant; liver damage; toxic by ingestion.
Hydrochloric acid	Highly corrosive irritant to skin, eyes, and mucous membranes; poison; toxic by inhalation and ingestion.
4-Hydroxy-3-methoxybenzaldehyde	Skin and severe eye, mucous membrane and respiratory system irritant; anesthetic; toxic by inhalation, ingestion and skin contact.



**Table 3-2
Symptoms and Effects of Groundwater Contaminants (Continued)**

CONTAMINANT	SYMPTOMS AND EFFECTS
Lead	Loss of appetite; anemia; malaise; insomnia; gingival lead line; eye irritant; headache; irritability; constipation; muscle/joint pains; tremors; flaccid paralysis without anesthesia; hallucinations; hypotension; distorted perceptions; muscle weakness; gastritis; liver damage; cerebral edema; poison by ingestion; toxic by inhalation; suspected carcinogen.
Methyl ethyl ketone	Irritant to eyes, nose, and respiratory system; headache; dizziness; nausea; toxic by ingestion, inhalation, and skin contact.
Methyl isobutyl ketone	Eye and mucous membrane irritant; headache; narcotic; nausea; dermatitis; coma; toxic by ingestion and inhalation.
Methylphosphonic acid	Eye and skin irritant; toxic by ingestion and inhalation.
Methylene chloride	Fatigue; weakness; sleepiness; lightheadedness; limb numbness; nausea; skin and eye irritant; toxic by inhalation, ingestion, and skin contact; suspected carcinogen.
2-Methylnaphthalene	Irritant to eyes, skin, and respiratory system; toxic by ingestion.
2-Methylphenol	Skin, eye and respiratory system irritant; confusion; depression; respiratory failure; dyspnea.
Naphthalene	Skin and eye irritant; headache; confusion; excitement; malaise; nausea; abdominal pain; profuse sweating; jaundice; hemoglobinuria; kidney failure; poison by ingestion; toxic by skin contact and inhalation.
Nitric acid	Corrosive to skin, eyes, mucous membranes and teeth; delayed pulmonary edema; pneumonitis and bronchitis; poison by ingestion; toxic by inhalation and skin contact.
Nitrobenzene	Anesthetic; respiratory stimulant; vascular changes; anoxia; irritant to eyes and skin; anemia; toxic by ingestion, inhalation, and skin contact.
1,4-Oxathiane	Skin and eye irritant; toxic by ingestion and inhalation.
Pentachloroethane	Nausea; abdominal pain; tremors; jaundice; irritant; dermatitis; poison by inhalation; toxic by ingestion.
Phenol	Severe eye and skin irritant; corrosion of mucous membranes; anorexia; weakness; muscle pain; dark urine; cyanosis; ochronosis; tremors; convulsions; twitches; poison by ingestion; toxic by inhalation.
2-Propanol	Irritant to eyes, nose, throat; drowsiness; dizziness; headache; dry skin; toxic by inhalation, skin contact; ingestion.



Table 3-2
Symptoms and Effects of Groundwater Contaminants (Continued)

CONTAMINANT	SYMPTOMS AND EFFECTS
RDX	Corrosive to skin, eyes, and mucous membranes; central nervous system stimulant; muscle twitching; seizures; poison by ingestion; toxic by inhalation and skin contact.
Sodium hydroxide	Corrosive to eyes, skin, mucous membranes; pneumonitis; temporary loss of hair; toxic by ingestion and inhalation;
Sulfuric acid	Corrosive to eyes, skin, mucous membranes and teeth; throat irritant; pulmonary edema and bronchitis; tracheobronchitis; conjunctivitis; emphysema; poison by ingestion and toxic by inhalation.
Tetrachloroethylene	Irritant to eyes, nose, throat; nausea, vertigo; dizziness; incoherence; headache; somnolence; skin erythema, flushed face and neck; toxic by inhalation.
Thiodiglycol	Skin and eye irritant; toxic by ingestion
2,4,6-TNT	Jaundice; cyanosis; sneezing; sore throat; peripheral neuropathy; muscle pain; dermal sensitizer; anemia; leukocytosis; cardiac irregularities; toxic by ingestion, inhalation, and skin contact.
Toluene	Eye irritant; fatigue; weakness; euphoria; confusion; dizziness; headache; dilated pupils; lacrimation; nervousness; muscle fatigue; insomnia; paresthesia; dermatitis; toxic by inhalation and skin contact.
2,4,5-Tribromophenol	Strong eye, skin, and mucous membrane and respiratory system irritant; poison by ingestion; toxic by inhalation; dermally absorbed.
2,4,6-Tribromophenol	Strong eye, skin, and mucous membrane and respiratory system irritant; poison by ingestion; toxic by inhalation; dermally absorbed.
1,2,3-Trichlorobenzene	Skin and eye irritant; toxic by ingestion and inhalation.
1,2,4-Trichlorobenzene	Skin and eye irritant; toxic by ingestion and inhalation.
1,1,1-Trichloroethane	Conjunctivitis; hallucinations; decreased motor activity; euphoria; irritability; aggression; diarrhea; hypermotility; nausea; proarrhythmic sensitizer to epinephrine; cardiac arrest; skin and severe eye irritant; toxic by ingestion, skin contact and inhalation.
1,1,2-Trichloroethane	Irritant to eyes, nose, skin, and lungs; central nervous system depressant; narcotic; poison by ingestion; toxic by inhalation and skin contact; experimental carcinogen.
Trichlorofluoromethane	Conjunctivitis; fibrosing alveolitis; narcosis; anesthetic; liver changes; poison by inhalation.



Table 3-2
Symptoms and Effects of Groundwater Contaminants (Continued)

CONTAMINANT	SYMPTOMS AND EFFECTS
Trichloroethylene	Headache; vertigo; disturbed vision; tremors; jaundice; hallucinations; somnolence; nausea; eye and skin irritant; cardiac arrhythmia; narcotic and anesthetic; paresthesia; toxic by ingestion, skin contact, and inhalation; experimental carcinogen.
Vinyl Chloride	Severe irritant to skin, eyes, and mucous membranes; weakness; abdominal pain; gastrointestinal bleeding; hepatomegaly; cyanosis; anesthetic; poison by inhalation and toxic by ingestion and skin contact; experimental carcinogen.
Xylene	Skin, nose, throat, and severe eye irritant; dizziness; excitement; drowsiness; incoherence; staggering gait; corneal vacuolization; anorexia; nausea; abdominal pain; toxic by ingestion, inhalation, and skin contact.



3.3 DETAILED BIOLOGICAL AND PHYSICAL HAZARDS AND CONTROLS

This section discusses the hazards that may be present on site, the procedures to avoid exposures, the symptoms associated with each hazard, and the appropriate first aid treatment. These hazards include temperature extremes, sharp objects, poisonous plants, insects, snakes, slipping, tripping and falling, and chemical agents such as nerve agents, blood agents, choking agents, incapacitating agents, irritant or riot control agents, vomiting agents and blistering agents.

3.3.1 Temperature Extremes

3.3.1.1 Heat Stress. The most common type of heat-related hazard that affects all field personnel is heat stress. Under this condition, the body's physiological processes fail to maintain a normal body temperature because of excessive heat. A number of physical reactions can occur from this condition ranging from mild reaction such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement, to a severe reaction which may be fatal. The following are examples of heat-related stress that may be encountered.

Heat Rash: caused by continuous exposure to heat and humid air and aggravated by chaffing clothes. Symptoms include a decreased ability to tolerate heat.

Heat Cramps: caused by profuse perspiration with inadequate fluid intake and chemical replacement (especially electrolytes). Signs: muscle spasms and pain in the extremities and abdomen.

Heat Exhaustion: caused by increased stress on various organs to meet increased demands to cool the body. Signs: shallow breathing; pale, cool, moist skin; profuse sweating; dizziness and lassitude.



Heat Stroke: life threatening; the most severe form of heat stress and is life threatening. Body must be cooled immediately to prevent severe injury and/or death. Signs and symptoms are: red, hot, dry skin, no perspiration; nausea; dizziness and confusion; strong, rapid pulse; coma. If an individual exhibits the above heat-related symptoms, immediately call military 17 or commercial 676-0960 and treat for heat stress as indicated on next page.

Heat Stress Avoidance Procedures:

Below are the preventive measures that will be followed to avoid heat stress related illnesses.

- Workers will be encouraged to drink 18 ounces of water before beginning work, such as in the morning or after lunch. Provide disposable, 4-ounce cups, and water that is maintained at 50-60 degrees F. Urge workers to drink 1-2 of these cups of water every 20 minutes for a total of 1-2 gallons per day. Provide a cool, preferably air conditioned area for rest breaks. Since alcohol and coffee are diuretics, the use of alcohol in non-working hours will be discouraged as will the intake of coffee during working hours.
- Workers will be monitored for signs of heat stress.
- Workers will be acclimated to site work conditions by slowly increasing workloads, i.e., do not begin site work activities with extremely demanding activities.
- To the extent possible, in hot weather, field activities will be conducted in the early morning or evening.
- Adequate shelter will be available to protect personnel against heat, as well as rain, cold, or snow, all of which can decrease physical efficiency and increase the probability of both heat and cold stress.
- Good personal hygiene standards will be maintained by frequent changes of clothing and showering. Clothing will be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.



Heat Stress Monitoring

Heat stress monitoring will be initiated when the ambient air temperature reaches 70° F and work activities require the use of impermeable personal protective equipment. Workers who are acclimatized to hot conditions, or who are engaged in less physically strenuous tasks may be less susceptible to heat related stresses. As a precaution, all workers will be routinely monitored for heat stress. (For a more detailed discussion of heat stress monitoring requirements, refer to Appendix B, Attachment 7.)

Heat Stress monitoring will be initiated by the SHSC in the following way:

- Obtain **body temperature** using an oral thermometer. Temperatures should be taken at each break before individual drinks any fluid or when heat-related symptoms are noticed or suspected. The thermometer should be placed under the tongue for 3 minutes.
 - If the oral temperature exceeds 99.6° F, reduce the next work cycle by 1/3 without changing the length of the rest period.
 - If the oral temperature exceeds 99.6° F at the beginning of the next rest period, decrease the time in the following work cycle by 1/3.
 - **Do not permit** a worker to wear a semi-permeable or impermeable garment when oral temperature exceeds 100.6° F.
- Obtain **heart rate** by counting the radial pulse during a 30-second or 1-minute period as early as possible in the rest period.
 - If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the time of the next work cycle by 1/3 without changing the rest period.
 - If the heart rate still exceeds 100 beats per minute at the beginning of the next rest period, shorten the time of the next work cycle by 1/3.
- Obtain a rough estimate of **body water loss** by weighing individuals on a scale accurate to +/- 0.25 pound at the beginning and end of each work day to see if sufficient fluids are being taken in to prevent dehydration. Weights should be taken while the individuals wear similar clothing. The body water loss should not exceed 1.5 percent of total body weight loss during the work day.



First Aid For Heat Stress

First Aid procedures for heat cramps and heat exhaustion include:

- get person out of heat and into a cooler place;
- put victim in the shock position and remove or loosen clothing; treat for shock, if necessary;
- if the victim is fully conscious and can tolerate it, give the victim one-half glass of water to drink every 15 minutes;
- call military 17 or commercial 676-0960.

Heat stroke is a life-threatening situation. First aid is to get the person out of the heat, call Military 17 or commercial 676-0960, immerse the victim in a cool bath, and treat for shock.

3.3.1.2 Cold Stress. JEG personnel will be instructed on the signs and symptoms of cold stress and on the methods of preventing cold-related disorders. The two major cold-related disorders are frostbite and hypothermia. The general symptoms are indicated below:

Frostbite: Sudden blanching of the skin progressing to skin with a waxy or white appearance which is firm to the touch, but the tissue beneath the skin is resilient.

Hypothermia: The symptoms of systemic hypothermia are usually exhibited in five stages as follows:

1. Shivering;
2. Apathy, listlessness, drowsiness, and (sometimes) rapid cooling of the body to less than 95° F;
3. Unconsciousness, glassy stare, slow pulse, and slow respiratory rate;
4. Freezing of the extremities; and
5. Death.



JEG personnel will watch for signs of frostbite and hypothermia in themselves and other field team members. If temperatures drop below 20° F, as measured by the wind chill index, field personnel will be required to wear thermal clothing. Field activities will be curtailed if the equivalent wind chill temperature, as shown on the Wind Chill Chart (Figure 3-3) page, is below 0° F, unless the activity is of an emergency nature.

3.3.2 Sharp Objects

Sharp Objects Avoidance Procedures

Awareness of site surroundings is the best procedure for avoiding sharp objects. To reduce the risk, steel toe/shank boots will be worn by all field personnel and observers.

First Aid For Sharp Objects

Accidents involving sharp objects usually result in bleeding injuries. First Aid procedures for bleeding injuries include direct pressure and elevation of the wound. If this technique does not stop the bleeding, apply pressure to the pressure points and transport individual to the appropriate medical facility for treatment. If the injury is life-threatening, call military 17 or commercial 676-0960.

3.3.3 Poisonous Plants

Poisonous Plant Avoidance Procedures

Poison ivy, poison oak, and poison sumac are identified by three or five leaves radiating from a stem. Poison ivy is a vine, while oak and sumac are bush-like. The plant tissues have an oleoresin which is active in live, dead and dried parts. The oleoresin may be carried via smoke, dust, contaminated clothing, and animal hair.



Figure 3-3 WINDCHILL CHART

Wind speed in mph	Actual Thermometer Reading (F)									
	50	40	30	20	10	0	-10	-20	-30	-40
	Equivalent Temperature (F)									
calm	50	40	30	20	10	0	-10	-20	-30	-40
5	48	37	27	16	6	-5	-15	-26	-36	-47
10	40	28	16	4	-9	-21	-33	-46	-58	-70
15	36	22	9	-5	-18	-36	-45	-58	-72	-85
20	32	18	4	-10	-25	-39	-53	-67	-82	-96
25	30	16	0	-15	-29	-44	-59	-74	-88	-104
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116
Over 40 mph (Little added effect)	Little Danger (for properly clothed person)			Increasing Danger (Danger from freezing of exposed flesh)				Great Danger		



First Aid For Poisonous Plants

Signs and symptoms include redness, swelling, and sometimes intense itching. Blisters form during the subsequent 24 hours. Crusting and scaling occurs within a few days. In the absence of complications, healing is complete in about ten days. Wash any exposed skin with a mild soap and water, but do not scrub the area.

3.3.4 Insects and Ticks

Ants, Bees, Wasps and Hornets

Stings of these insects are responsible for more deaths in the United States than bites and stings of all other venomous creatures. This is due to sensitization by the victim to the venom from repeated stings, which can result in anaphylactic reactions. The stinger may remain in the skin and should be removed by teasing or scraping rather than pulling. An ice cube placed over the sting will reduce pain. An analgesic-corticosteroid lotion is often useful. People with known hypersensitivity to such stings should carry a kit containing an antihistamine and epinephrine.

Ticks and Tickborne Diseases

Lyme Disease and Rocky Mountain Spotted Fever:

Lyme disease is an illness caused by a bacterium which may be transmitted by the bite of the tick Ixodes dammini, commonly referred to as the deer tick. Not all ticks are infected with the bacterium; however, when an infected tick bites, the bacterium is passed into the bloodstream of the host where it multiplies. The deer tick is commonly found onsite living in grassy and wooded areas feeding on mammals such as mice, shrews, raccoons, opossums, deer, and humans.



The illness typically occurs in the summer and is characterized by a slowly expanding red rash that develops in a few days to a few weeks after the bite of an infected tick. This may be accompanied by flu-like symptoms along with headache, stiff neck, fever, muscle aches, and/or general malaise. At this stage, treatment by a physician usually is effective. If left alone, these early symptoms may disappear, but more serious problems may follow. The most common late symptom of the untreated disease is arthritis. Other problems which may occur include meningitis, neurological abnormalities, and cardiac abnormalities. It is important to note that some people do not get the characteristic rash and progress directly to the later manifestations. Treatment of later symptoms is more difficult than early symptoms and is not always successful.

Rocky Mountain spotted fever disease is transmitted by the infected dog tick, Dermacentor variabilis and is common in the eastern and southern United States. It is important to note that the dog tick is significantly larger than the deer tick, previously discussed. Nearly all cases of rocky mountain spotted fever occur in the spring and summer, generally several days after exposure to infected ticks. The onset of illness is abrupt, often with high fever, headache, chills, and severe weakness. After the fourth day of fever, victims develop a spotted pink rash, which usually starts at the hands and feet and gradually extends to most of the body.

Tick Avoidance Procedures:

When in an area suspected of harboring ticks (grass, bushes, woodland) the following precautions can minimize the chances of being bitten by a tick:

- Wear TYVEX suits with taped cuffs and sleeves.
- Wear light colored clothing so ticks can be easily spotted.
- Wearing tick repellents may be useful.
- Inspect clothing frequently while in tick habitat.



First Aid For Tick Bites:

Inspect your head and body thoroughly when you return from the field. Removal of ticks is best accomplished using small tweezers. Do not squeeze the tick's body. Grasp it where the mouth parts enter the skin and tug gently, but firmly, until it releases its hold on the skin. Save the tick in a jar labeled with the date, body location of the bite, and the place where it may have been acquired.

Wipe the bite thoroughly with an antiseptic and seek medical attention as soon as possible. The various stages and symptoms of both diseases are well recognized and if detected, can be treated with antibiotics. Early detection and treatment with antibiotics significantly reduces the severity of both Lyme disease and Rocky Mountain spotted fever.

SPIDERS

Almost all of the 30,000 species of spiders are venomous, but only a relatively small number have fangs long and strong enough to penetrate the human skin. Spiders are generally found in dark protected areas such as access ways to sanitary sewers, under ledges, in protective casings of monitoring wells, pump housings, buildings, portable toilets, and manhole covers.

The black widow spider ranges in color from gray to brown to black, depending on the species. The abdomen is shiny black with a red hourglass or red spots. Although both male and female are venomous, only the latter has fangs large and strong enough to penetrate the human skin. Mature females range in body length from 10 to 18 mm. The person bitten may recall receiving a sharp, pinprick-like bite, but in some cases the bite is so minor that it goes unnoticed. Rarely is there any local skin reaction. The initial pain is sometimes followed by a dull, occasionally numbing pain in the affected extremity, and by pain and cramps in one or several of the large body muscles. Sweating and weakness are common, as well as varying degrees of headache and dizziness. The lymph nodes in the region of the bite will often be tender or painful. In severe cases, there is rigidity of the abdominal muscles and pain in the lower back, thighs, or abdomen. There is no effective first-aid treatment. Treat for shock and transport to the nearest medical facility.



The brown recluse or violin spider has an abdomen which ranges in color from grayish through orange and reddish-brown to dark brown. The back shell of the "violin" is brown to blackish and distinct from the pale yellow to reddish-brown background of the head and chest. This spider has 6 eyes grouped in 3 diads. Both male and female are venomous. They average 6 to 12 mm in body length. The bite of this spider produces about the same degree of pain as the sting of an ant, but sometimes the person is completely unaware of the bite. In most cases, a localized burning sensation develops which may last for 30 to 60 minutes. The area often itches, becomes red and warm, with a small blanched area around the immediate bite site. The reddened area enlarges and becomes purplish during the subsequent one to eight hours. A small blister forms at the bite site, increases in size and subsequently ruptures. The whole area may become swollen and painful. Other signs and symptoms include fever, malaise, stomach cramps, nausea and vomiting. In severe cases, there may be breakdown of the red blood cells, renal failure, or death. All first aid measures should be avoided as the natural appearance of the bite is most important in determining the diagnosis. A cube of ice may be placed on the wound. Transport to the nearest medical facility.

First Aid For Spider Bites

First Aid for spider bites includes applying ice to the bitten area and keeping that area below the heart level to slow circulation of the venom. The individual should seek medical advice. If the situation appears to be life threatening (onset of anaphylactic reaction), Call military 17 or commercial 676-0960 and observe victim for shock.

3.3.5 Poisonous Snakes

Snake Avoidance Procedure

The best avoidance procedure is to be familiar with snake habitat, and observant in the field. Snakes can be found under debris, manhole covers, or overgrown vegetation. All field personnel will exercise caution and maintain alertness to this hazard when in the field.



First Aid For Snake Bites

All reactions from snakebites are aggravated by acute fear and anxiety. The severity of local and general reaction from poisonous snakebite depends upon the amount of venom injected and the speed of absorption of venom into the victim's circulation, the size of the victim, the protection from clothing, including shoes and gloves, the speed at which antivenom therapy can be provided, and the location of the bite.

The extremely painful characteristics of a pit viper bite (e.g., rattlesnake, copperhead) include rapid swelling that can be identified by one or more puncture wounds created by the fangs. The skin is usually marked with general discoloration. Symptoms may include general weaknesses, rapid pulse, nausea and vomiting, shortness of breath, dimness of vision, and shock.

There are three objectives in the administration of first aid for snake bites. The first is to reduce the circulation of blood through the bite area, the second is to delay the absorption of the venom, and the third is to prevent aggravation of the local wound and to sustain respiration.

The most important first aid step is to get the snakebite victim to medical assistance quickly. Meanwhile:

- Keep the victim still and as calm as possible, preferably in a prone position.
- Immobilize the bitten extremity and keep it at or below heart level. Transport the victim to the hospital. If the victim can reach medical assistance before symptoms develop (usually 4-5 hours), no further first aid measures need be applied.
- If mild-to-moderate symptoms develop before a hospital can be reached, apply a constricting band 2 to 4 inches above the bite, but not around the head, neck or trunk. The band should be 3/4 to 1/2 inches wide, not thin like a rubber band. The band should be snug but loose enough for a finger to be slipped underneath. Watch for swelling. Loosen the band if it becomes too tight, but do not remove it. Periodically check the pulse in the extremity beyond the bite to insure that the blood flow has not stopped.



- If moderate to severe symptoms develop while still on the facility, consider the situation life-threatening and call military 17 or commercial 676-0960 for medical assistance.

Several other factors must be considered in cases of snakebite:

- **Shock.** Keep the victim lying down and comfortable, and maintain his/her body temperature.
- **Breathing and heartbeat.** If breathing stops, give mouth-to-mouth resuscitation. If breathing stops and there is no pulse, perform CPR as you have been trained to do.
- **Identify the snake.** If you can kill the snake without risk or delay, bring it to the hospital for identification, but exercise extreme caution in handling the snake.
- **Cleaning the bitten area.** You may wash the bitten area with soap and water and blot it dry with sterile gauze. You may apply dressings and bandages, but only for a short period of time.
- **Medicine to relieve pain.** Do not give the victim alcohol, sedatives, aspirin, or any medicine containing aspirin. Some painkillers, however, may be given. Consult a doctor or other medical personnel for specific medications that may be used.
- **Snakebite kits.** Keep a kit accessible for all outings in primitive areas or areas known or suspected to be snake infested.

It is not recommended that cold compresses, ice, dry ice, chemical ice packs, spray refrigerants, or other methods of cold therapy be used in the first aid treatment of snakebite.

3.3.6 Animal Bites

Wildlife found on the site (e.g., raccoons, skunks, foxes) usually avoid people. Unhealthy or threatened wildlife may be aggressive. Potential hazards due to animal bites are best controlled by cautiously entering new areas and avoiding animals whenever they are spotted. If bitten, the victim should be transported immediately to receive proper medical attention. The condition and behavior of the animal should be noted and reported to the physician.



3.3.7 Chemical Agents

There is potential that, during the field survey, military chemical agents may be encountered. These agents include nerve agents, blood agents, choking agents, incapacitating agents, irritant or riot control agents, vomiting agents, and blistering agents. All JEG personnel working at APG-EA have undergone the training provided by APG personnel concerning military chemical agents (e.g., Toxic Aid Briefing) and are capable of recognizing agent symptoms and performing the required first aid/self aid procedures. Training records are maintained by the CHSD and at the home offices of the project personnel. Should JEG personnel find containers suspected of containing chemical agents, these areas will be evacuated immediately and Military 17 will be called. This section describes the symptoms of agent exposure and the treatment for each agent.

3.3.7.1 Nerve Agents. Some nerve agents are Tabun (GA), Sarin (GB), Soman (GD) and VX. These act by inhibiting cholinesterase enzymes throughout the body. Effects of these agents vary, depending upon the form of the agent, route of exposure, and degree of concentration. Routes of exposure can be by inhalation or skin absorption.

Symptoms of Nerve Agent Exposure:

The symptoms associated with moderate inhalation exposure include dimming of vision due to severe constriction of the pupils (miosis), runny nose (rhinorrhea), and tightness in the chest. The symptoms associated with moderate skin contact exposure copy those of inhalation with the addition of localized sweating and muscle reaction at the site of exposure.

The symptoms associated with severe inhalation or skin contact exposure include nausea, convulsions, and respiratory arrest.



First Aid for Nerve Agents:

Speed in getting medical assistance is extremely important.

- Don mask immediately;
- Move victim to clean area;
- Request medical assistance (dial military 17 or commercial 676-0960);
- Remove contaminated clothing and thoroughly wash skin, using nominal 5% sodium hypochlorite (household bleach).
- Monitor victim while awaiting medical support. Upon appearance of symptoms beyond miosis, administer the two injectors from the Nerve Agent Antidote Kit, Mark I (atropine, small autoinjector first), holding the injector against the thigh for at least 10 seconds. Follow immediately with the second injector (2-PAM CL, large autoinjector) and inject in the thigh, holding the injector against the thigh for at least 10 seconds. Administer the antidote kit every 5 to 20 minutes, if symptoms persist or recur, with a maximum of 3 sets. No more injections will be administered unless advised by medical personnel. Save spent injectors as a positive means of determining number of autoinjectors used. Used injectors should be clipped to victim's shirt.
- Administer CPR, if indicated. Mouth-to-mouth resuscitation should be used when approved mask-bag or oxygen delivery systems are not available. If facial contamination exists, do not use mouth-to-mouth resuscitation.

3.3.7.2 Blood Agents. Speed in getting medical assistance is extremely important. Some of the blood agents are hydrogen cyanide (AC) and cyanogen chloride (CK). Primary site of action is the central nervous system, particularly the respiratory functions, by inhibiting cytochrome oxidase and interfering with cell utilization of oxygen. Inhalation is the usual route of entry.

Symptoms of Blood Agent Exposure:

The symptoms of moderate exposure include vertigo, nausea, and headache, followed by convulsions and/or coma. At high concentrations, symptoms include



deep, rapid breathing, violent convulsions after 15 to 20 seconds, cessation of regular breathing within 1 minute, and termination of heart action shortly thereafter.

First Aid for Blood Agents:

Speed in getting medical assistance is extremely important.

- Don mask immediately;
- Move victim to clean area;
- Request medical assistance (dial military 17 or commercial 676-0960);
- Administer CPR, if indicated. Mouth-to-mouth resuscitation should be used when approved mask-bag or oxygen delivery systems are not available. If facial contamination exists, do not use mouth-to-mouth resuscitation.

3.3.7.3 Choking Agents. Phosgene (CG) is the best known choking agent. It causes irritation to the upper respiratory tract, damaging the air passages in the lungs, and causing them to fill with liquid (pulmonary edema).

Symptoms of Choking Agent Exposure:

The symptoms of exposure to choking agents include coughing, choking, tightness in the chest, nausea, occasional vomiting, headache, lacrimation, followed by pulmonary edema, rapid shallow breathing, and painful cough and cyanosis. Symptoms may be delayed or they may occur and then disappear for up to 24 hours, and then recur as pulmonary edema develops. Seeking medical treatment as soon as possible is essential.

First Aid for Choking Agents:

Speed in getting medical assistance is extremely important.



- Don mask immediately;
- Move victim to clean area and remove mask;
- Request medical assistance (dial military 17 or commercial 676-0960);
- Observe victim;
- Provide drainage from victim's mouth to prevent aspiration;
- Administer CPR, if indicated. Mouth-to-mouth resuscitation should be used when approved mask-bag or oxygen delivery systems are not available. If facial contamination exists, do not use mouth-to-mouth resuscitation.

3.3.7.4 Incapacitating Agents. Incapacitating agents are hallucinogens (e.g., BZ), that produce mental confusion and lack of coordination. These agents are absorbed by inhalation or ingestion. Symptoms are similar to alcoholic intoxication; therefore, a medical identification bracelet or card should be worn or carried to prevent misdiagnosis. Symptoms may occur for up to several hours after exposure.

Symptoms of Exposure to Incapacitating Agents:

Symptoms of exposure include rapid heartbeat, dizziness, vomiting, extremely dry mouth and blurred vision.

First Aid for Incapacitating Agents:

- Don mask immediately;
- Move victim to clean area and remove mask;
- Keep victim calm; restrain if needed;
- Request medical assistance (dial military 17 or commercial 676-0960);
- Observe victim and provide ventilation;
- Keep body temperature down.



3.3.7.5 Irritant or Riot Control Agents. These agents produce temporary effects with no long-term damage. These are the "tear agents" such as CS and CN. Their effect is localized, irritating the eyes and upper respiratory tract.

Symptoms of Exposure to Irritant or Riot Control Agents:

The primary symptom of exposure is tearing. Secondary exposure symptoms include nausea and vomiting.

First Aid/Self Aid for Irritant or Riot Control Agents:

- Don mask and evacuate area;
- Once in fresh air, remove mask and flush eyes with clean water;
- Dial military 17 or commercial 676-0960 for medical assistance.

3.3.7.6 Vomiting Agents. Examples of vomiting agents are DM, DA and DC.

Symptoms of Exposure to Vomiting Agents:

The primary symptom is tearing while the secondary symptom at high concentrations is nausea and vomiting.

First Aid/Self Aid for Vomiting Agents:

- Don mask immediately-lift mask from face briefly if necessary to permit vomiting or to drain saliva from the face;
- Remove victim from area;
- Dial military 17 or commercial 676-0960 for medical assistance.

3.3.7.7 Blistering Agents. Symptoms of Blistering Agents:

Blistering agents (mustard, HD, H, HT, and L) cause cell damage upon contact. Skin contact can cause effects ranging from reddening to severe blistering. The



eye is most vulnerable to mustard either by liquid or vapor contact. Symptoms include localized reddening and gritty feeling in the eye. Long exposure to low concentrations or exposures to high concentrations can result in permanent eye damage and/or blindness. Upper respiratory tract damage is caused by inhalation of vapors or aerosol. Symptoms include respiratory distress similar to a chest cold. Severe exposure can cause secondary infection such as bronchial pneumonia.

First Aid for Blistering Agents:

Cell damage from blistering agents occurs within 2 minutes of exposure. It is very important to decontaminate the exposed area immediately with soap and water and follow with nominal 5% household bleach solution within 2 minutes. If the eye is exposed, flush with water only. Once emergency decontamination has been performed, dial military 17 or commercial 676-0960 for medical assistance

3.3.8 Unexploded Ordnance

It is unlikely that unexploded ordnance (UXO) will be encountered during groundwater monitoring activities. (Figure 3-4 is a graphic representation of common UXO.) Therefore, it is assumed that UXO screening will not be necessary for this task. However, if suspected unexploded ordnance are encountered, the area will be marked with a red flag and will be evacuated immediately. The field team will dial military 17 or commercial 676-0960 and state the nature of the emergency.

3.3.9 Slips, Trips and Falls

Avoidance Procedures

All field personnel will become familiar with the general terrain and the potential physical hazards such as ravines, pot holes, loose gravel and/or debris that would be associated with the accidental risk of slips, trips, and/or falls. Slips, trips and falls may result in bleeding injuries and/or fractures, dislocations, sprains or strains.



First Aid for Slips, Trips and Falls

In the case of bleeding injuries such as abrasions, incisions, punctures, lacerations, or avulsions, move the victim to a clean area and apply direct pressure to control bleeding. If bleeding does not stop elevate the wound above the heart and continue applying direct pressure. Transport the individual to the appropriate facility for medical treatment. In situations that are not life-threatening, transport the individual to the off post Edgewood Health Clinic. In life-threatening situation, call military 17 or commercial 676-0960 for medical assistance.

In the case of fractures, dislocations, sprains, control bleeding, treat for shock, and monitor airway circulation and breathing. Transport the individual for medical treatment. In life-threatening situations, call military 17 or commercial 676-0960 for medical assistance.

3.3.10 Noise

Noise is not expected to pose a hazard for this groundwater monitoring project. If a noisy environment is encountered, hearing protection must be worn in areas where noise levels are at the permissible exposure limit (PEL) of 85 dBA or greater. A good rule of thumb for knowing when hearing protection is required is when at 3 feet apart in normal conversation, voices must be raised to be heard. If indicated, a Type II sound level meter will be used to measure sound levels and verify the need for hearing protection. Hearing protection shall be specified by the SHSC or CHSD based upon measured levels at the site.

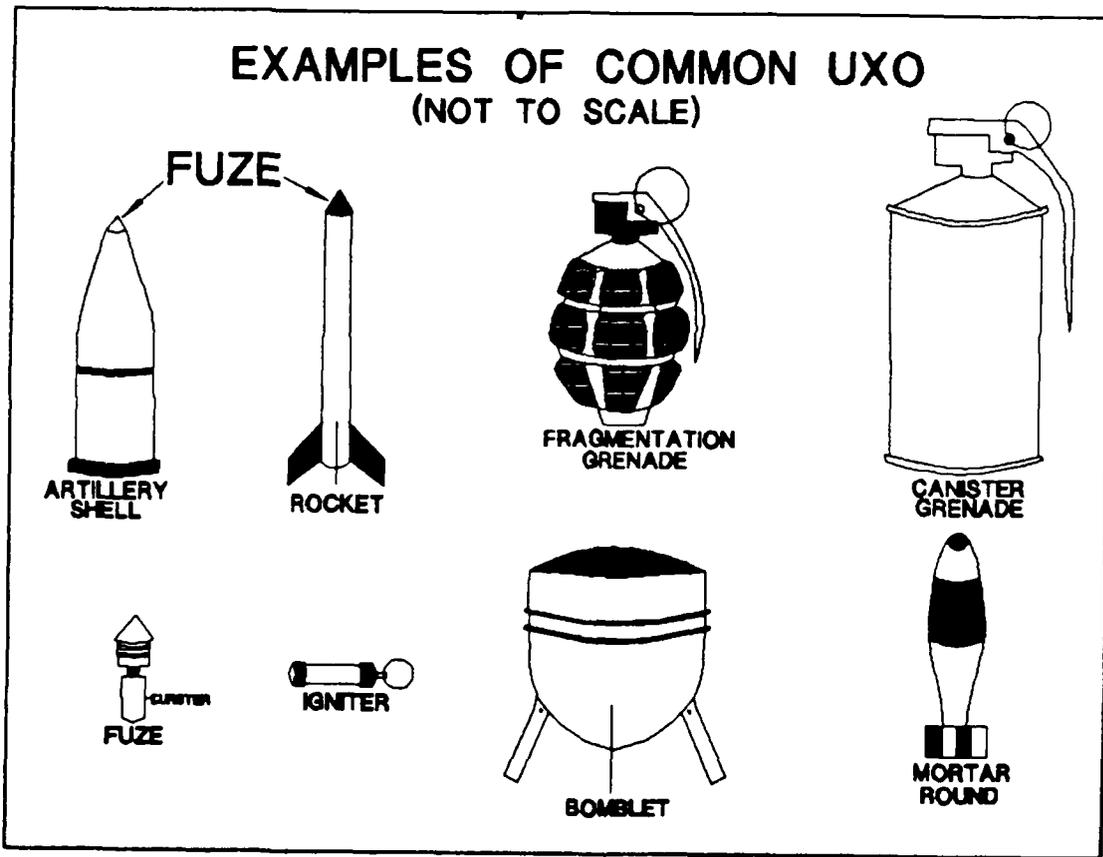
3.3.11 Precariously Positioned Objects

Field personnel shall become familiar with the general area and the potential physical hazards which would be associated with debris or objects (e.g., drums, pallets, boards) that may be piled or scattered around the sampling sites. If objects are stacked in an unsafe manner, the SHSC shall notify the APG point-of-contact (POC). Field activities shall not begin until APG personnel remove or restack the objects in a safe manner.



bleeding. If bleeding does not stop elevate the wound above the heart and continue applying direct pressure. Transport the individual to the appropriate facility for medical treatment. In situations that are not life-threatening, transport the individual to the off post Edgewood Health Clinic. In life-threatening situation, call military 17 or commercial 676-0960 for medical assistance.

Figure 3-4



3.3.12 Utility Lines

Utility lines both above and below ground may pose a hazard to team members during field activities. Personnel must maintain a safe clearance (at least 15 feet) from overhead utility lines at all times.

3.3.13 Walking and Working in Open Terrain

Field personnel shall become familiar with the general terrain of the site and potential physical hazards (storm water management ponds, uneven terrain) which would be associated with accidental slips, trips, and/or falls.

- The immediate period after medium and heavy rain fall is particularly susceptible to earth movement and slides; greater caution is prudent during these periods.
- Be attentive where you walk since wells, pits, holes, or similar hazards may be partially covered or visually obstructed.
- Be cautious around soil or terrain which recently may have been disturbed, relocated, or otherwise made less stable.
- Avoid the top edges of drop-off areas whether they have been disturbed or not.
- Travel in open terrain in the company of another person.

3.3.14 Lightning

Electrical storms commonly occur in the APG-EA region during spring, summer and fall. The resulting lightning poses a safety hazard to field personnel. Since the storms are often fast moving, field personnel should watch for indications of electrical storms - particularly when such storms are forecast (should be covered in daily health and safety meeting). The distance to an electrical storm can be estimated by observing the interval between the lightning flash and the sound of thunder. Since sound travels approximately 1,100 feet per second, an interval of 5 seconds corresponds to a storm distance of approximately 1 mile. If an electrical storm is observed within 3 miles of the site, field personnel should cease outside activities and proceed to the site office for further



instructions. If caught in the open by an electrical storm, all personnel will immediately seek shelter in their vehicle and proceed as above. In the event that their vehicle is inaccessible, they will move to a topographically low area away from tall objects and conductors (e.g., transformers, power lines, metal sheds) and wait for the storm to leave the area.

3.4 PHYSICAL (SAFETY) HAZARDS AND CONTROLS

The following are safety hazards both specific to this site and general to most site work.

<u>Hazard</u>	<u>Engineering or Administrative Controls</u>
Flying debris/objectives	Provide shielding and personal protective equipment.
Noise > 85 dBA	Noise protection and monitoring required.
Steep terrain/unstable surface	Brace and shore equipment.
Build-up of explosive gases	Provide 20-lb A,B,C fire extinguisher, ventilation and monitoring.
Build-up of static electricity	No spark sources within 50 feet of an excavation, heavy equipment or UST removal. Ground as appropriate.
Gas cylinders	Make certain gas cylinders are properly anchored and chained.
High pressure hose rupture	Check that fittings and pressurized lines are in good repair before using. Secure all lines to prevent whipping.
Electric Shock	Make certain equipment is properly grounded. Do not modify electrical wiring unless qualified to do so.
Suspended loads	Work not permitted under suspended loads.
Moving vehicles	Backup alarm required for heavy equipment. Observer remains in contact with operator and signals safe backup. Personnel to wear high visibility vests and remain outside of turning radius.
Overhead electrical wires	Heavy equipment to remain at least 15 feet from overhead powerline for powerlines of 50 kV or less. For each kV > 50 kV increase distance by 1/2 foot.
Muddy work areas	Use wood pallets of similar devices in muddy work areas.
Back injury	Use proper lifting techniques or mechanical lifting aids.
Protruding objects	Flag and/or pad visible objects.



3.5 DESCRIPTION OF FIELD ACTIVITIES

This task is designed to sample groundwater monitoring wells in the Canal Creek Area of APG-EA. Field activities include locating the wells, purging the wells, sampling the wells, and decontaminating the field equipment used to complete the task. The Groundwater Sampling and Analysis Plan for the Canal Creek Area details the specific pre-sampling, sampling and post-sampling activities.



4.0 TRAINING

Canal Creek Area, APG-EA, Maryland

Groundwater Monitoring Plan, Volume III

All personnel working at APG-EA in connection with this groundwater sampling and analysis project shall have received hazardous waste site worker training in accordance with 29 CFR 1910.120(e). This includes 40-hour initial training and annual 8-hour refresher training as required for all site workers, as well as 8-hour supervisor/manager training for the Project Manager, Task Manager, and SHSC.

Personnel training records are maintained at the offices of the various project participants. Copies of personnel training records, verifying workers training and dates, shall be provided to the SHSC prior to the start of the project and maintained on site at all times during the project. Onsite copies shall include as a minimum the dates of initial training and the most recent refresher training. The SHSC is responsible for ensuring that all project personnel have received their annual training and qualify to work on the project.



Jacobs Engineering Group Inc.
Washington Operations

All personnel shall be included in a hazardous waste workers medical surveillance program consistent with the regulations and guidelines set forth in 29 CFR 1910.120(f) and 29 CFR 1910.134.

Personnel medical records are maintained at the offices of the various project participants or contracted medical providers. Copies of medical documentation, certifying each worker medically qualified to wear a respirator and work with hazardous materials, shall be provided to the SHSC prior to the start of the project. These copies shall be maintained onsite at all times during the project. The on-site copies shall include the date of the individual's last exam, a statement certifying the individual medically qualified, and a physician's signature. The SHSC is responsible for ensuring that all project personnel have received their annual exam and are currently medically qualified to work on the project. Additionally, all field personnel will have baseline cholinesterase (Category C) conducted at Kirk Army Health Clinic, Edgewood Area, Building E4110.



6.1 EQUIPMENT SPECIFICATION

6.1.1 All Sites

Standing upwind from the well head, field team members will take PID readings at the well head and in the breathing zone. If breathing zone PID readings are not sustained above background levels or if identified vapor levels are less than the action level sampling activities may begin. If breathing zone readings are sustained above background, the Site Health and Safety Coordinator may upgrade the levels of protection until air monitoring can be conducted to identify the contaminant(s). Sampling activities may also be suspended in selected wells until airborne contaminants are identified. Level B respiratory protection is not anticipated during the groundwater sampling project. Table 6-1 summarizes PPE considerations.



TABLE 6-1

PPE CONSIDERATIONS

Task	Level	Body	Foot (ANSI Z 41.1)	Head (ANSI Z 89.1)	Eye (ANSI Z 87)	Hand	Respirator (ANSI Z 88.2)
Minimum for field work	D	<ul style="list-style-type: none"> Disposable Tyvek coveralls 	<ul style="list-style-type: none"> Steel toe/shank leather safety shoes/boots 	<ul style="list-style-type: none"> Hardhat 	<ul style="list-style-type: none"> Safety glasses 	<ul style="list-style-type: none"> None required 	<ul style="list-style-type: none"> None required
Sampling	Modified D	<ul style="list-style-type: none"> Disposable coated Tyvek coveralls resistant to permeation by contaminated groundwater 	<ul style="list-style-type: none"> Steel toe/shank leather safety shoes/boots with neoprene or nitrile show/boot covers OR neoprene or nitrile boots with steel toe/shank 	<ul style="list-style-type: none"> Hardhat 	<ul style="list-style-type: none"> Safety glasses or goggles 	<ul style="list-style-type: none"> Inner gloves: N-Dex, latex rubber or nitrile Outer gloves: Nitrile 	<ul style="list-style-type: none"> None required
Sampling	C	<ul style="list-style-type: none"> Same as Level D or modified Level D as specified by SHSC 	<ul style="list-style-type: none"> Steel toe/shank leather safety shoes/boots with neoprene or nitrile show/boot OR nitrile boots with steel toe/shank 	<ul style="list-style-type: none"> Hardhat 	<ul style="list-style-type: none"> Safety glasses or goggles 	<ul style="list-style-type: none"> Inner gloves: N-Dex, latex rubber or nitrile Outer Gloves: Nitrile 	<ul style="list-style-type: none"> Full face air purifying respirator, MSA Ultratwin or equivalent, equipped with GMC-H cartridges for protection against organic vapors, acid gases, dusts, fumes, and mists (Optional) Full face Powered Air Purifying Respirator (PAPR) with cartridges equivalent to above

6.2 REASONS TO UPGRADE OR DOWNGRADE LEVEL OF PROTECTION

UPGRADE	DOWNGRADE
<ul style="list-style-type: none">• Request of individual performing task.• Change in work task that will increase contact or potential contact with hazardous materials.• Occurrence or likely occurrence of gas or vapor emission.• Known or suspected presence of dermal hazards.• Personnel air monitoring results exceed action level for the level of protection currently in use.	<ul style="list-style-type: none">• New information indicating that situation is less hazardous than originally thought.• Change in site conditions that decreases the hazard.• Change in work task that will reduce contact with hazardous materials.

7.0 AIR MONITORING

Canal Creek Area, APG-EA, Maryland

Groundwater Monitoring Plan, Volume III

7.1 ENVIRONMENTAL

7.1.1 Equipment Specifications

Table 7-1 Summarizes specifications for relevant monitoring equipment.

**TABLE 7-1
MONITORING EQUIPMENT SPECIFICATIONS**

Instrument	Tasks	Action Levels	Frequency	Calibration
Dust Monitor: Mini Ram	All Dust Producing Tasks, except perimeter, or off site activities	0-1.0 mg/m ³ ^{ab} Level D >1.0-8.4 mg/m ³ ^{ab} Level C >8.4 mg/m ³ ^{ab} Stop work; re-evaluate	When visible dust is present in worker's breathing zone, and at 15 minute intervals while elevated readings are sustained.	Zero Daily Pre and Post-Use
Noise Level Meter:	All Tasks	Noise measurements are required when voice must be raised to communicate at a distance of three feet or less.	Initial measurement and additional when operations change and noise levels increase above 85 dBA	Daily - Pre and Post Use.
Photoionization Detector (PID): e.g., Photovac Microtip with 10.6eV lamp	All Tasks	Measurements taken in the breathing zone Background (BG) Level D >BG-5.0 ppm ^{ab} Level C >5.0 ppm ^{ab} Level B; use colorimetric tubes to identify contaminants; reevaluate and either downgrade; stop work; or continue sampling in Level B.	In the employee breathing zone at the beginning of operations and at intervals during sampling activities. The intervals will be determined by the sampling team or when odors are noticed	Daily - Pre and Post Use.

TABLE 7-1 (Continued)
MONITORING EQUIPMENT SPECIFICATIONS

Instrument	Tasks	Action Levels	Frequency	Calibration
Flame Ionization Detector (FID): OVA-128 or equivalent.	All Tasks	Measurements taken in the breathing zone Background (BG) (excluding methane) >BG-5.0 ppm ^{ab} Level D (excluding methane) >5.0 ppm ^{ab} Level C (excluding methane) >5.0 ppm ^{ab} Level B; use colorimetric tubes to identify contaminants; reevaluate and either downgrade; stop work; or continue sampling in Level B.	In the employee breathing zone at the beginning of operations and at intervals during sampling activities. The intervals will be determined by the sampling team or when odors are noticed.	Daily - Pre and Post Use.
Colorimetric Tubes: e.g., methylene chloride, methane, carbon tetrachloride	All Tasks	0-12.0 ppm ^{ab} Level D >12-25 ppm ^{ab} Level C >25-100 ppm ^{ab} Level B >100 ppm ^{ab} Stop work; re-evaluate	When PID or OVA readings exceed 5.0 ppm in the breathing zone and every 15 minutes while readings are sustained.	Pump Calibration: Daily - Pre and Post Use.
Colorimetric Tubes: Toluene and Xylene	All Tasks	0-50 ppm ^{ab} Level D >50-500 ppm ^{ab} Level C 500-1000 ppm ^{ab} Level B >1000 ppm ^{ab} Stop work; re-evaluate	When PID or OVA readings exceed 5.0 ppm in the breathing zone and every 15 minutes while readings are sustained.	Daily - Pre and Post Use.
Combustible Gas Indicator	All Tasks	0-10% expl Level D >10-20% expl Level C >20% expl Stop work; re-evaluate	While working in a landfill whenever OVA readings exceed 5.0 ppm in the breathing zone and every 15 minutes while readings are sustained.	Daily - Pre and Post Use.

ab = above background

* This HASP must be revised and approved prior to implementation of Level B work.

expl = explosive limit



Jacobs Engineering Group Inc.
Washington Operations

7.1.2 Calibration Specification

Table 7-2 Summarizes calibration specifications for relevant monitoring instruments.

**TABLE 7-2
CALIBRATION SPECIFICATIONS**

Instrument	Gas	Span	Reading	Method
PID: Microtip, 10.6 eV probe	100 ppm isobutylene	9.8 ± 2.0	55 ppm	1.5 l/m reg T-tubing 0.25 l/m reg direct tubing
FID: OVA -128	100 ppm methane	3.0 ± 1.5	100 ppm	1.5 l/m reg T- tubing
CGI: MSA 260, 261, 360, or 361	0.75 pentane	N/A	50% LEL ± 5 % LEL	1.5 l/m reg direct tubing

7.2 PERSONAL

If elevated levels of specific substances are detected using the colorimetric tubes, the SHSC shall initiate personal air monitoring and notify the CHSD by the end of the day.



8.1 SITE CONTROL PROCEDURES

- Limit access to the sampling location(s) by cordoning off the area with "caution do not enter" barricade tape.
- Maintain a copy of this HASP readily available to employees who may be exposed during this site work.
- Establish onsite communications. These should consist of:
 - Line of sight/hand signals,
 - Horn, or
 - Two-way radio or cellular phone
- Establish offsite communications.
- Set a wind indicator to readily determine wind direction.
- Establish and delineate contiguous work zones (exclusion [EZ], contamination reduction [CRZ], and support [SZ]). The latter 2 zones should be upwind of the EZ unless obstacles are such that this is not feasible.
- Establish decontamination and waste disposal procedures.

8.2 WORK PRACTICES

- In the event that any unforeseen hazards become apparent in the field necessitating greater precautions than what is specified in this HASP, the SHSC shall suspend field operations until this HASP has been revised and approved accordingly.
- The "buddy system" is to be used at all times.
- Maintain copy of the site entry log (Attachment 4).
- Dust suppression methods shall be implemented when required to minimize unwanted emissions.
- Personnel shall position themselves upwind of sampling locations.
- Personnel shall avoid visibly contaminated areas as much as possible.
- Eating, drinking, or smoking is not permitted in exclusion or contamination reduction zones where access is restricted.
- SHSC shall establish areas for eating, drinking, smoking. Drinking water and cups to be supplied in support area.



- Chemicals brought on site shall be stored in properly labeled containers and where they are unlikely to be accidentally disturbed.
- Site work shall be performed during daylight hours only.
- If toilet facilities are not located within a 3-minute walk from the decontamination area, either provide a chemical toilet and hand washing facilities, or have a vehicle available (not the emergency vehicle) for transport to nearby facilities.

8.3 DISPOSAL OF WASTE MATERIALS GENERATED ONSITE

- Containerize groundwater in a dedicated tank truck or in separate 55-gallon drums. Label the container(s) and move it/them to the temporary staging area specified by the APG point-of-contact (POC). Containers may not be transported offsite for disposal until analytical results of collected samples have been received and the container contents have been classified accordingly. Hazardous waste containers shall be transported by a registered hauler to a permitted treatment, storage, and disposal facility. Representatives from the Hazardous Waste Branch of the Environmental Management Division must sign hazardous waste manifests. Solid trash and PPE which has been contaminated at concentrations sufficient to be classified as hazardous waste shall also be disposed of as hazardous waste.
- Solid trash, i.e., disposable PPE and items used in the work zones which are not contaminated at concentrations sufficient to be classified as hazardous waste, shall be containerized and disposed of as industrial solid waste with other trash generated onsite.
- Decontamination water resulting from personnel and equipment decontamination activities will initially be considered hazardous waste. Representative samples of the water will be tested for RCRA characteristics. Upon review of sample results, a determination will be made by the APG POC or his designee regarding handling and/or disposal of these wastes.



9.1 DECONTAMINATION PROCEDURES

9.1.1 Samples and Equipment

The FTL verifies that equipment leaving the site is properly decontaminated according to the procedures outlined below. Documentation of decontamination must be made in the field log notebook that is a part of the permanent project file.

- **Sampling Equipment:** After use, decontaminate sampling equipment according to procedures found in the Sampling and Analysis Plan. Prior to removal from site, thoroughly wash the decontaminated sampling equipment with nonphosphate detergent and rinse with water.
- **Samples:** Wipe exterior of sample containers to remove visible contamination.
- **Heavy Equipment:** Scrape off dirt. Steam clean.
- **Vehicles:** Vehicles driven within the boundaries of the sites must be washed and the interior vacuumed before returning the vehicle to the office, rental agency, or to any person not named on this HASP. A commercial carwash is adequate for this purpose. Vehicles driven in the EZ, CRZ, or used to transport contaminated personnel or supplies must be steam cleaned inside and outside before leaving the CRZ.

9.1.2 Personnel

LEVEL D PPE

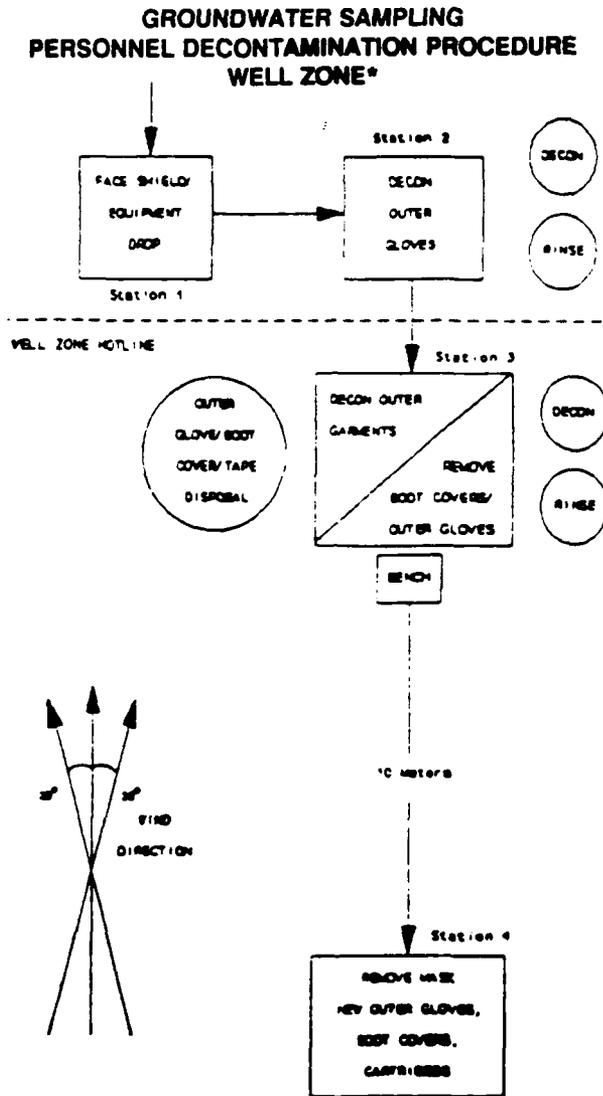
Wash and rinse gloves and boots with soap and water. Remove and dispose of gloves and coveralls. Wash hands and face with soap and water.

LEVELS B and C PPE

A decontamination schematic is provided as Figure 9-1; procedural details are described below.



Figure 9-1



*These decontamination procedures will be utilized when moving from one well zone to another within the exclusion zone.

Table 9-1

Decontamination Procedures

Decontamination Station	Decontamination Activity
Station 1: Equipment Drop	1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments) on plastic drop cloths. Segregation at the drop reduces the possibility of cross contamination. During hot weather operations, cool down station may be set up within this area.
Station 2: Wash Outer Garment and Boots	2. Scrub outer boots, outer gloves, and splash suit with an aqueous solution containing a nonphosphate detergent. Rinse using copious amounts of water. Remove tape.
Station 3: Remove Outer Boots and Gloves	3. Remove outer boots and gloves. Deposit in plastic lined container.
Station 4: Change Cartridge or Air Tank (Level B)	4. If worker leaves exclusion zone to change the change respirator cartridge or air tank, this is the last (Level C) step in the decontamination procedure. Exchange air tank or respirator cartridge, don new outer gloves and boot covers, tape joints, and return to duty.
Station 5: Remove Boots and Outer Garments	5. Boots, chemical-resistant splash suit and outer garments are removed and deposited in separate containers lined with plastic.
Station 6: Remove Respirator and Inner Gloves	6. Respirator is removed while avoiding touching face with inner gloves. Respirator deposited on plastic sheets and inner gloves into lined container.
Station 7: Personnel Wash	7. Hands and face are washed thoroughly. Shower as soon as possible.



9.1.3 Equipment and Supplies

Station Number	Decontamination Supplies
Station 1:	<ul style="list-style-type: none"> a. Various Size Containers b. Plastic Liners and Drop Cloths
Station 2:	<ul style="list-style-type: none"> a. Containers (20-30 gallons) b. Decontamination Solution (Alconox or other nonphosphate detergent) c. Rinse Water d. 2-3 Long-handled, Soft-bristled scrub brushes
Station 3:	<ul style="list-style-type: none"> a. Containers (20-30 gallons) b. Plastic Liners c. Bench or stools
Station 4:	<ul style="list-style-type: none"> a. Air tanks or masks and cartridges, depending upon level of protection b. Tape c. Boot Covers d. Gloves
Station 5:	<ul style="list-style-type: none"> a. Containers (20-30 gallons) b. Plastic liners c. Bench or stools
Station 6:	<ul style="list-style-type: none"> a. Plastic Sheets b. Basin or bucket c. Soap and towels d. Bench or stools
Station 7:	<ul style="list-style-type: none"> a. Soap and Water b. Tables c. Wash basin or bucket

10.1 PRE-EMERGENCY PLANNING

The SHSC performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with the facility and local emergency service providers as appropriate. Planning tasks performed by the SHSC include the following:

- Evaluate and document capabilities of local and Army emergency response teams.
- Verify local emergency contacts, hospital routes, evacuation routes, and assembly points.
- Notify appropriate emergency responders listed in Subsection 10.5 prior to site mobilization.
- Confirm and post emergency telephone numbers and route to hospital.
- Post site map marked with location of emergency equipment and supplies.
- Drive route to hospital.
- Designate one vehicle as the emergency vehicle; place a copy of this HASP, including the hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment and supplies.
- Establish emergency signals, evacuation routes, and onsite and offsite assembly points.
- Review emergency procedures for personnel injury (Subsection 10.3).
- Review names of onsite personnel trained in first aid and CPR.
- Review emergency response and post-emergency notification procedures.
- Rehearse the emergency response plan once prior to site activities.
- Point out to field team members where emergency response equipment is located in the support area.
- Brief new workers on the emergency response plan.

10.2 EMERGENCY EQUIPMENT AND SUPPLIES

- 20 pound A:B:C fire extinguisher (or equivalent)
- Industrial first aid kit
- Stretcher or blanket



- Two-way radio(s) or cellular phone
- Oral thermometer
- Digital pulse meter
- CPR masks/shields for certified personnel

10.3 EMERGENCY MEDICAL TREATMENT

- SHSC is to assume charge during a medical emergency until ambulance arrives, or injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR.
- Call ambulance and hospital, as appropriate.
- Determine if decontamination will make injury worse. If yes, seek medical treatment immediately.
- Make certain injured person is accompanied to emergency room by at least one field team member with the same employer.
- Provide hospital emergency personnel with a copy of the HASP.

10.4 EVACUATION

- Personnel are to leave the sampling location and assemble at designated assembly point upon detecting the emergency signal for evacuation.
- If emergency situation involves contamination of personnel, notify the local contact of emergency facility.
- If appropriate, SHSC and a "buddy" are to remain at/near sampling location after location has been evacuated to assist local responders and advise them of the nature and location of the incident.
- SHSC, or designee, is to account for field team members at the assembly point.
- SHSC is to write up incident report (per Subsection 10.6) as soon as possible after occurrence.



10.4.1 Evacuation Routes and Assembly Points

See Figures 10.1, 10.2, and 10.3 for evacuation routes. Assemble on the shoulder of the road at the gate.

**TO BE DESIGNATED AND DOCUMENTED BY THE SHSC DURING THE
EMPLOYEE HEALTH AND SAFETY BRIEFING.**

Route To Hospital: Refer to Figure 10-4.

**FOR EMERGENCIES INVOLVING CHEMICAL AGENTS OR LIFE-THREATENING
SITUATIONS CONTACT EDGEWOOD US ARMY CLINIC, BUILDING E4110**

PHONE: 17 (MILITARY), 676-0960 (COMMERCIAL)

Location of clinic: Refer to Figure 10-1

10.5 EMERGENCY RESPONSE CONTACTS

10.5.1 Emergency Phone Numbers

Primary Emergency Phone Numbers

Ambulance	Military 17, Commercial 676-0960
Hospital Emergency Care	17 or 676-0960
Poison Control Center	17 or 676-0960
Fire	17 or 676-0960
Police	17 or 676-0960
Explosives Unit	17 or 676-0960



Canal Creek Area, APG-EA, Maryland

Groundwater Sampling and Analysis Plan, Volume III

Secondary Emergency Phone Numbers

CHEMTREC	800-424-9300
TSCA Hotline	202-554-1404
CDC	404-452-4100 or 404-329-2888
National Response Center	800-424-8802
Pesticide Information Center	800-845-7633
EPA ERT Emergency	201-321-6660
RCRA Hotline	800-424-9346
Bureau of Explosives	202-835-9500
John Wrobel (Client Contact)	401-671-4840 671-3320

All off-post notifications must be coordinated through the APG POC or his designated representative.

10.5.2 Agent and Life-Threatening Emergencies

Hospital:	Edgewood U.S. Army Clinic
Location:	Building E-4110
Directions:	See Map (Figure 10-1)

10.5.3 Nonagent and Non Life-Threatening Emergencies

Hospital:	Fallston General Hospital
Address:	200 Milton Avenue Fallston, Maryland
Directions:	Exit post at Magnolia Gate and continue northwest on Route 152 to Route 1. Turn right on Route 1. Continue to Milton Avenue and turn left to hospital.
Telephone:	(410) 877-3700
Travel Time:	Approx. 12 minutes
Distance:	Approx. 7 miles



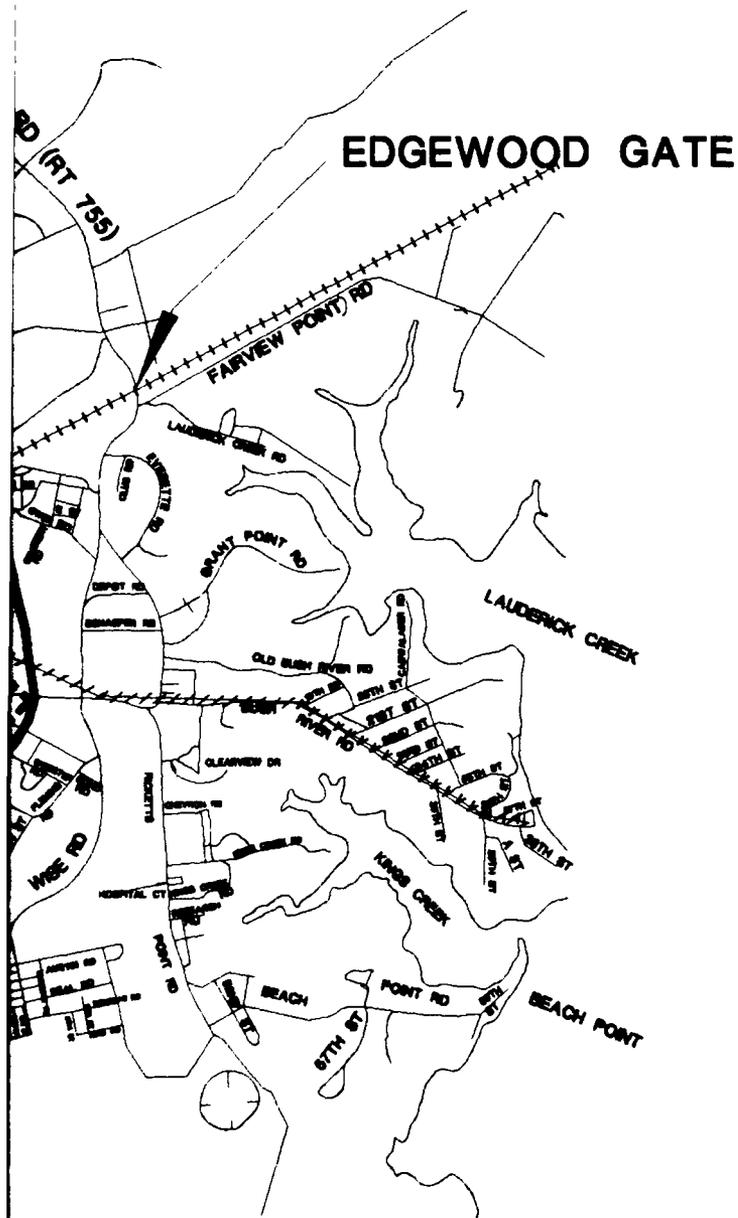
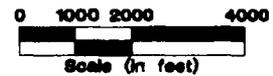
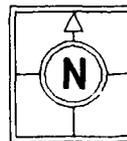


Figure 10-1

Evacuation Routes from
Evacuation Zone 1

-  Primary Route
-  Secondary Routes
-  Evacuation Zone Boundary



Site:
Edgewood Area - Aberdeen Proving Ground
Edgewood, Maryland

Jacobs Project
Number:
35-E358-02

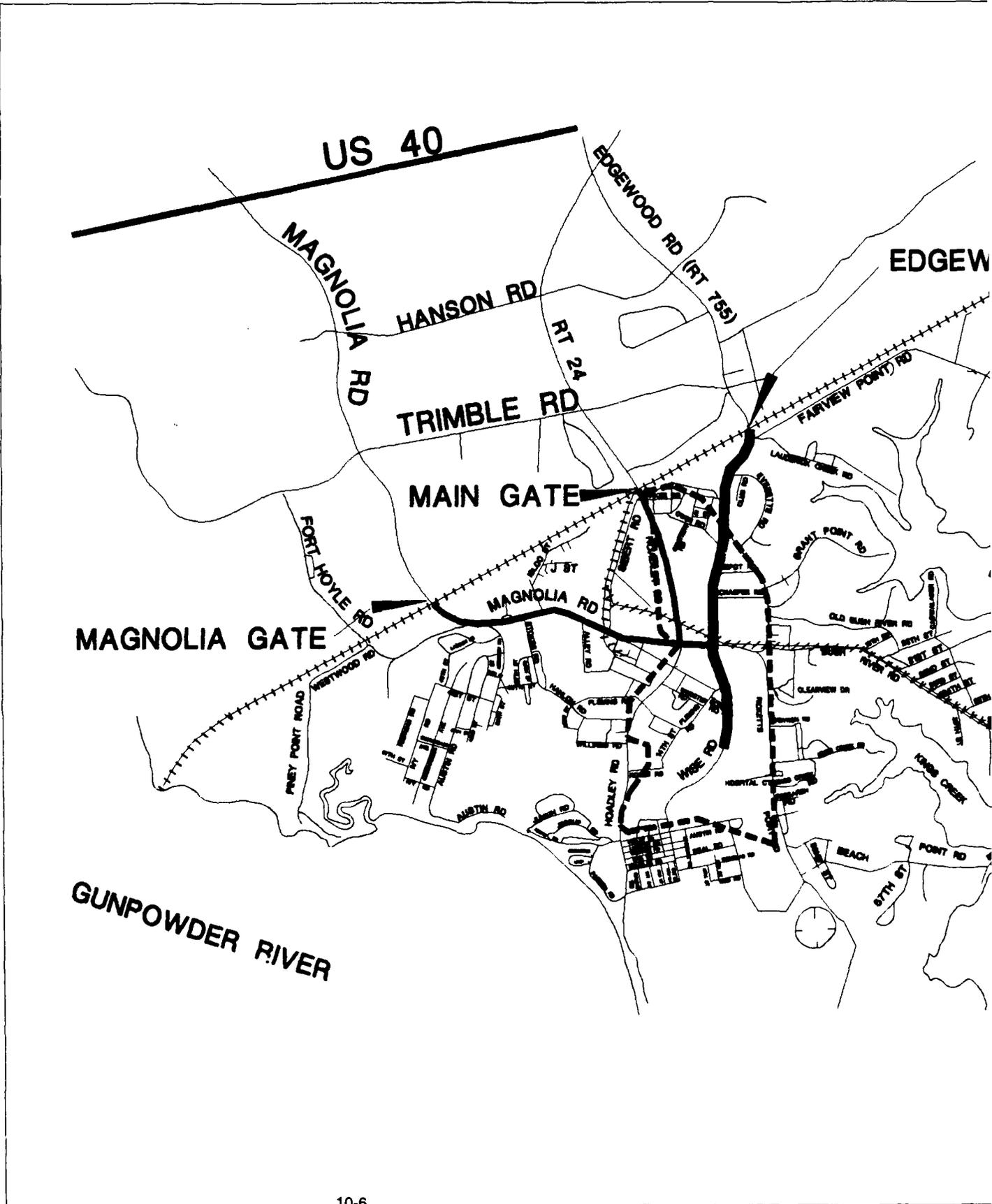
Drawn By: K. Rapuano

Drawing File Name:

Date: 03/10/93

RIFS20

JE JACOBS ENGINEERING GROUP INC.
1212 NEW YORK AVE, SUITE 1050, WASHINGTON, D.C., 20005



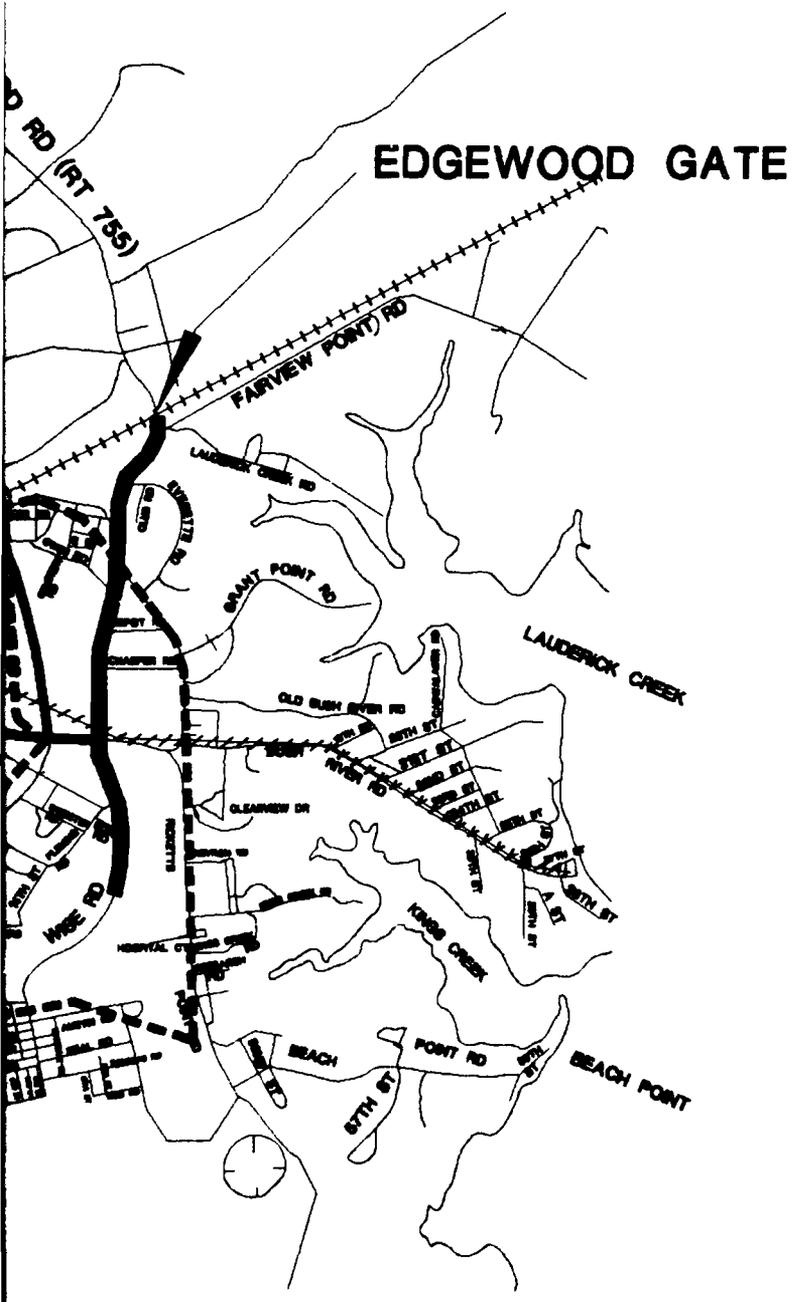
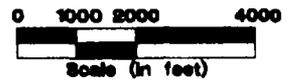
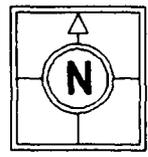
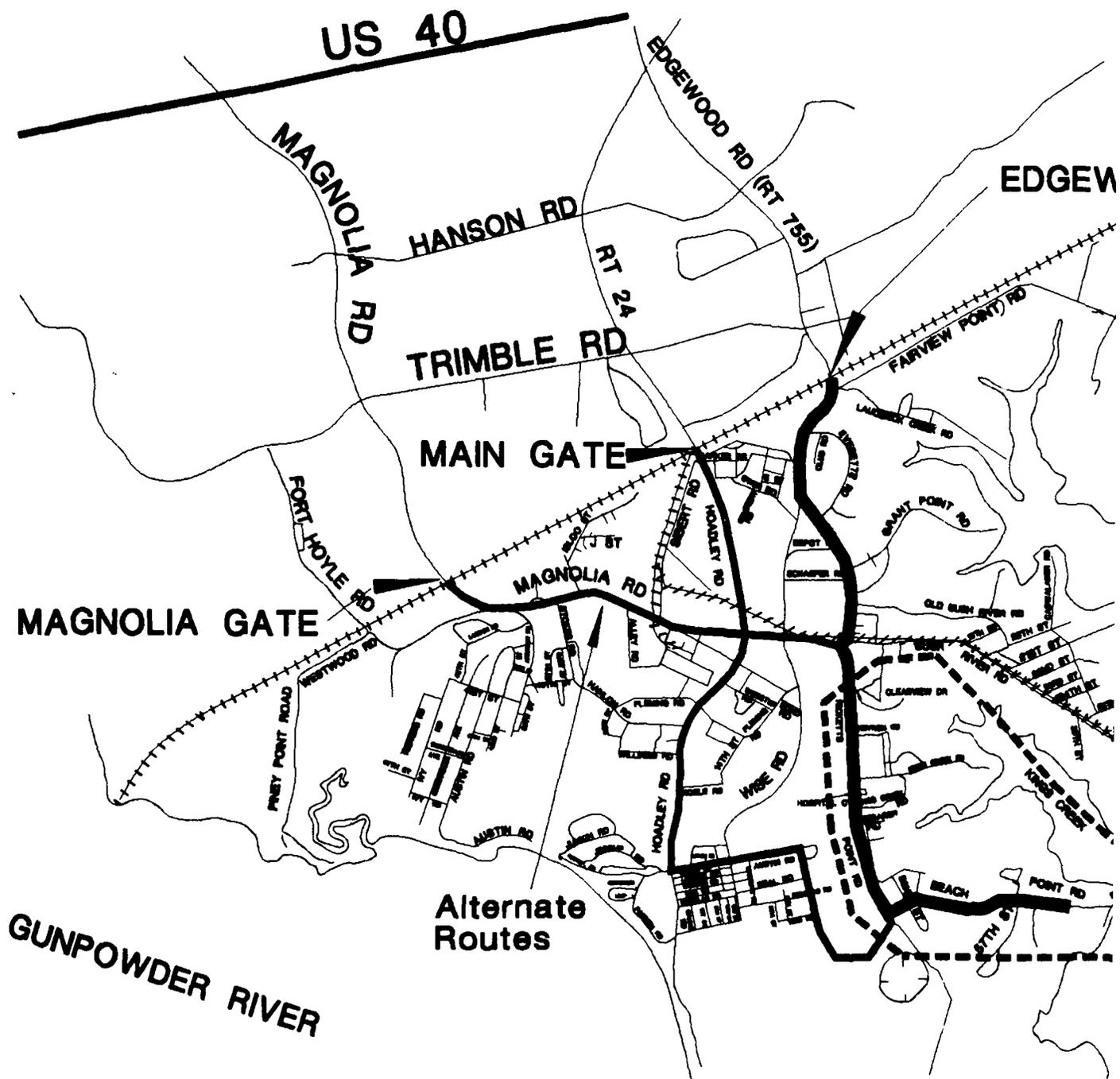


Figure 10-2
Evacuation Routes from
Evacuation Zone 2

-  Primary Route
-  Secondary Routes
-  Evacuation Zone Boundary



Site: Edgewood Area - Aberdeen Proving Ground Edgewood, Maryland		Jacobs Project Number: 35-E356-02
Drawn By: K. Rapuano Date: 03/10/93	Drawing File Name: RIFS19	
JE JACOBS ENGINEERING GROUP INC. 1212 NEW YORK AVE, SUITE 1060, WASHINGTON, D.C., 20006		



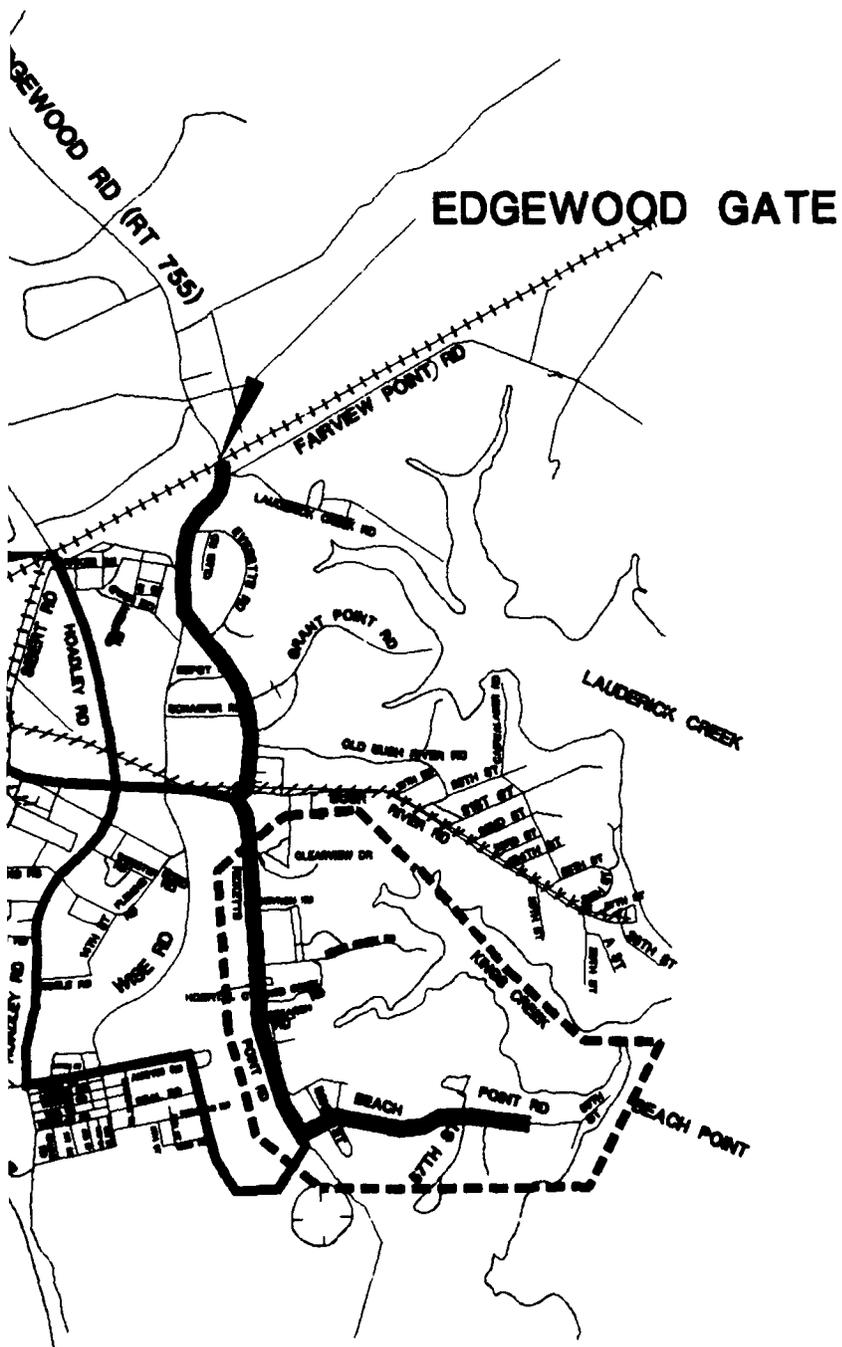
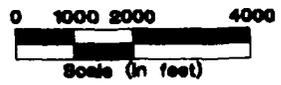
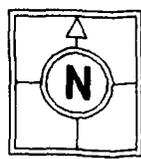
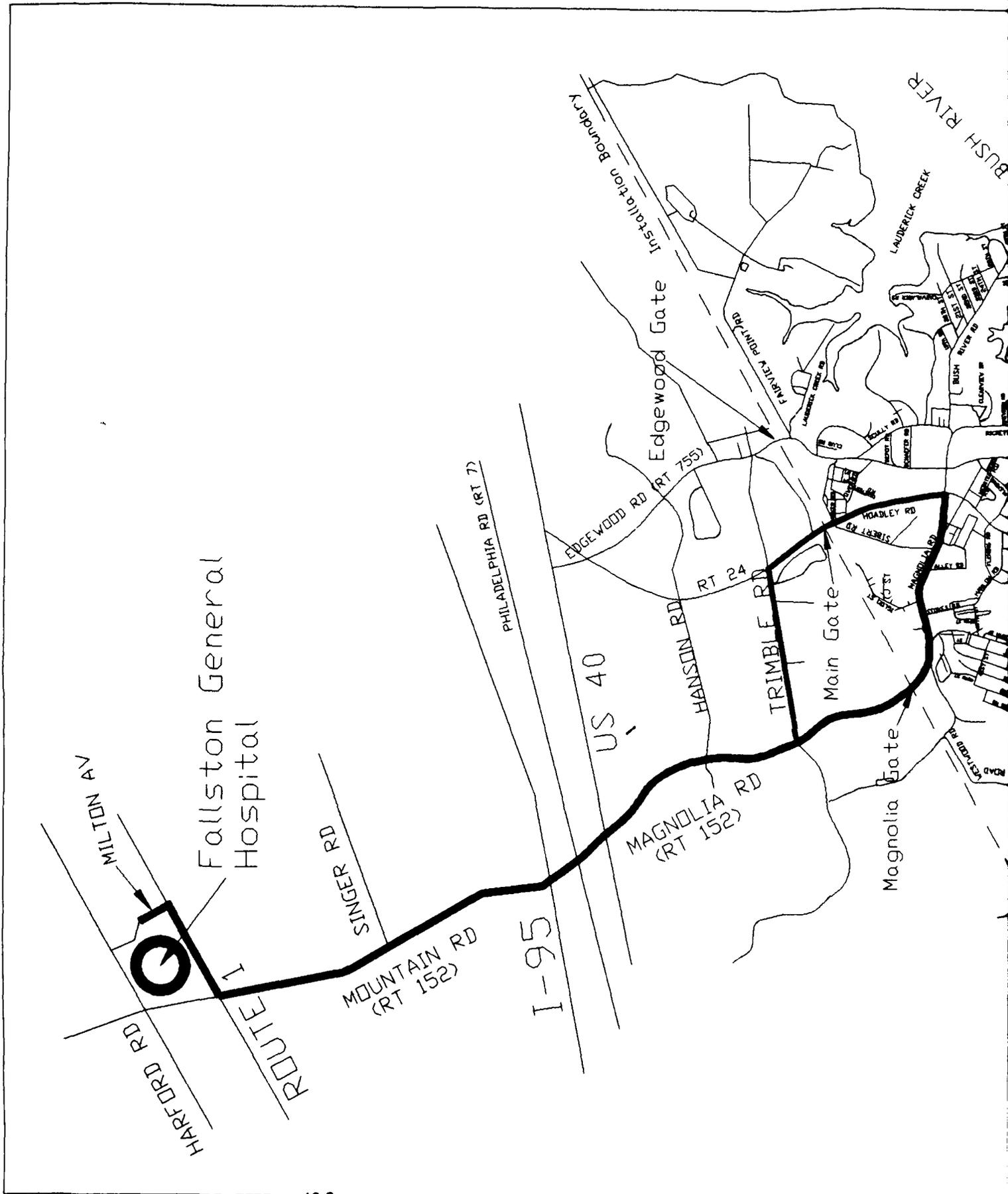


Figure 10-3
Evacuation Routes from
Evacuation Zone 3

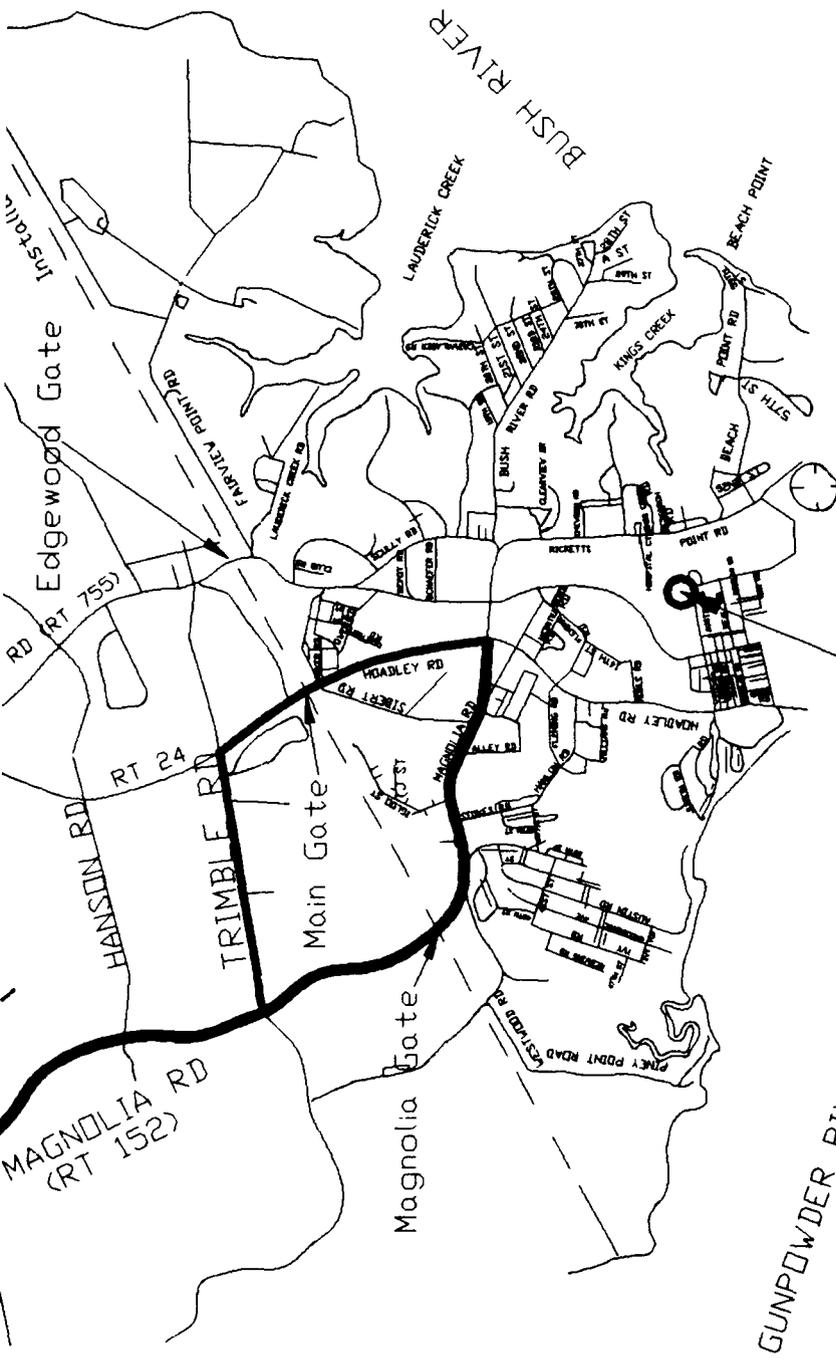
- Primary Route
- Secondary Routes
- Evacuation Zone Boundary



Site: Edgewood Area - Aberdeen Proving Ground Edgewood, Maryland		Jacobs Project Number: 35-E358-02
Drawn By: K. Rapuano	Drawing File Name: RIFS18	
Date: 03/10/93		
JE JACOBS ENGINEERING GROUP INC. 1212 NEW YORK AVE, SUITE 1060, WASHINGTON, D.C. 20005		



+



Edgewood Army
Medical Clinic

Figure 10-4

Emergency Medical Facilities

- Hospital Route
- Alternate Hospital Route

Site: Edgewood Area - Aberdeen Proving Ground Edgewood, Maryland		Jacobs Project Number: 35-E356-02	
Drawn By: K. Rapuano		Drawing File Name: NEWHSPTL	
Date: 08/10/93			
JE JACOBS ENGINEERING GROUP INC. 1212 NEW YORK AVE, SUITE 1050, WASHINGTON, D.C. 20005			

10.6 POST-INCIDENT OR EMERGENCY NOTIFICATIONS AND RECORDKEEPING

- As soon as possible following an accidental incident or emergency the SHSC, or designee, is to attempt to directly notify at least one of the following individuals identified by name under Subsection 10.6.1 of this HASP
- CHSD (call pager number if not onsite at time of incident/emergency).
- SHSC (call pager number if not onsite at time of incident/emergency).

Be prepared to provide the following information:

- (1) SHSC's name: George Moore
 - (2) Installation contact name: John Wrobel
 - (3) Exact location of incident
 - (4) Name and employer of victim(s)
 - (5) Nature and extent of injuries
 - (6) Whether victim(s) transported offsite for medical treatment
 - (7) Telephone number where SHSC can be contacted during next 24 hours
- The person who is notified directly shall immediately notify (directly or indirectly) each of the following individuals (excluding self): SHSC, CHSD, PM, TM.
 - Within 12 hours of a lost time accident the, SHSC will notify Bob Crouse, DSHE (410) 671-3660 and the Battelle Environmental Management Operations POC (Dr. Mark Montgomery) at (916) 852-7172 or the Battelle APG representative (Gary Grimm) at (410) 676-0200.
 - Within 24 hours: SHSC must notify Victim's Human Resources Department (VHRD). In the case of a fatality or hospital admittance of 5 or more people, OSHA must also be notified, preferably by the SHSC or CHSD.
 - Within 48 hours: SHSC must complete and submit Form 308 (Attachment 3) to the PM, and CHSD. If victim is a JEG employee, Form 308 must be submitted to CHSD and to the Corporate Human Resources Department contact.
 - Appropriate personnel will conduct a follow-up investigation in accordance with applicable Jacobs Team SOP(s).

10.6.1 List of Contacts

CORPORATE HEALTH AND SAFETY DIRECTOR (CHSD)

Name: Dr. Terry Briggs, CIH
Phone: (303) 595-8855
Pager: To be determined



SITE HEALTH AND SAFETY COORDINATOR (SHSC)

Name: George Moore
Phone: (202) 789-7290 (Office)
To be determined (Site)
Pager: To be determined

PROJECT PERSONNEL

Project Manager (PM)
Name: Francine Gordon
Phone: (202) 789-7290

Task Manager (TM)
Name: Robert Paquette
Phone: (202) 789-7290
Washington Operations Manager
Name: Sheldon Meyers
Phone: (202) 789-7290

CLIENT CONTACT

Name: John Wrobel
Phone: (410) 671-4840/3320
Name: Bob Crouse (Safety)
Phone: (410) 671-3157/3320



Employees engaged in activities that have the potential for exposure to chemical substances will participate in a comprehensive education and training program consistent with the requirements of the Hazard Communication Standard, 29 CFR 1910.1200. The program shall present employees engaged in these operations with the knowledge required to work safely in these environments. The program shall be designed to ensure that employees are knowledgeable about the hazards and appropriate safety precautions.

JEG's Hazard Communication Program is documented in the company's Safety and Health Program Plan. A copy of this plan is maintained on post with the Installation Safety Division. In addition to the requirements of this plan, project personnel are required to review the safety data associated with the chemicals anticipated at the project site. MSDSs or equivalent data for possible chemicals released to the environment in the project area (i.e., decontamination chemicals and sample preservatives) will be maintained by the SHSC and available for review by all project personnel.



APPENDIX A

RECORDKEEPING

JEG recordkeeping requirements will be followed. Jacobs personnel are also required to maintain logs and reports (e.g., training logs, supplied air use logs, and daily health and safety meeting information). In the event that Level C or a higher level of protection is used, SHSC, on a weekly basis, will record days worked and the level(s) of protection worn by field team members using Form 533. The completed form is to be submitted to the CHSD. The following forms are provided as attachments to this HASP:

Attachment 1 - Employee Signoff

Attachment 2 - Form 533 - Record of Hazardous Waste Field Activity

Attachment 3 - First Aid Registry, Authorization for Medical Treatment and Exposure/
Injury Report

Attachment 4 - Daily Site Entry Form



APPENDIX B

ATTACHMENTS TO PLAN

- Attachment 1 — Employee Signoff
- Attachment 2 — Form 533 — Record of Hazardous Waste Field Activity
- Attachment 3 — First Aid Registry, Authorization for Medical Treatment and Exposure/Injury Report
- Attachment 4 — Daily Site Entry Log
- Attachment 5 — Generic Chemical Hazard Profiles
- Attachment 6 — Material Safety Data Sheets (MSDSs)
- Attachment 7 — Heat Stress Monitoring SOP
- Attachment 8 — Manual for Control of Radiation



Drawn By: K. Rapuano

Drawing File Name:

Date: 03/10/93

RIF820



JACOBS ENGINEERING GROUP INC.

1212 NEW YORK AVE, SUITE 1060, WASHINGTON, D.C., 20005

ATTACHMENT 3

FIRST AID REGISTRY, AUTHORIZATION FOR
MEDICAL TREATMENT AND EXPOSURE/INJURY REPORT

JACOBS ENGINEERING GROUP INC.

(Division)

AUTHORIZATION FOR MEDICAL TREATMENT

TO: Dr. _____ Address: _____ Date _____

This form signed by our representative is your authority to render treatment to:

(Employee)

in accordance with the provisions of and under the conditions prescribed by the Workmens' Compensation Act. Unless the case is an emergency, kindly obtain authorization for surgery, radical procedures, or hospitalization from the insurance carrier. Send your bill and report to us at the address listed below.

Authorized Representative

Date of Injury _____ Location _____ Job No. _____
How Injury Occurred _____

Please complete and return by mail to the following address to insure prompt payment of charges:

Pat Costamagna, Jacobs Engineering Group, 251 S. Lake Ave
Pasadena, CA 91101 (813) 578-6886

=====
FOR DOCTOR'S USE ONLY

Diagnosis of Injury: _____

Disposition of Patient:

___ Occupational ___ Non-Occupational ___ Unable to Determine

___ Able to resume regular duties

___ Able to resume regular duties next workday

___ Able to resume restricted duties with the following limitations: _____

___ Unable to return to work, estimated length of disability: _____

Return for follow-up visit on _____ (Date)

(Doctor's Signature)

**JACOBS ENGINEERING GROUP, INC.
EMPLOYEE EXPOSURE/INJURY REPORT**

Page 1

This form should be completed by the employee. Please return the form to Robin "Ann" Kring, Health and Safety Coordinator, Jacobs Engineering Group, Inc., 600 Seventeenth Street, Suite 1100N, Denver, Colorado 80202.

Date: _____

Employee's Name: _____

SSN: _____

Sex: M F Age: _____

Region: _____ Location: _____

Project: _____ Project Title: _____

Incident:

Type: Possible Exposure _____ Exposure _____ Physical Injury _____

Location: _____

Date of Incident: _____ Time of Incident: _____

List amount of time lost from work (if any) _____

Date of Reporting Incident: _____

Person to Whom Incident Was Reported: _____

Weather Condition During Incident: Temperature _____

Wind Speed & Direction _____ Humidity _____

Cloud Cover _____ Clear _____ Precipitation _____

Materials Potentially Encountered:

Chemical (Give chemical name or description - liquid, solid, gas, vapor fume, mist):

JACOBS ENGINEERING GROUP, INC.
EMPLOYEE EXPOSURE/INJURY REPORT
Page 2

Radiological: _____

Other: _____

Nature of the Exposure/Injury:

State the nature of the exposure/injury in detail and list the parts of the body affected.

(Attach extra sheets if needed.)

Was medical care received? Yes No

If so, when? _____

Where? On-Site _____ Off-Site _____

By Whom? Name of Paramedic: _____

Name of Physician: _____

Other: _____

If "Off-Site", name facility (hospital, clinic, etc.): _____

Length of stay at the facility? _____

Was the Health and Safety Manager contacted? Yes No When _____

Was the Medical Consultant contacted? Yes No

If so, who was the contact? _____

**JACOBS ENGINEERING GROUP, INC.
EMPLOYEE EXPOSURE/INJURY REPORT
Page 3**

Did the exposure/injury result in permanent disability? Yes [] No []

If so, explain:

Has the employee returned to work? Yes [] No []

If so, give date: _____

List the names of other persons affected during this incident:

List the names of persons who witnessed the exposure/injury incident:

Possible cause of the exposure/injury:

What was the name and title of the field team leader or immediate supervisor at the site of the incident?

**JACOBS ENGINEERING GROUP, INC.
EMPLOYEE EXPOSURE/INJURY REPORT
Page 4**

Was the operation being conducted under an established Safety Plan?

Yes No If yes, attach a copy. In no, explain.

Describe protective equipment and clothing used by the employee:

Other information, comments (Attach relative data if necessary):

Did any limitations in safety equipment or protective clothing contribute to affect exposure? If so, explain:

What was the employee doing when the exposure/injury occurred? (Describe briefly as "Site Reconnaissance", "Site Categorization", "Sampling", etc.)

**JACOBS ENGINEERING GROUP, INC.
EMPLOYEE EXPOSURE/INJURY REPORT
Page 5**

How did the exposure/injury occur? (Describe fully what factors led up to and/or contributed to the incident.)

Name of person(s) initiating report, job title, phone number:

Employee's Name (Print or type)

Employee's Signature

Date

=====

What corrective action(s) or change to the Site Safety Plan, if any, have been or will be taken to avoid recurrence of the exposure or accident?

**JACOBS ENGINEERING GROUP, INC.
EMPLOYEE EXPOSURE/INJURY REPORT
Page 6**

Additional Comments:

Project Manager/Field Team Leader's Name

(Print or type)

Project Manager/Field Team Leader's

Signature

Date _____

JACOBS ENGINEERING GROUP INC.
AUTO ACCIDENT REPORT

Date of Accident _____ Time of Accident _____
Location of Accident _____

=====

Driver of Company Vehicle

Name _____ Date of Birth _____
Address _____
Home Phone No. _____ Driver's License No. _____
License Number _____
Serial Number of Vehicle _____
Name of Other Passengers in Vehicle _____
Equipment Number _____

=====

Driver of Other Vehicle

Name of Driver _____
Home Address of Driver _____
Phone Number Home _____ Work _____
Driver's License Number (Including State) _____
Employer _____
Owner of Vehicle _____
Serial Number of Vehicle _____
Make and Model of Car _____
Relation of Driver to Owner of Vehicle _____
Insurance Company of Owner _____
Insurance Company of Driver & Policy Number _____

=====

Description of Accident - _____

=====

Description of Damage to Vehicles

Company Vehicle _____

Other Vehicle _____

Place Where Damaged Vehicles Can Be Seen _____

=====

Injuries (Explain) _____

=====

Name of Law Enforcement Body Investigating Accident _____

Name, Address & Phone No. of Witnesses _____

Signature _____ Date _____

Job Name: _____ Job Number: _____

2.4 VEHICLE ACCIDENTS

2.4.1 Reporting

- o An Auto Accident Form (Appendix 2-7) shall be kept in all Company vehicles utilized for offsite service.
- o The form shall be completed by the driver of the vehicle in conjunction with his Supervisor and the Project Superintendent and forwarded within 24 hours after an accident to the Corporate Safety Department.

2.4.2 Requirements

- o The report shall be filed when a Company vehicle is involved in any type of accident.
- o The form shall also be used in filing reports of accidents involving equipment vehicles (onsite or offsite) such as cherry pickers, backhoes, trucks, cars, etc.

2.4.3 Distribution

- o The report shall be distributed as follows:
 - Equipment Yard - 1 Copy
 - Site File - 1 Copy
 - Corporate Insurance - Original
 - Corporate Safety Department - 1 Copy

ATTACHMENT 5

GENERIC CHEMICAL HAZARD PROFILES

ATTACHMENT 5
GENERIC CHEMICAL HAZARD PROFILES

The following information is intended to be generic for purposes of providing a brief overview. Detailed information relevant to hazards associated with specific chemical substances potentially of concern at this site are provided in Attachment 7.0 of this HASP.

CALIBRATION GASES

Common pressurized gases used to calibrate air monitoring instrumentation include heptane, hexane, hydrogen sulfide, isobutylene, methane, oxygen, and pentane. For the most part these gases are flammable. If the cylinders are not handled with care, since they are pressurized, they can become mini torpedoes if the cylinder valve stem is severed from the cylinder.

The primary toxic routes of entry into the body are inhalation and skin absorption, so these substances should be handled in a well ventilated area. Symptoms of exposure include lightheadedness, nausea, headache, numb extremities, dermatitis, loss of appetite, chemical pneumonia, and giddiness. Exposure to elevated levels of such gases can damage the skin, eyes, and respiratory systems and can cause death.

CORROSIVES

Corrosives include acids, bases/caustics, and inorganic halogen salts. Some of the more common acids include acetic, citric, hydrochloric, hydrofluoric, nitric, perchloric, phosphoric, picric and sulfuric acids. Some of the more common caustics include ammonia, ammonium hydroxide, potassium hydroxide, sodium hydroxide, and sodium hypochlorite. Inorganic halogen salts are compounds containing halogens (chlorine, bromine, fluorine) such as sodium chloride, potassium bromate, and sodium fluoride, which are corrosive to metals and finishes, but are relatively insignificant health threats.

For the most part, corrosives are non-flammable, although the liquid forms are moderately to highly volatile. Picric acid when dry and perchloric acid (perchlorates) can be explosive. The primary routes of entry into the body are via inhalation, ingestion, and skin contact. Symptoms of exposure include tissue burns, nose and throat inflammation, and pulmonary edema. Corrosives can cause extensive damage to the respiratory system, skin, and eyes.

LANDFILL GASES

Landfills in the past were often uncontrolled such that almost any and every type of waste materials could have been deposited at such sites. When organic and inorganic matter degrades and decomposes gases re generated, typically including though not limited to: ammonia, carbon dioxide, carbon disulfide, hydrogen chloride, hydrogen fluoride, hydrogen cyanide, hydrogen sulfide, methane, vinyl chloride, vinyl fluoride, vinyl chloride. These gases are flammable and extremely volatile. Some, such as hydrogen sulfide, are heavier than air and settle in low lying places.

The primary routes of entry into the body are via inhalation and skin absorption. Symptoms of exposure include light headedness, giddiness, nausea, headache, numb extremities, dermatitis, los of appetite, chemical pneumonia, and tremors. Exposure to elevated levels of these gases can damage the skin, eyes, and respiratory system and can lead to death.

Metals commonly associated with batteries, paints, plating operations, and petroleum-based products include inorganic lead compounds, arsenic, cadmium (a probable human carcinogen), chromium (a probable human carcinogen) copper, nickel, silver, tin and zinc compounds. Petroleum based products, such as lubricants, and especially leaded gasolines, contain organic lead compounds such as tetraethyl and tetraethyl lead, as well as assorted inorganic metals mentioned above and others such as antimony, barium, beryllium, cobalt, magnesium, manganese, and vanadium. Explosive powders used in ordinances contain aluminum as well.

Metals pose a health hazard in their solid form, especially as airborne dusts. The primary routes of entry into the body are via inhalation, ingestion, and skin contact. Organic compounds such as tributyltin may penetrate the skin without producing appreciable local injury. Symptoms of exposure include: eye, skin, and upper respiratory system irritation; headache, insomnia, metallic taste in the mouth, lassitude, pallor, anorexia, constipation, abdominal pain, anemia, tremors. Heavy metals can cause damage to the central nervous system, kidneys, respiratory system, and liver. Cancers of the lungs and bones are associated with metal intoxication.

PETROLEUM-BASED HYDROCARBONS

Lubricants, oils, fuels, and gasoline contain petroleum-based hydrocarbons such as: benzene and its derivatives, naphthas, toluene, xylenes, and coal tar pitch volatiles. Coal tar pitch volatiles are also known as Polycyclic Hydrocarbons (PCHs) or Polynuclear

Aromatics (PNAs). Benzene and PNAs are known carcinogens. Petroleum based hydrocarbon materials generally contain metal contaminants also; refer to the Metals profile. Lubricants and waste oils are slightly to highly volatile and flammable. Obviously, fuels and gasoline are extremely volatile and flammable.

The primary routes of entry into the body are via ingestion and skin contact or dermal absorption. Inhalation of the more volatile constituents, toluene, xylenes, naphthas, and benzene and its derivatives, can be toxic. Acute symptoms of exposure include eye, skin, and upper respiratory system irritation; giddiness, confusion, headache, nausea, staggered gait, and fatigue. High level and chronic exposure can cause damage to the liver, kidneys, and bone marrow, and can cause skin cancer and leukemia.

SOLVENTS (HALOGENATED)

Halogenated solvents are hydrocarbon compounds that also have halogen molecules such as chlorine, bromine, and fluorine. Generally halogenated solvents re moderately to highly volatile and are non-combustible. In general, the toxicity of halogens typically ranks: fluorinated > brominated > chlorinated.

Some of the more common chlorinated solvent wastes include: carbon tetrachloride*, chloroform*, methylene chloride*, methyl chloroform (1,1-trichloroethane), tetrachloroethylene* (perchloroethylene), and trichloroethylene. Substances followed by an asterisk (*) are probable human carcinogens.

Primary routes of entry into the body are inhalation, dermal absorption, and ingestion. Symptoms of acute exposure include: eye, skin, and upper respiratory irritation; flush face, and neck; vertigo, headache, lassitude, dizziness, fatigue, nausea, vomiting, disorientation, confusion, and poor equilibrium. High level or chronic exposures can cause damage to the skin, eyes, liver, kidneys, central nervous system, respiratory system, and heart.

SOLVENTS (NONHALOGENATED) AND PAINTS

Some of the more common constituents of nonhalogenated solvent and paint wastes include: acetone, methyl ethyl ketone (MEK), toluene, xylenes; and alkyl acetates, acrylates, and alcohols. These substances are slightly to highly volatile and are moderately to highly flammable.

Primary routes of entry into the body are via inhalation, ingestion, and dermal adsorption. Symptoms of exposure include irritation of the eyes, skin, or upper respiratory system headaches, drowsiness, dermatitis, dizziness, confusion, giddiness, and euphoria. Higher levels of exposure can cause narcosis and damage to the kidneys and blood.

ATTACHMENT 6

MATERIAL SAFETY DATA SHEETS (MSDSs)

**SODIUM HYDROXIDE, DRY SOLID, FLAKE, BE
 **SODIUM HYDROXIDE, DRY SOLID, FLAKE, BE
 **SODIUM HYDROXIDE, DRY SOLID, FLAKE, BE

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
 CHEMICAL DIVISION
 1 REAGENT LANE
 FAIR LAWN NJ 07410
 (201) 796-7100

EMERGENCY NUMBER: (201) 796-7100
 CHEMTREC ASSISTANCE: (800) 424-9300

THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE RELIABILITY OF THE INFORMATION FOR THEIR PARTICULAR PURPOSES.

SUBSTANCE IDENTIFICATION

SUBSTANCE: **SODIUM HYDROXIDE, DRY SOLID, FLAKE, BEAL OF GRANULAR
 CAS-NUMBER 1310-73-2

TRADE NAMES & SYNONYMS:

CAUSTIC SODA, SODA LYE, LYE, WHITE CAUSTIC, CAUSTIC SODA, BEAL
 CAUSTIC SODA, DRY, CAUSTIC SODA, FLAKE, CAUSTIC SODA, GRANULAR
 CAUSTIC SODA, SOLID, SODIUM HYDRATE, SODIUM HYDROXIDE (ANHYDRO)
 SODIUM HYDROXIDE, FLAKE, SODIUM HYDROXIDE, DRY, SODIUM HYDROXIDE, SOLID
 ASCARITE, SODIUM HYDROXIDE, STOCK 4935235, UN 1825,
 S-318; S-319; S-320; S-312, BP359; NaOH;

CHEMICAL FAMILY:
 INORGANIC BASE

MOLECULAR FORMULA: Na-OH

MOLECULAR WEIGHT: 40.00

OSHA RATINGS (SCALE 0-5) HEALTH=3 FIRE=0 REACTIVITY=1 PERSISTENCE=0
 NFPA RATINGS (SCALE 0-4) HEALTH=3 FIRE=0 REACTIVITY=1

COMPONENTS AND CONTAMINANTS

COMPONENT: SODIUM HYDROXIDE PERCENT 100
 CAS# 1310-73-2

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

SODIUM HYDROXIDE:

- 2 MG/M3 OSHA CEILING
- 2 MG/M3 ACGIH CEILING
- 2 MG/M3 NIOSH RECOMMENDED CEILING
- 2 MG/M3 OEG MAK TWA (TOTAL DUST);
- 4 MG/M3 OEG MAK 5 MINUTE PEAK, MOMENTARY VALUE, 8 TIMES/SHIFT

MEASUREMENT METHOD: PARTICULATE FILTER; HYDROCHLORIC ACID; TITRATION;
 (NIOSH VOL. III # 7401, ALKALINE DUSTS).

1000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY

**OSHA LIMITS ADOPTED JANUARY 19, 1989 ARE SUBJECT TO THE DECISION OF THE
11TH CIRCUIT COURT OF APPEALS (AFL-CIO V. OSHA) AS OF JULY 7, 1992.**

 PHYSICAL DATA

DESCRIPTION: OORLESS, WHITE OR OFF-WHITE HYGROSCOPIC SOLID.
 BOILING POINT: 2534 F (1390 C) MELTING POINT: 604 F (318 C)
 SPECIFIC GRAVITY: 2.130 VAPOR PRESSURE: 100 MMHG @ 1111 C
 PH: 14 @ 5% SOLUTION SOLUBILITY IN WATER: 111 %
 SOLVENT SOLUBILITY: SOLUBLE IN ALCOHOL, GLYCEROL, INSOLUBLE ACETONE, ETHER.

 FI - AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD
 NEGLIGIBLE FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME

EXTINGUISHING MEDIA
 WATER SPRAY, CARBON DIOXIDE, WATER SPRAY OR REGULAR FOAM
 (1990 EMERGENCY RESPONSE GUIDEBOOK, 007 F 5800.5)

FOR LARGER FIRES, USE WATER SPRAY, FOG OR REGULAR FOAM
 (1990 EMERGENCY RESPONSE GUIDEBOOK, 007 F 5800.5).

FIREFIGHTING
 MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO IT WITHOUT RISK. APPLY COOLING
 WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED TO FLAMES UNTIL WELL AFTER FIRE
 IS OUT. STAY AWAY FROM ENDS OF TANKS (1990 EMERGENCY RESPONSE GUIDEBOOK,
 007 F 5800.5, GUIDE PAGE 63).

USE AGENT SUITABLE FOR TYPE OF FIRE. USE WATER IN FLOODING QUANTITIES AS FOG.
 APPLY WATER FROM AS FAR A DISTANCE AS POSSIBLE

 TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION: 49-CFR 172.101:
 CORROSIVE MATERIAL

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS: 49-CFR 172.101 AND
 SUBPART E,
 CORROSIVE

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49-CFR 173.245B
 EXCEPTIONS: 49-CFR 173.244

FINAL RULE ON HAZARDOUS MATERIALS REGULATIONS (HMR) 49-CFR PART 173.101-173.104,
 HODNET NUMBERS HM-181, HM-181A, HM-181B, HM-181C, HM-181D AND HM-204,
 EFFECTIVE DATE OCTOBER 1, 1991. HOWEVER, COMPLIANCE WITH THE REGULATIONS IS

AUTHORIZED ON AND AFTER JANUARY 1, 1991. (55 FR 52402, 12/21/90)

EXCEPT FOR EXPLOSIVES, INHALATION HAZARDS, AND INFECTIOUS SUBSTANCES, THE EFFECTIVE DATE FOR HAZARD COMMUNICATION REQUIREMENTS IS EXTENDED TO OCTOBER 1, 1993. (56 FR 47158, 09/18/91)

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER, 49 CFR 172.101: SODIUM HYDROXIDE, SOLID-UN 1823

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION, 49 CFR 172.101: 3 - CORROSIVE MATERIAL

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP, 49 CFR 172.101: PG II

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS, 49 CFR 172.101 AND SUBPART E: CORROSIVE

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS:

EXCEPTIONS: 49 CFR 173.154

NON-BULK PACKAGING: 49 CFR 173.212

BULK PACKAGING: 49 CFR 173.240

U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS, 49 CFR 172.101:

PASSENGER AIRCRAFT OR RAILCAR: 150 KG

HAZARDOUS AIRCRAFT ONLY: 500 KG

TOXICITY

SODIUM HYDROXIDE.

IRITATION DATA: 500 MG/24 HOURS SKIN-RABBIT SEVERE; 1% EYE-RABBIT SEVERE; 50 UG/24 HOURS EYE-RABBIT SEVERE; 1 MG/24 HOURS EYE-RABBIT SEVERE; 400 UG EYE-RABBIT MILD; 1 MG/30 SECONDS RINSED EYE-RABBIT SEVERE; 12/24 HOURS EYE-MONKEY SEVERE.

TOXICITY DATA: 1350 MG/KG SKIN-RABBIT LD50 (VAN WATERS & ROGERS INC. MSDS); 500 MG/KG ORAL-RABBIT LD50; 104-340 MG/KG ORAL-RAT LD50 (VAN WATERS & ROGERS INC. MSDS); 40 MG/KG INTRAPERITONEAL-MOUSE LD50; MUTAGENIC DATA (RTCA).

GENOTOXICITY STATUS: NONE

LOCAL EFFECTS: CORROSIVE- INHALATION, SKIN, EYE, INGESTION

ACUTE TOXICITY LEVEL: TOXIC BY INGESTION, MODERATELY TOXIC BY DERMAL ABSORPTION

TARGET EFFECTS: NO DATA AVAILABLE.

AT INCREASED RISK FROM EXPOSURE. PERSONS WITH PRE-EXISTING SKIN AND EYE CONDITIONS

HEALTH EFFECTS AND FIRST AID

INHALATION:

SODIUM HYDROXIDE.

CORROSIVE: 250 MG/M3 IMMEDIATELY DANGEROUS TO LIFE OR HEALTH

ACUTE EXPOSURE- EFFECTS DUE TO INHALATION OF DUSTS OR MIST MAY VARY FROM MILD IRRITATION OF THE NOSE AT 2 MG/M3 TO SEVERE PNEUMONITIS DEPENDING ON THE SEVERITY OF EXPOSURE. LOW CONCENTRATIONS MAY CAUSE MUCOUS MEMBRANE IRRITATION WITH SORE THROAT, COUGHING, AND DYSPNEA. INTENSE EXPOSURES MAY RESULT IN DESTRUCTION OF MUCOUS MEMBRANES AND DELAYED PULMONARY EDEMA

PRESSURE.

- ORGANIC PEROXIDES: INCOMPATIBLE.
- PENTOL (3-METHYL-2-PENTENE-4-YN-1-OL): POSSIBLE EXPLOSION.
- PHOSPHORUS: MAY FORM MIXED PHOSPHINES WHICH MAY IGNITE SPONTANEOUSLY IN AIR.
- PHOSPHORUS PENTOXIDE: MAY REACT VIOLENTLY WHEN HEATED.
- PLASTICS: MAY BE ATTACKED.
- B-PROPIOLACTONE: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
- PROPYLENE OXIDE: IGNITION OR EXPLOSION MAY OCCUR.
- RUBBER: MAY BE ATTACKED.
- SODIUM TETRAHYDROBORATE: DRY MIXTURES WITH SODIUM HYDROXIDE CONTAINING 15-40% OF TETRAHYDROBORATE LIBERATE HYDROGEN EXPLOSIVELY AT 230-250 C.
- SULFURIC ACID: MIXING IN A CLOSED CONTAINER CAUSES AN INCREASE IN TEMPERATURE AND PRESSURE.
- 1,2,4,5-TETRACHLOROBENZENE: VIOLENT REACTION.
- TETRACHLOROBENZENE + METHYL ALCOHOL: POSSIBLE EXPL. N.
- TETRACHLOROETHYLENE: POSSIBLE EXPLOSION.
- TETRAHYDROFURAN: SERIOUS EXPLOSIONS CAN OCCUR.
- TIN: EVOLUTION OF HYDROGEN GAS WHICH MAY FORM AN EXPLOSIVE MIXTURE.
- 1,1,1-TRICHLOROETHANOL: EXPLOSION MAY OCCUR.
- TRICHLOROETHYLENE: FORMATION OF EXPLOSIVE MIXTURES OF DICHLORODIETHYLENE.
- TRICHLOROETHYLENE + METHANOL: MAY CAUSE VIOLENT REACTION.
- WAX: MAY BE ATTACKED.
- ZINC DUST: FIRE AND EXPLOSION HAZARD.
- ZINC OXIDE: MAY CAUSE EXPLOSIVE REACTION WITH HYDROGEN.

ADDITIONAL INFORMATION: RELEASE TO AIR: 100% (100% DANGEROUS)

POLYMERIZATION: POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE AND DISPOSAL

OBEY ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

--STORAGE--

STORE IN A COOL, DRY, WELL-VENTILATED LOCATION, SEPARATE FROM ACIDS, WATER METALS, IMMEDIATELY REPAIR AND PROTECT LEAKS OR ANY DEFECTED MATERIAL (NFPA 49, HAZARDOUS CHEMICAL DATA, 1991).

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

--DISPOSAL--

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40 CFR 261.11 (EPA HAZARDOUS WASTE NUMBER 0002, 100 POUND CERCLA SECTION 103 REPORTABLE QUANTITY).

 CONDITIONS TO AVOID

MAY BURN BUT DOES NOT IGNITE READILY. FLAMMABLE, POISONOUS GASES MAY ACCUMULATE IN TANKS AND HOPPER CARS. MAY IGNITE COMBUSTIBLES (WOOD, PAPER, OIL, ETC.).

 SPILL AND LEAK PROCEDURES

SOIL SPILL:
 DIG HOLDING AREA SUCH AS LAGOON, POND OR PIT FOR CONTAINMENT.

USE PROTECTIVE COVER SUCH AS A PLASTIC SHEET TO PREVENT MATERIAL FROM DISSOLVING IN FIRE EXTINGUISHING WATER OR RAIN.

WATER SPILL:
 ADD SUITABLE AGENT TO NEUTRALIZE SPILLED MATERIAL TO PH-7.

OCCLUSIONAL SPILL:
 DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR SMALL AIR SPILLS, WASH CLEAN. SHOULDER POUCH MATERIAL INTO CLEAN, OPEN TANKS OR AIR TIGHT TANKS CONTAINERS FROM TANKS. AREA FOR LARGER SPILLS. USE APPROPRIATE SPILL KIT FOR LATER DISPOSAL. KEEP UNNECESSARY PEOPLE AWAY. REPORT TO LOCAL EMERGENCY RESPONSE CENTER.

REPORTABLE QUANTITY: 100, 1000 POUNDS
 THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40) IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103. THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-2802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.61).

 PROTECTIVE EQUIPMENT

VENTILATION:
 PROVIDE LOCAL EXHAUST VENTILATION SYSTEM TO MEET PUBLISHED EXPOSURE LIMITS.

RESPIRATOR:
 THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POUCHET GUIDE TO CHEMICAL HAZARDS, NIOSH CRITERIA DOCUMENTS OF BY THE U.S. DEPARTMENT OF LABOR, 29 CFR 1910 SUBPART L.
 THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE. MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

SODIUM HYDROXIDE:

50 MG/M3- ANY POWERED AIR-PURIFYING RESPIRATOR WITH A DUST AND MIST FILTER, ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.

100 MG/M3- ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE,
ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR WITH A HIGH
EFFICIENCY PARTICULATE FILTER.

250 MG/M3- ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE AND OPERATED IN
A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR WITH A HIGH
EFFICIENCY PARTICULATE FILTER.
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS
OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

ANY SUPPLIED-AIR RESPIRATOR THAT HAS A FULL FACEPIECE AND IS OPERATED IN A
PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE IN COMBINATION WITH AN
AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND
OR OTHER POSITIVE-PRESSURE MODE

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE IMPERMEABLE CLOTHING AND EQUIPMENT
TO PREVENT ANY POSSIBILITY OF SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THE
SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A
FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

EMERGENCY WASH FACILITIES:
WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE
EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN
AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - FISHER SCIENTIFIC, INC.
CREATION DATE 11/17/84 REVISION DATE 07/26/90

-ADDITIONAL INFORMATION-
THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST
INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF
MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO
SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS
SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE
INFORMATION FOR THEIR PARTICULAR PURPOSES.

**HYDROCHLORIC ACID, CONCENTRATED (36-37)
 **HYDROCHLORIC ACID, CONCENTRATED (36-37)
 **HYDROCHLORIC ACID, CONCENTRATED (36-37)

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
 CHEMICAL DIVISION
 1 REAGENT LANE
 FAIR LAWN NJ 07410
 (201) 796-7100

EMERGENCY NUMBER: (201) 796-7100
 CHEMTREC ASSISTANCE: (800) 424-9300

THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE RELIABILITY OF THE INFORMATION FOR THEIR PARTICULAR PURPOSES.

SUBSTANCE IDENTIFICATION

SUBSTANCE: **HYDROCHLORIC ACID, CONCENTRATED (36-37)**

TRADE NAMES/SYNONYMS:

HYDROCHLORIC ACID, HYDROCHLORIDE, MURIATIC ACID, SPIRITS OF SALT,
 HYDROCHLORIC ACID, CONCENTRATED, HYDROGEN CHLORIDE, CG EB, UN 1789, A140,
 A144, A508, A455, A481

CHEMICAL FAMILY:
 INORGANIC ACID

MOLECULAR FORMULA: H-CL

MOLECULAR WEIGHT: 36.46

OSHA RATINGS (SCALE 1-3): HEALTH=3 FIRE=0 REACTIVITY=1 PERSISTENCE=0
 NFPA RATINGS (SCALE 1-4): HEALTH=3 FIRE=0 REACTIVITY=1

COMPONENTS AND CONTAMINANTS

COMPONENT: HYDROGEN CHLORIDE PERCENT: 26.0-36.0
 CAS# 7647-01-0

COMPONENT: WATER PERCENT: 63.0-64.0

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

HYDROGEN CHLORIDE (HYDROCHLORIC ACID):

5 PPM (7.6 MG/M3) OSHA CEILING

5 PPM (7.6 MG/M3) ACGIH CEILING

5 PPM (7.6 MG/M3) NIOSH RECOMMENDED CEILING

5 PPM (7.6 MG/M3) OPG MAK TWA

10 PPM (15.2 MG/M3) OPG MAK 5 MINUTE PEAK, MOMENTARY VALUE, 8 TIME SHIFT

MEASUREMENT METHOD: SILICA GEL TUBE, SODIUM BICARBONATE/SODIUM CARBONATE,
 ION CHROMATOGRAPHY; (NIOSH VOL. III # 7903, INORGANIC ACIDS).

500 POUNDS SARA SECTION 302 THRESHOLD PLANNING QUANTITY (GAS)

5000 POUND SARA SECTION 304 REPORTABLE QUANTITY (GAS)
 5000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY (LIQUID)
 SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

 PHYSICAL DATA

DESCRIPTION: COLORLESS OR SLIGHTLY YELLOW FUMING LIQUID WITH A PUNGENT

ODOR BOILING POINT: 384 F (196 C) SPECIFIC GRAVITY: 1.2

VAPOR PRESSURE: NOT AVAILABLE PH: 1.1 (0.1 N)

SOLUBILITY IN WATER: SOLUBLE VAPOR DENSITY: 1.3

 FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
 NEGLIGIBLE FIRE HAZARD WHEN EXPOSED TO HEAT OF FLAME.

FIREFIGHTING MEDIA

FOR SMALL FIRES: CARBON DIOXIDE, WATER BRANCH OF REGULAR FOAM
 (SEE EMERGENCY RESPONSE GUIDEBOOK, DOT P 601)

FOR LARGER FIRES: USE WATER BRANCH FOAM OR REGULAR FOAM
 (SEE EMERGENCY RESPONSE GUIDEBOOK, DOT P 601)

FIREFIGHTING

MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO IT WITHOUT RISK. APPLY COOLING
 WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED TO FLAMES UNTIL WELL AFTER FIRE
 IS OUT. STAY AWAY FROM ENDS OF TANKS (SEE EMERGENCY RESPONSE GUIDEBOOK
 DOT P 5000 E, GUIDE PAGE 601)

EXTINGUISH USING AGENTS SUITABLE FOR TYPE OF FIRE. USE FLOODING AMOUNTS OF
 WATER AS FOS. COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER. APPROX FROM AS
 FAR A DISTANCE AS POSSIBLE. AVOID BREATHING CORROSIVE VAPORS. KEEP FLAME

 TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49-CFR 173.101
 CORROSIVE MATERIAL

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49-CFR 173.101 AND
 SUPPLEMENT E:
 CORROSIVE

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS 49-CFR 173.240
 EXCEPTIONS: 49-CFR 173.244

 TOXICITY:

HYDROGEN CHLORIDE (HYDROCHLORIC ACID).
 IRRITATION DATA.

ANHYDROUS: 100 MG RINSED EYE-RABBIT MILD.
 HYDROCHLORIC ACID: 5 MG/30 SECONDS RINSED EYE-RABBIT MILD.
 TOXICITY DATA:
 HYDROGEN CHLORIDE (ANHYDROUS GAS): 4701 PPM/30 MINUTES INHALATION-RAT LC50;
 2644 PPM/30 MINUTES INHALATION-MOUSE LC50.
 MONOHYDRATE: NO DATA AVAILABLE.
 DIHYDRATE: NO DATA AVAILABLE.
 TRIHYDRATE: NO DATA AVAILABLE.
 HEXAHYDRATE: NO DATA AVAILABLE.
 HYDROGEN CHLORIDE (AEROSOL): 5664 PPM/30 MINUTES INHALATION-RAT LC50 2142
 PPM/30 MINUTES INHALATION-MOUSE LC50.
 HYDROCHLORIC ACID: 1300 PPM/30 MINUTES INHALATION-HUMAN LCLO; 3000 PPM 5
 MINUTES INHALATION-HUMAN LCLO; 3124 PPM/1 HOUR
 INHALATION-RAT LC50; 1108 PPM/1 HOUR INHALATION-MOUSE LC50;
 4413 PPM/30 MINUTES INHALATION-RABBIT LCLO; 4413 PPM/30 MINUTES
 INHALATION-GUINEA PIG LCLO; 900 MG/KG ORAL-RABBIT LD50; 1449 MG/KG
 INTRAPERITONEAL-MOUSE LD50; 81 MG/KG UNREPORTED-MAN LDLO. MUTAGENIC DATA
 (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS).
 CARCINOGEN STATUS: NONE.
 LOCAL EFFECTS: CORROSIVE- INHALATION, SKIN, EYE AND INGESTION.
 ACUTE TOXICITY LEVEL: MODERATELY TOXIC BY INHALATION, INGESTION.
 TARGET EFFECTS: NO DATA AVAILABLE.

 HEALTH EFFECTS AND FIRST AID

INHALATION:
 HYDROGEN CHLORIDE (HYDROCHLORIC ACID)
 CORROSIVE, 100 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.
 ACUTE EXPOSURE- INHALATION OF GAS OR FUMES AT LEVELS OF 5000 PPM MAY
 CAUSE IRRITATION AND BURNING OF THE THROAT, COUGHING AND CHOKING.
 50-100 PPM MAY BE BARELY TOLERABLE FOR 1 HOUR. HIGH LEVELS MAY CAUSE
 INFLAMMATION AND OCCASIONALLY ULCERATION OF THE NOSE, THROAT OR LARYNX;
 BRONCHITIS, PNEUMONIA, PALPITATIONS AND HEADACHE. HIGHER CONCENTRATIONS
 MAY CAUSE NECROSIS OF THE TRACHEAL AND BRONCHIAL EPITHELIUM, NASOSEPTAL
 PERFORATION, ATELECTASIS, EMPHYSEMA, DAMAGE TO PULMONARY BLOOD VESSELS
 AND LESIONS OF THE LIVER AND OTHER ORGANS. DEATH MAY BE DUE TO LARYNGEAL
 SPASM, BRONCHOPNEUMONIA OR PULMONARY EDEMA. 1300-2000 PPM MAY BE
 DANGEROUS, EVEN IN BRIEF EXPOSURES. REPRODUCTIVE EFFECTS HAVE BEEN
 REPORTED IN ANIMALS.
 CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE EROSION AND
 DISCOLORATION OF EXPOSED TEETH, CHRONIC BRONCHITIS AND GASTRITIS.
 FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING
 HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLIND
 EYES. AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND
 AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. ADMINISTRATION OF OXYGEN
 SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION
 IMMEDIATELY.

SKIN CONTACT:
 HYDROGEN CHLORIDE (HYDROCHLORIC ACID):
 CORROSIVE
 ACUTE EXPOSURE- CONTACT MAY CAUSE SEVERE IRRITATION, INFLAMMATION,
 ULCERATION, NECROSIS AND CHEMICAL BURNS. SKIN SYMPTOMS MAY DEVELOP
 INCLUDING RAPID PULSE, SWEATING AND COLLAPSE. PHOTOSENSITIZATION
 REACTIONS MAY OCCUR IN PERSONS PREVIOUSLY EXPOSED. CONTACT WITH A

COMPRESSED GAS MAY CAUSE FROSTBITE.
 CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT WITH VAPORS OR DILUTE SOLUTIONS MAY CAUSE DERMATITIS. PHOTSENSITIZATION MAY OCCUR.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). IN CASE OF CHEMICAL BURNS, COVER AREA WITH STERILE, DRY DRESSING, BANDAGE SECURELY, BUT NOT TOO TIGHTLY. GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
 HYDROGEN CHLORIDE (HYDROCHLORIC ACID).
 CORROSIVE.

ACUTE EXPOSURE- CONTACT MAY CAUSE SEVERE IRRITATION, CONJUNCTIVITIS, CORNEAL NECROSIS AND BURNS WITH IMPAIRMENT OR PERMANENT LOSS OF VISION. A DROP OF HYDROCHLORIC ACID SPLASHED IN THE EYE AND IMMEDIATELY WASHED OUT HAS PRODUCED A WHITE COAGULATION OF THE CORNEAL AND CONJUNCTIVAL EPITHELIUM. ANIMALS EXPOSED TO VAPOR CONCENTRATIONS OF 1000 PPM FOR ONE AND A HALF HOURS SHOWED CLOUDING OF THE CORNEA AND SWELLING. FOR 6 HOURS SHOWED SLIGHT EROSION OF THE CORNEAL EPITHELIUM. CONTACT WITH A COMPRESSED GAS MAY CAUSE FROSTBITE.
 CHRONIC EXPOSURE- ANIMALS EXPOSED TO VAPOR AT 100 PPM FOR 6 HOURS DAILY FOR 30 DAYS SHOWED ONLY SLIGHT SWELLING AND CLOUDING OF THE CORNEA. NO CORNEAL INJURY. EFFECTS ARE CORRELATED TO CONCENTRATION, DURATION AND FREQUENCY OF EXPOSURE. CONJUNCTIVITIS OR EPITHELIAL DYSPLASIA MAY OCCUR. FROSTBITE MAY OCCUR.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER. COVER EYE, WASH UPPER AND LOWER LIDS. WASH AND EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). CONTINUE IRRIGATING WITH NORMAL SALINE UNTIL EYE HAS RETURNED TO NORMAL (30-60 MINUTES). COVER WITH STERILE BANDAGE. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
 HYDROGEN CHLORIDE (HYDROCHLORIC ACID).
 CORROSIVE.

ACUTE EXPOSURE- INGESTION OF THE ACID MAY CAUSE BURNS OF THE MOUTH, THROAT, ESOPHAGUS AND STOMACH WITH CONSEQUENT PAIN, UNEASINESS, ANOREXIA, SALIVATION, VOMITING, DIARRHEA, CHILLS, SHOCK AND INTENSE THIRST. NEPHRITIS, FEVER AND PERFORATION OF THE INTESTINAL TRACT AND CIRCULATOR COLLAPSE MAY OCCUR. DEATH MAY BE DUE TO ESOPHAGEAL OR GASTRIC NECROSIS.
 CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- DO NOT USE GASTRIC LAVAGE OR EMESIS. DILUTE THE ACID IMMEDIATELY BY DRINKING LARGE QUANTITIES OF WATER OR MILK. IF VOMITING OCCURS, ADMINISTER FLUIDS REPEATEDLY. INGESTED ACID MUST BE DILUTED APPROXIMATELY 100 FOLD TO RENDER IT HARMLESS TO TISSUES. MAINTAIN AIRWAY AND TREAT SHOCK (DREIBACH, HANDBOOK OF POISONING, 11TH ED.). GET MEDICAL ATTENTION IMMEDIATELY. IF VOMITING OCCURS, KEEP HEAD BELOW HIPS TO HELP PREVENT ASPIRATION.

ANTIDOTE
 NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:
 REACTS EXOTHERMICALLY WITH WATER OR STEAM TO PRODUCE TOXIC AND CORROSIVE FUMES.

INCOMPATIBILITIES:

HYDROGEN CHLORIDE (HYDROCHLORIC ACID):
 ACETIC ANHYDRIDE: VIOLENT REACTION.
 ALCOHOLIC HYDROGEN CYANIDE: EXPLOSIVE REACTION.
 ALUMINUM: EXPLOSION.
 ALUMINUM-TITANIUM ALLOYS: IGNITES OR INCANDESCES WHEN HEATED.
 2-AMINOETHANOL: VIOLENT REACTION.
 AMMONIUM HYDROXIDE: VIOLENT REACTION.
 BASES: VIOLENT REACTION.
 BRASS: CORRODES.
 BRONZE: CORRODES.
 CALCIUM CARBIDE: REACTS WITH INCANDESCENCE.
 CALCIUM HYPOCHLORITE: IGNITION.
 CESIUM ACETYLIDE: IGNITES ON CONTACT.
 CHLORINE + DINITROANILINES: VIGOROUS REACTION WITH RELEASE OF FLAMMABLE HYDROGEN GAS FUMES.
 CHLOROSULFONIC ACID: VIOLENT REACTION.
 1,1-DICHLOROETHYLENE: EXTREMELY EXOTHERMIC DECOMPOSITION REACTION.
 DIACETIC ACID: DECOMPOSES.
 ETHYLENE DIAMINE: VIOLENT REACTION.
 ETHYLENE IMINE: VIOLENT REACTION.
 FLUORINE: IGNITES ON CONTACT.
 HEXALITHIUM DISILICIDE: INCANDESCES.
 IRON: CORRODES WITH EVOLUTION OF FLAMMABLE HYDROGEN GAS.
 MAGNESIUM BORIDE: PRODUCES A SPONTANEOUSLY FLAMMABLE GAS.
 MERCURIC SULFATE: VIOLENT REACTION AT 135 C.
 METAL ACETYLIDES: VIOLENT REACTION.
 METALS: SEVERE CORROSION WITH EVOLUTION OF FLAMMABLE HYDROGEN GAS.
 OLEUM: VIOLENT REACTION.
 OXIDIZERS (STRONG): VIOLENT REACTION.
 OXYGEN + PLATINUM: IGNITES ON CONTACT.
 PERCHLORIC ACID: VIOLENT REACTION.
 PLASTICS RUBBER COATINGS: ATTACKS.
 POTASSIUM PERMANGANATE: EXPLOSION HAZARD.
 BETA-PROPYLACTONE: VIOLENT REACTION.
 PROPYLENE OXIDE: VIOLENT REACTION.
 PLATINUM ACETYLIDE: IGNITES ON CONTACT.
 SODIA GEL: INCOMPATIBLE.
 SODIUM: VIGOROUS OR EXPLOSIVE REACTION.
 SULFURIC ACID: EXPLOSIVE REACTION WITH RELEASE OF TOXIC HYDROGEN CHLORIDE GAS.
 TETRALENIUM TETRANITRIDE: EXPLODES ON CONTACT.
 VINYL ACETATE: VIOLENT REACTION.

DECOMPOSITION:

THERMAL DECOMPOSITION MAY RELEASE CORROSIVE HYDROGEN CHLORIDE.

POLYMERIZATION:

HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

STORAGE

- PROTECT AGAINST PHYSICAL DAMAGE. STORE IN COOL, WELL-VENTILATED PLACE, SEPARATED FROM ALL OXIDIZING MATERIALS (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).
- STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

DISPOSAL

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40 CFR 261, EPA HAZARDOUS WASTE NUMBER 0000, 100 POUND CERCLA SECTION 103 REPORTABLE QUANTITY.

CONDITIONS TO AVOID

● DO NOT STORE IN UNLIDED CONTAINERS. FLAMMABLE VAPORS MAY ACCUMULATE IN TANKS AND UNDER CAPS. MAY IGNITE COMBUSTIBLE LIQUID, PAPER, OIL, ETC.

SPILL AND LEAK PROCEDURES

- SOIL SPILL:
DIG HOLDING AREA SUCH AS LAGOON, POND OR PIT TO CONTAINMENT.
- DIKE FLOW OF SPILLED MATERIAL USING SOIL OR SANDBAGS OR FOAMED BARRIERS SUCH AS POLYURETHANE OR CONCRETE.
- USE CEMENT POWDER OR FLY ASH TO ABSORB LIQUID MASS.
- NEUTRALIZE SPILL WITH SLAKED LIME, SODIUM BICARBONATE OR CRUSHED LIMESTONE.
- AIR SPILL:
KNOCK DOWN VAPORS WITH WATER SPRAY. KEEP UPWIND.
- WATER USED TO KNOCK DOWN VAPORS MAY BECOME CORROSIVE OR TOXIC AND SHOULD BE CONTAINED PROPERLY FOR LATER DISPOSAL.
- WATER SPILL:
NEUTRALIZE WITH AGRICULTURAL LIME, SLAKED LIME, CRUSHED LIMESTONE, OR SODIUM BICARBONATE.
- OCCUPATIONAL SPILL:
DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR SMALL DRY SPILLS, WITH CLEAN SHOVEL PLACE

MATERIAL INTO CLEAN, DRY CONTAINER AND COVER. MOVE CONTAINERS FROM SPILL AREA. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA AND DENY ENTRY.

REPORTABLE QUANTITY (RQ): 5000 POUNDS

THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-9302 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.61).

PROTECTIVE EQUIPMENT

VENTILATION

PROVIDE LOCAL EXHAUST VENTILATION SYSTEM TO MEET PUBLISHED EXPOSURE LIMITS

RESPIRATOR

THE FOLLOWING RESPIRATORS ARE RECOMMENDED BASED ON INFORMATION FOUND IN THE PHYSICAL DATA, TOXICITY AND HEALTH EFFECTS SECTIONS. THEY ARE RANKED IN ORDER FROM MINIMUM TO MAXIMUM RESPIRATOR PROTECTION. THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE. MUST BE BASED ON THE SPECIFIC OPERATION, MATERIALS, AND THE WORKING LIMITS OF THE RESPIRATOR. MUST BE LISTED AS APPROVED BY THE NATIONAL OVERTIME FOR OCCUPATIONAL SAFETY AND HEALTH AND THE NATIONAL FIRE PROTECTION ASSOCIATION UNDER-NEARS.

HYDROGEN CHLORIDE (HYDROCHLORIC ACID)

50 FPM- ANY SUPPLIED-AIR RESPIRATOR

ANY SELF-CONTAINED BREATHING APPARATUS

ANY CHEMICAL CARTRIDGE RESPIRATOR WITH CARTRIDGE(S) PROVIDING PROTECTION AGAINST HYDROCHLORIC ACID.

100 FPM- ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE

ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE

ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE

ANY AIR-PURIFYING, FULL-FACEPIECE RESPIRATOR (GAS MASK) WITH A CANISTERS, FRONT- OR BACK-MOUNTED CARTRIDGE PROVIDING PROTECTION AGAINST HYDROCHLORIC ACID

ANY CHEMICAL CARTRIDGE RESPIRATOR WITH A FULL FACEPIECE AND CARTRIDGE(S) PROVIDING PROTECTION AGAINST HYDROCHLORIC ACID

ANY POWERED, AIR-PURIFYING RESPIRATOR WITH CARTRIDGE(S) PROVIDING PROTECTION AGAINST HYDROCHLORIC ACID

ESCAPE- ANY AIR-PURIFYING, FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CANISTERS, FRONT- OR BACK-MOUNTED ACID GAS CANISTER.

ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS

FOR PNEUMONIC AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE

ANY SUPPLIED-AIR RESPIRATOR THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND

OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT ANY POSSIBILITY OF SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

EMERGENCY WASH FACILITIES:
WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - FISHER SCIENTIFIC, INC.
CREATION DATE: 04/30/81 REVISION: DATE: 07/15/81

-ADDITIONAL INFORMATION-
THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION FOR THEIR PARTICULAR PURPOSES.

L-ASCORBIC ACID
 L-ASCORBIC ACID
 L-ASCORBIC ACID

 MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
 CHEMICAL DIVISION
 1 REAGENT LANE
 FAIR LAWN NJ 07410
 (201) 796-7100

EMERGENCY NUMBER: (201) 796-7100
 CHEMTREC ASSISTANCE: (800) 424-9300

THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION FOR THEIR PARTICULAR PURPOSES.

 SUBSTANCE IDENTIFICATION

SYNOPSIS: **L-ASCORBIC ACID**

CAS NUMBER: 50-81-7

TRADE NAME(S) / SYNONYMS:

VITAMIN C, L-LYXOASCORBIC ACID, LEBIONIC, ASCORBOLINA, ANISCORBITIC, VITAMIN C, VITAMINIC ACID, ALLEPOREIN, ASCORIN, VITAMIN C, L-ASCORBIC ACID, VITAMIN C, VITAMIN C, L-ASCORBIC ACID, DETEMICAN, L-(+)-ASCORBIC ACID, L-LYXOASCORBIC ACID, PROSCORBIC, TESTASCORBIC, R-51, BF-551.

CHEMICAL FAMILY:
 CARBOXYLIC ACID, ALCOHOLIC

MOLECULAR FORMULA: C₆H₈O₆

MOLECULAR WEIGHT: 176.14

OSHA RATING (SCALE 0-3): HEALTH=0 FIRE=1 REACTIVITY=0 PERSISTENCE=0
 NFPA RATING (SCALE 0-4): HEALTH=0 FIRE=1 REACTIVITY=0

 COMPONENTS AND CONTAMINANTS

COMPONENT	L-ASCORBIC ACID	PERCENT	100.00
	CAS# 50-81-7		

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

NO OCCUPATIONAL EXPOSURE LIMITS ESTABLISHED BY OSHA, ACGIH, OR NIOSH

 PHYSICAL DATA

DESCRIPTION: ODDORLESS, WHITE TO SLIGHTLY YELLOW CRYSTALS (PLATES OR MONOCLINIC

NEEDLES) OR POWDER WITH A MILD ACIDIC TASTE; GRADUALLY DARKENS ON EXPOSURE

TO LIGHT. MELTING POINT: 374-378 F (190-192 C) SOME DECOMPOSITION

SPECIFIC GRAVITY: 1.65 PH: 3 @ 0.5% SOLUTION SOLUBILITY IN WATER: 33%

SOLVENT SOLUBILITY: SLIGHTLY SOLUBLE IN ALCOHOL, INSOLUBLE IN ETHER,
CHLORFORM, BENZENE, PETROLEUM ETHER, OILS AND FATS, FAT SOLVENTS

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
SLIGHT FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

DUST-AIR MIXTURES MAY IGNITE OR EXPLODE.

UPPER EXPLOSIVE LIMIT: 10 G/FT3 (MINIMUM)

LOWER EXPLOSIVE LIMIT: 20 G/FT3 (OPTIMUM)

AUTOIGNITION TEMP.: 1220 F (660 C)

FIREFIGHTING MEDIA:

DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT # 1000 5)

FOR LARGER FIRES, USE WATER SPRAY, FOG OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT # 1000 5)

FIREFIGHTING:

IF THE CONTAINER FROM FIRE AREA IS YOU CAN DO IT WITHOUT FIRE, DO NOT REENTER
AREA UNTIL IT IS COOL WITH HIGH-PRESSURE WATER SPRAY. DO NOT REENTER UNTIL
IT IS COOL WITH HIGH-PRESSURE WATER SPRAY. (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT # 1000 5)

USE AGENTS SUITABLE FOR TYPE OF SURROUNDING FIRE. AVOID BREATHING HAZARDOUS
VAPORS, KEEP UPRIGHT.

TOXICITY

UNACETATED ACID

LD50 (RAT) 1000 MG/KG ORAL-RAT; LD50 1000 MG/KG ORAL-MOUSE; LD50
1000 MG/KG SUBCUTANEOUS-RAT; LD50 1000 MG/1000 DAYS INTRAVENOUS-MAN; TD01
100 MG/KG INTRAVENOUS-WOMAN; LD01 14 MG/KG INTRAVENOUS-RAT; LD50
518 MG/KG INTRAVENOUS-MOUSE; LD50 148 MG/KG INTRAPERITONEAL-MOUSE; LD01

MUTAGENIC DATA (ATELS); REPRODUCTIVE EFFECTS DATA (ATELS)

CARCINOGEN STATE: NONE

ACUTE TOXICITY LEVEL: SLIGHTLY TOXIC BY INGESTION.

TOXIC EFFECTS: POISONING MAY AFFECT THE BLOOD AND KIDNEYS.

INCREASED RISK FROM EXPOSURE: PERSONS WITH DIABETES, SICKLE CELL

ANEMIA, CRYSTALPHOSPHATE DEHYDROGENASE DEFICIENCY, PERSONS PRONE TO RECURRENT

CALCULI, OR THOSE ON ANTICOAGULANT THERAPY, THOSE WITH HYPERCALCAEMIA,

GASTROINTESTINAL DISORDERS INCLUDING ULCERS, ACHYLORRYA OR GASTRITIS,

DIARRHEA, AS WELL AS COLIC, AND CHRONIC INFLAMMATORY DISEASE MAY ALSO

BE AT RISK.

ADDITIONAL DATA: INTERACTIONS WITH MEDICATIONS HAVE BEEN REPORTED. MAY CROSS

THE PLACENTA AND BE EXCRETED IN BREAST MILK.

HEALTH EFFECTS AND FIRST AID

INHALATION:

L-ASCORBIC ACID:

ACUTE EXPOSURE- INHALATION MAY CAUSE MILD MUCOUS MEMBRANE IRRITATION, COUGHING AND CHEST DISCOMFORT.
CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:

L-ASCORBIC ACID:

ACUTE EXPOSURE- CONTACT MAY CAUSE MILD IRRITATION.
CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:

L-ASCORBIC ACID:

ACUTE EXPOSURE- CONTACT MAY CAUSE MILD IRRITATION.
CHRONIC EXPOSURE- REPEATED APPLICATION OF A 1% SOLUTION TO THE EYES OF PATIENTS CAUSED NO INJURY.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE OR ISOTONICALLY LIFTING UPPER AND LOWER LIDS. UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:

L-ASCORBIC ACID:

ACUTE EXPOSURE- INGESTION OF LARGE DOSES MAY CAUSE GASTROINTESTINAL IRRITATION INCLUDING NAUSEA AND DIARRHEA. PARTICULARLY WHEN CONSUMED ON AN EMPTY STOMACH. BLOOD DISORDERS SUCH AS HEINZ BODY FORMATION MAY OCCUR WITH HIGH DOSES OR IF AN INFECTION IS PRESENT. HEMOLYSIS IN 6-PHOSPHATE DEHYDROGENASE DEFICIENT INDIVIDUALS HAS BEEN REPORTED.
CHRONIC EXPOSURE- HUMANS HAVE CONSUMED 40 GM DAY FOR A MONTH OR 100 GM DAY FOR A FEW DAYS WITHOUT OBVIOUS SYMPTOMS. REPEATED INGESTION OF LARGE DOSES OF VITAMIN C MAY PRECIPITATE OXALATE (WASTE OF CALCIUM) STONES IN THE KIDNEYS OR BLADDER. REBOUND SCURVY HAS BEEN REPORTED IN INFANTS OF MOTHERS TAKING HIGH DOSES OF VITAMIN C. A PRECIPITABLE REDUCTION IN SERUM VITAMIN C LEVELS DUE TO AN ALTERED REGULATORY MECHANISM FOLLOWING PROLONGED INGESTION OF MASSIVE DOSES MAY ALSO RESULT IN REBOUND SCURVY. DENTAL EROSION HAS BEEN REPORTED IN AN INDIVIDUAL WHO TOOK HIGH DAILY DOSES OF CHEWABLE VITAMIN C FOR 2 YEARS. VITAMIN C IS EXCRETED IN HUMAN BREAST MILK AND NURSING INFANTS MAY BE AFFECTED BY LARGE DOSES. EFFECTS ON THE NEWBORN AND FEMALE FERTILITY HAVE BEEN REPORTED FROM INGESTION DURING PREGNANCY IN GUINEA PIGS AND RATS.

FIRST AID- IT IS UNLIKELY THAT EMERGENCY TREATMENT WILL BE REQUIRED. IF ADVERSE EFFECTS OCCUR, TREAT SYMPTOMATICALLY AND SUPPORTIVELY AND GET MEDICAL ATTENTION.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES

L-ASCORBIC ACID:
ACIDS (STRONG): INCOMPATIBLE.
ALKALIES: INCOMPATIBLE.
ALUMINUM: SOLUTIONS MAY RELEASE EXPLOSIVE HYDROGEN GAS.
COPPER: OXIDES VITAMIN C RAPIDLY.
IRON: SOLUTIONS MAY RELEASE EXPLOSIVE HYDROGEN GAS
OXIDIZERS (STRONG): FIRE AND EXPLOSION HAZARD.
ZINC: SOLUTIONS MAY RELEASE EXPLOSIVE HYDROGEN GAS

DECOMPOSITION:

THERMAL DECOMPOSITION MAY RELEASE ACRID SMOKE AND IRRITATING FUMES

POLYMERIZATION:

NO POLYMERIZATION HAS BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

***STORAGE**

KEEP CONTAINER TIGHTLY CLOSED. PROTECT FROM EXPOSURE TO AIR OR LIGHT
STORE IN A COOL, DRY, WELL VENTILATED AREA.
STORE AWAY FROM INCOMPATIBLE SUBSTANCES

CONDITIONS TO AVOID

MAY BLAZE BUT DOES NOT IGNITE EASILY. AVOID CONTACT WITH STRONG OXIDIZERS, EXCESSIVE HEAT, SPARKS, OR OPEN FLAME.

SPILL AND LEAK PROCEDURES

OCULAR: RINSE WITH WATER FOR 15 MINUTES.
SKIN: REMOVE CLOTHING AND PLACE IN SUITABLE CLEAN, DRY CONTAINERS FOR RECLAMATION OR LATER DISPOSAL. DO NOT FLUSH SPILLED MATERIAL INTO SEWER. KEEP UNNECESSARY PEOPLE AWAY.

PROTECTIVE EQUIPMENT

VENTILATION:
 PROVIDE LOCAL EXHAUST VENTILATION. VENTILATION EQUIPMENT MUST BE EXPLOSION PROOF.

RESPIRATOR:
 THE FOLLOWING RESPIRATORS ARE RECOMMENDED BASED ON INFORMATION FOUND IN THE PHYSICAL DATA, TOXICITY AND HEALTH EFFECTS SECTIONS. THEY ARE RANKED IN ORDER FROM MINIMUM TO MAXIMUM RESPIRATORY PROTECTION.
 THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE. MUST BE BASED ON THE SPECIFIC OPERATION, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND MUST BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

ANY DUST AND MIST RESPIRATOR.

ANY AIR-PURIFYING RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER.

ANY POWERED AIR-PURIFYING RESPIRATOR WITH A DUST AND MIST FILTER.

ANY POWERED AIR-PURIFYING RESPIRATOR WITH A HIGH-EFFICIENCY PARTICULATE FILTER.

ANY TYPE OF SUPPLIED-AIR RESPIRATOR OPERATED IN THE PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE OR CONTINUOUS-FLOW MODE.

ANY SELF-CONTAINED BREATHING APPARATUS

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

ANY SUPPLIED-AIR RESPIRATOR THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE IMPERMEABLE CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:

EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE.

EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - FISHER SCIENTIFIC, INC.
CREATION DATE: 12/21/84 REVISION DATE: 05/19/92

-ADDITIONAL INFORMATION-
THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION FOR THEIR PARTICULAR PURPOSES.

2-PROPANOL
 2-PROPANOL
 2-PROPANOL

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
 CHEMICAL DIVISION
 1 REAGENT LANE
 FAIR LAWN NJ 07410
 (201) 796-7100

EMERGENCY NUMBER: (201) 796-7100
 CHEMTREC ASSISTANCE: (800) 424-9300

THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION FOR THEIR PARTICULAR PURPOSES.

SUBSTANCE IDENTIFICATION

SUBSTANCE: **2-PROPANOL**

CAS-NUMBER: 67-63-0

TRADE NAMES/SYNONYMS:

ISOPROPANOL, LUTOSOL, PETROCEL, DIMETHYL CARBINOL, IPA, AVANTIN, PROPAN-2-OL, ALCOSSOLVE 2, AVANTINE, ISOPROPYL ALCOHOL, ALCOJEL, ISOHOL, N-PROPAN-2-OL, SEC-PROPYL ALCOHOL, PPO, STCC 4909205, UN 1219, A415, A416, A417, A426, A419, A432, A451, A519, A520, A451SK, A416SK, A426P, A464, A516, C3H8O,

CHEMICAL FAMILY:

HYDROXYL, ALIPHATIC

MOLECULAR FORMULA: C₃H₈O

MOLECULAR WEIGHT: 60.11

OSHA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=0 PERSISTENCE=0
 NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=3 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: 2-PROPANOL
 CAS# 67-63-0

PERCENT: 100

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

ISOPROPYL ALCOHOL (ISOPROPANOL; 2-PROPANOL):
 400 PPM (983 MG/M³) OSHA TWA; 500 PPM (1230 MG/M³) OSHA STEL
 400 PPM (983 MG/M³) ACGIH TWA; 500 PPM (1230 MG/M³) ACGIH STEL
 400 PPM (983 MG/M³) NIOSH RECOMMENDED TWA
 500 PPM (1230 MG/M³) NIOSH RECOMMENDED STEL
 400 PPM (983 MG/M³) DFG MAK TWA;
 800 PPM (1966 MG/M³) DFG MAK 30 MINUTE PEAK, AVERAGE VALUE, 4 TIMES/SHIFT

MEASUREMENT METHOD: CHARCOAL TUBE; 2-BUTANOL/CARBON DISULFIDE; GAS CHROMATOGRAPHY WITH FLAME IONIZATION DETECTION; (NIOSH VOL. III # 1400, ALCOHOLS I).

SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING
(ONLY PERSONS WHO MANUFACTURE BY THE STRONG ACID PROCESS ARE SUBJECT,
- SUPPLIER NOTIFICATION NOT REQUIRED.)

**OSHA LIMITS ADOPTED JANUARY 19, 1989 ARE SUBJECT TO THE DECISION OF THE
11TH CIRCUIT COURT OF APPEALS (AFL-CIO V. OSHA) AS OF JULY 7, 1992.**

PHYSICAL DATA

DESCRIPTION: TRANSPARENT, COLORLESS, MOBILE LIQUID WITH A CHARACTERISTIC MILD
ALCOHOLIC ODOR AND A SLIGHTLY BITTER TASTE. BOILING POINT: 180 F (82 C)
MELTING POINT: -129 F (-89 C) SPECIFIC GRAVITY: 0.785 VOLATILITY: 100%
VAPOR PRESSURE: 40 MMHG @ 23.6 C EVAPORATION RATE: (BUTYL ACETATE=1) 2.56
SOLUBILITY: IN WATER: SOLUBLE ODOR THRESHOLD: 50 PPM VAPOR DENSITY: 0.1
SOLVENT SOLUBILITY: SOLUBLE IN ETHANOL, ETHER, CHLOROFORM, ACETONE,
BENZENE; INSOLUBLE IN SALT SOLUTIONS
VISCOSITY: 0.1 CP @ 25 C

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE
OF IGNITION AND FLASH BACK.

VAPOR-AIR MIXTURES ARE EXPLOSIVE ABOVE FLASH POINT.

FLASH POINT: 53 F (12 C) (CC) UPPER EXPLOSIVE LIMIT: 12.7% @ 93 C

LOWER EXPLOSIVE LIMIT: 2.0% AUTOIGNITION TEMP.: 750 F (399 C)

FLAMMABILITY CLASS(OSHA): IB

FIREFIGHTING MEDIA:

DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR ALCOHOL-RESISTANT FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FOR LARGER FIRES, USE WATER SPRAY, FOS OR ALCOHOL-RESISTANT FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

ALCOHOL FOAM

NFPA 325M, FIRE HAZARD PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND VOLATILE
SOLIDS, (1991).

FIREFIGHTING:

MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO IT WITHOUT RISK. APPLY COOLING
WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED TO FLAMES UNTIL WELL AFTER FIRE
IS OUT. STAY AWAY FROM ENDS OF TANKS. FOR MASSIVE FIRE IN CARGO AREA, USE

UNMANNED HOSE HOLDER OR MONITOR NOZZLES; IF THIS IS IMPOSSIBLE, WITHDRAW FROM AREA AND LET FIRE BURN. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF TANK DUE TO FIRE. ISOLATE FOR 1/2 MILE IN ALL DIRECTIONS IF TANK, RAIL CAR OR TANK TRUCK IS INVOLVED IN FIRE (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5, GUIDE PAGE 26).

EXTINGUISH ONLY IF FLOW CAN BE STOPPED; USE WATER IN FLOODING AMOUNTS AS FOG. SOLID STREAMS MAY NOT BE EFFECTIVE. COOL CONTAINERS WITH FLOODING QUANTITIES OF WATER, APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING TOXIC VAPORS, KEEP UPWIND.

WATER MAY BE INEFFECTIVE (NFPA 305M, FIRE HAZARD PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND VOLATILE SOLIDS, 1991)

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49-CFR 172.101.
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49-CFR 172.101 AND
SUBPART E:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS 49-CFR 173.150
EXCEPTIONS 49-CFR 173.150

FEDERAL RULES OF HAZARDOUS MATERIALS REGULATIONS 49-CFR PARTS 171-180.
CURRENT NUMBERS HM-181, HM-182A, HM-181B, HM-181C, HM-181D AND HM-181E.
EFFECTIVE DATE OCTOBER 1, 1991. HOWEVER, COMPLIANCE WITH THE REGULATIONS IS
AUTHORIZED ON AND AFTER JANUARY 1, 1991. (56 FR 52410, 12/01/90)

EXCEPT FOR EXPLOSIVES, INHALATION HAZARDS, AND INFECTIOUS SUBSTANCES THE
EFFECTIVE DATE FOR HAZARD COMMUNICATION REQUIREMENTS IS EXTENDED TO
OCTOBER 1, 1993. (56 FR 47159 OF 12/93)

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER 49 CFR 172.101.
158PROPAND-UN 1019

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION 49 CFR 172.101
3 - FLAMMABLE LIQUID

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP 49 CFR 172.101
P3 II

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101
AND SUBPART E:
FLAMMABLE LIQUID

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS
EXCEPTIONS 49 CFR 173.150
NON-BULK PACKAGING 49 CFR 173.200
BULK PACKAGING 49 CFR 173.242

U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS 49 CFR 172.101:
PASSENGER AIRCRAFT OR RAILCAR: 5 L
CARGO AIRCRAFT ONLY: 60 L

TOXICITY

ISOPROPYL ALCOHOL (ISOPROPANOL; 2-PROPANOL):

IRRITATION DATA: 500 MG SKIN-RABBIT MILD; 100 MG/EYE-RABBIT SEVERE; 10 MG EYE-RABBIT MODERATE; 100 MG/24 HOURS EYE-RABBIT MODERATE.
 TOXICITY DATA: 16,000 PPM/4 HOURS INHALATION-RAT LCLO; 12,800 PPM/3 HOURS INHALATION-MOUSE LCLO; 12,800 MG/KG SKIN-RABBIT LD50; 5272 MG/KG ORAL-MAN LDLO; 14,432 MG/KG ORAL-MAN TDLO; 3570 MG/KG ORAL-HUMAN LDLO; 223 MG/KG ORAL-HUMAN TDLO; 5045 MG/KG ORAL-RAT LD50; 3600 MG/KG ORAL-MOUSE LD50; 6410 MG/KG ORAL-RABBIT LD50; 1537 MG/KG ORAL-DOG LDLO; 5 MG/KG SUBCUTANEOUS-MAMMAL LDLO; 8 GM/KG SUBCUTANEOUS-MOUSE LDLO; 1088 MG/KG INTRAVENOUS-RAT LD50; 1509 MG/KG INTRAVENOUS-MOUSE LD50; 1194 MG/KG INTRAVENOUS-RABBIT LD50; 1963 MG/KG INTRAVENOUS-CAT LDLO; 1024 MG/KG INTRAVENOUS-DOG LDLO; 2735 MG/KG INTRAPERITONEAL-RAT LD50; 4477 MG/KG INTRAPERITONEAL-MOUSE LD50; 667 MG/KG INTRAPERITONEAL-RABBIT LD50; 2550 MG/KG INTRAPERITONEAL-GUINEA PIG LD50; 3444 MG/KG INTRAPERITONEAL-HAMSTER LD50; 3770 MG/KG UNREPORTED-MAN LDLO. MUTAGENIC DATA (TECS), REPRODUCTIVE EFFECTS DATA (TECS).
 CARCINOGEN STATUS: HUMAN INADEQUATE EVIDENCE ANIMAL INADEQUATE EVIDENCE (IARC GROUP-3); STRONG ACID MANUFACTURING PROCESS; HUMAN SUFFICIENT EVIDENCE (IARC GROUP-1); WORKERS INVOLVED IN THE MANUFACTURE OF ISOPROPYL ALCOHOL IN THE STRONG-ACID PROCESS, INVOLVING THE FORMATION OF ISOPROPYL OILE, SHOWED AN INCREASE IN PARANASAL AND LARYNAL CANCER.
 LOCAL EFFECTS: IRRITANT- INHALATION, EYE.
 ACUTE TOXICITY LEVEL: ELEVATED LEVELS BY INGESTION, DERMAL ABSORPTION.
 TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSION.
 AT INCREASED RISK FROM EXPOSURE: PERSONS WITH PRE-EXISTING BURN DISORDERS, IMPAIRED LIVER, RENAL AND/OR PULMONARY FUNCTION.
 ADDITIONAL DATA: POTENTIATES THE EFFECT OF CARBON TETRACHLORIDE AND OTHER HEPATOTOXIC CHLORINATED ALIPHATIC HYDROCARBONS.

HEALTH EFFECTS AND FIRST AID

INHALATION:

ISOPROPYL ALCOHOL (ISOPROPANOL; 2-PROPANOL):

IRRITANT/NARCOTIC. 12,000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.
 ACUTE EXPOSURE- HUMAN SUBJECTS EXPOSED TO 400 PPM FOR 3-5 MINUTES HAD MILD IRRITATION OF THE NOSE AND THROAT. AT 800 PPM THE IRRITATION WAS NOT SEVERE BUT UNCOMFORTABLE. HIGHER CONCENTRATIONS MAY CAUSE EFFECTS AS DETAILED IN ACUTE INGESTION. THE LENGTH OF TIME REQUIRED TO PRODUCE DEEP NARCOSIS IN ANIMALS WAS INVERSELY PROPORTIONAL TO THE CONCENTRATION. THE ONSET OF DEEP NARCOSIS RANGED FROM 400 MINUTES AT 1000 PPM TO 100 MINUTES AT 24,500 PPM.
 CHRONIC EXPOSURE- MICE SUBJECTED TO 10900 PPM ISOPROPYL ALCOHOL IN AIR FOR ABOUT 4 HOURS/DAY UNTIL THEY HAD ACCUMULATED 100 HOURS OF EXPOSURE WERE NARCOTIZED BUT SURVIVED. REVERSIBLE FATTY CHANGES WERE OBSERVED IN THE LIVER. MALE MICE EXPOSED TO EITHER 1000 OR 5000 PPM OF ISOPROPYL ALCOHOL VAPOR FOR 6 HOURS A DAY FOR 9 EXPOSURES EXHIBITED HYALINE DROPLET NEPHROPATHY. REPRODUCTIVE EFFECTS HAVE BEEN REPORTED IN ANIMALS. THERE HAS BEEN AN INCREASED INCIDENCE OF CANCER OF THE PARANASAL SINUSES, AND POSSIBLY OF THE LARYNX. IN THE MANUFACTURE OF ISOPROPYL ALCOHOL BY THE STRONG ACID PROCESS, INVOLVING THE FORMATION OF ISOPROPYL OILE IT IS NOT CLEAR WHICH SUBSTANCES ARE RESPONSIBLE.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST.

EVEN IF DELAYED. DO NOT ATTEMPT EMESIS IF RESPIRATION IS DEPRESSED. MAINTAIN BLOOD PRESSURE. TREATMENT SHOULD BE ADMINISTERED BY QUALIFIED MEDICAL PERSONNEL (DREISBACH, HANDBOOK OF POISONING, 12TH ED.). GET MEDICAL ATTENTION.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:

ISOPROPYL ALCOHOL (ISOPROPANOL; 2-PROPANOL):
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES. MAY SLOWLY PEROXIDISE ON EXPOSURE TO AIR UNDER NORMAL STORAGE CONDITIONS. AN EXPLOSION HAZARD MAY EXIST IF THE SUBSTANCE IS DISTILLED OR ALLOWED TO EVAPORATE TO DRYNESS.

INCOMPATIBILITIES:

ISOPROPYL ALCOHOL (ISOPROPANOL; 2-PROPANOL):
ACIDS: INCOMPATIBLE.
ACIDS ANHYDRIDES: INCOMPATIBLE.
ALUMINUM: DISSOLUTION IS EXOTHERMIC.
BARIUM PERCHLORATE: FORMATION OF EXPLOSIVE COMPOUND.
DIBROMANE (METHYL ETHYL KETONE): ACCELERATED THE PEROXIDATION OF THE ALCOHOL.
COPPER(II) SULFATE (ANHYDRATE): IGNITION.
COPPER(II) MAY BE ATTACKED.
DIOXYGENIC TETRAFLUOROSULFATE: IGNITION AT AMBIENT TEMPERATURES.
HALOGENS: INCOMPATIBLE.
HYDROGEN + PALLADIUM (PARTICLES): IGNITION ON EXPOSURE TO AIR.
HYDROGEN PEROXIDE: FORMATION OF EXPLOSIVE COMPOUND.
KETONES: MARKEDLY INCREASES THE POSSIBILITY OF PEROXIDATION.
NITROFORM (TRINITROMETHANE): DISSOLVES LIBERATING HEAT AND POSSIBLY EXPLODING.
OILS: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
OXIDIZERS (STRONG): FIRE AND EXPLOSION HAZARD.
OXYGEN (GAS): AUTOXIDATION ON EXPOSURE TO LIGHT, RESULTS IN FORMATION OF KETONES AND POTENTIALLY EXPLOSIVE HYDROGEN PEROXIDE.
PERSSOGEN: IN THE PRESENCE OF IPON SALTS, MAY EXPLODE.
PLASTICS: MAY BE ATTACKED.
POTASSIUM TERT-BUTOXIDE: IGNITION.
RUBBER: MAY BE ATTACKED.
SODIUM DICHROMATE + SULFURIC ACID: EXOTHERMIC REACTION WITH POSSIBLE INCANDESCENCE.
SEE ALSO ALCOHOLS

DECOMPOSITION:

THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC OXIDES OF CARBON

POLYMERIZATION:

HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE AND DISPOSAL

RESERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE

****STORAGE****

PRESERVE IN TIGHT CONTAINERS, REMOTE FROM HEAT. (U.S. PHARMACOPEIA, NATIONAL FORMULARY, 1985).

STORE IN ACCORDANCE WITH 29 CFR 1910.106.

BONDING AND GROUNDING: SUBSTANCES WITH LOW ELECTROCONDUCTIVITY, WHICH MAY BE IGNITED BY ELECTROSTATIC SPARKS, SHOULD BE STORED IN CONTAINERS WHICH MEET THE BONDING AND GROUNDING GUIDELINES SPECIFIED IN NFPA 77-1983, RECOMMENDED PRACTICE ON STATIC ELECTRICITY.

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

****DISPOSAL****

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40 CFR 262, EPA HAZARDOUS WASTE NUMBER D001, 100 POUND CERCLA SECTION 103 REPORTABLE QUANTITY.

CONDITIONS TO AVOID

AVOID CONTACT WITH HEAT, SPARKS, FLAMES, OR OTHER SOURCES OF IGNITION. VAPORS MAY BE IRRITANT AND POISONOUS. DO NOT FILL UNNECESSARY PERSONNEL IN AREA OF HOT OVERPRESSURE CONTAINERS. CONTAINERS MAY VIOLENTLY RUPTURE AND TRAVEL A CONSIDERABLE DISTANCE IN HEAT OF FIRE.

SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:
SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR LARGE SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA AND DENY ENTRY.

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE GENERAL DILUTION VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

RESPIRATOR:
THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POUCH GUIDE TO CHEMICAL HAZARDS, NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29 CFR 1910 SUBPART Z.
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND

HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

ISOPROPYL ALCOHOL:

- 1000 PPM- ANY POWERED, AIR-PURIFYING RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE(S).
ANY CHEMICAL CARTRIDGE RESPIRATOR WITH A FULL FACEPIECE AND ORGANIC VAPOR CARTRIDGE(S).
- 10,000 PPM- ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.
- 12,000 PPM- ANY AIR-PURIFYING, FULL-FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE, FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
- ESCAPE- ANY AIR-PURIFYING, FULL-FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE, FRONT- OR BACK-MOUNTED ORGANIC VAPOR CANISTER.
ANY APPROPRIATE ESCAPE-TYPE, SELF-CONTAINED BREATHING APPARATUS

- FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS
ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE

- ANY SUPPLIED-AIR RESPIRATOR THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE

- CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

- GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

- EYE PROTECTION
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE

- EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE

● AUTHORIZED - FISHER SCIENTIFIC, INC.
● CREATION DATE: 02/26/85 REVISION DATE: 07/16/92

- -ADDITIONAL INFORMATION-
● THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE

INFORMATION FOR THEIR PARTICULAR PURPOSES.

****NITRIC ACID****
****NITRIC ACID****
****NITRIC ACID****

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
1 REAGENT LANE
FAIR LAWN NJ 07410
(201) 796-7100

EMERGENCY NUMBER: (201) 796-7100
CHEMTREC ASSISTANCE: (800) 424-9300

THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION FOR THEIR PARTICULAR PURPOSES.

SUBSTANCE IDENTIFICATION

108674-001 ****NITRIC ACID****

CAS-NUMBER: 7723-35-7

TRADE NAME(S) AND SYNONYMS:

ACQUA FORTIS (WFNA) RFNA; HYDROGEN NITRATE; AZOTIC ACID; NITRIC HYDROXIDE
NITAL; STOC 4918528, UN 2051
A200; A2000; A2005; A202; A206C; A509; A467; A20051; A1980; A460; HNO3

CHEMICAL FAMILY:
INORGANIC ACID

MOLECULAR FORMULA: H-N-O3

MOLECULAR WEIGHT: 63.01

OSHA RATINGS (SCALE 0-3): HEALTH=1 FIRE=0 REACTIVITY=1 PERSISTENCE=0
NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=0 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: NITRIC ACID PERCENT: 70

COMPONENT: WATER PERCENT: 30

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

NITRIC ACID:

- 2 PPM (5 MG/M3) OSHA TWA; 4 PPM (10 MG/M3) OSHA STEL
- 2 PPM (5 MG/M3) ACGIH TWA; 4 PPM (10 MG/M3) ACGIH STEL
- 2 PPM (5 MG/M3) NIOSH RECOMMENDED TWA
- 4 PPM (10 MG/M3) NIOSH RECOMMENDED STEL
- 10 PPM (25 MG/M3) DFG MAK TWA
- 20 PPM (50 MG/M3) DFG MAK 5-MINUTE PEAK MOMENTARY VALUE, 2-TIME SHIFT

MEASUREMENT METHOD: SILICA GEL TUBE; SODIUM BICARBONATE/SODIUM CARBONATE;
ION CHROMATOGRAPHY; (NIOSH VOL. III # 7903, INORGANIC ACIDS)

1000 POUNDS SARA SECTION 302 THRESHOLD PLANNING QUANTITY

1000 POUNDS SARA SECTION 304 REPORTABLE QUANTITY
1000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY
SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

**OSHA LIMITS ADOPTED JANUARY 19, 1989 ARE SUBJECT TO THE DECISION OF THE
11TH CIRCUIT COURT OF APPEALS (AFL-CIO V. OSHA) AS OF JULY 7, 1992.**

PHYSICAL DATA

DESCRIPTION: COLORLESS TO PALE YELLOW LIQUID WITH A SUFFOCATING ODOR
BOILING POINT: 181 F (83 C) MELTING POINT: -44 F (-42 C)
SPECIFIC GRAVITY: 1.5027 @ 25 C VAPOR PRESSURE: 47.9 MMHG @ 20 C
EVAPORATION RATE: NOT AVAILABLE SOLUBILITY IN WATER: VERY SOLUBLE
VAPOR DENSITY: 3.2
SOLVENT SOLUBILITY: SOLUBLE IN ETHER

FIRE AND EXPLOSION DATA

FLAME AND EXPLOSION HAZARD
CONTAINERS: FIRE HAZARD: EXPOSED TO HEAT OF FLAME
CATALYZER, OXIDIZERS DECOMPOSE, ESPECIALLY WHEN HEATED, TO YIELD O₂ AND OTHER GASES WHICH WILL INCREASE THE BURNING RATE OF COMBUSTIBLE MATTER
CONTACT WITH EASILY OXIDIZABLE, ORGANIC, OR OTHER COMBUSTIBLE MATERIALS MAY RESULT IN IGNITION, VIOLENT COMBUSTION OR EXPLOSION

FIREFIGHTING MEDIA:
WATER, DRY CHEMICAL OR SODA ASH
1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800 5

FOR LARGER FIRES: FLOOD AREA WITH WATER FROM A DISTANCE
1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800 5

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO IT WITHOUT RISK. APPLY COOLING WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED TO FLAMES UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM ENDS OF TANKS. FOR MASSIVE FIRE IN CARGO AREA, USE UNMANNED HOSE HOLDER OR MONITOR NOZZLES. IF THIS IS IMPOSSIBLE, WITHDRAW FROM AREA AND LET FIRE BURN. 1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800 5, GUIDE PAGE 44.

USE FLOODING AMOUNTS OF WATER AS FOR COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER. APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING CORROSIVE VAPORS. KEEP UPRIGHT. CONSIDER EVACUATION OF DOWNWIND AREA IF MATERIAL IS LEAKING.

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49-CFR 172.101;
OXIDIZER

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49-CFR 172.101 AND
SUBPART E:
OXIDIZER AND CORROSIVE

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49-CFR 173.268
EXCEPTIONS: NONE

FINAL RULE ON HAZARDOUS MATERIALS REGULATIONS (HMR, 49 CFR PARTS 171-160),
DOCKET NUMBERS HM-181, HM-181A, HM-181B, HM-181C, HM-181D AND HM-204.
EFFECTIVE DATE OCTOBER 1, 1991. HOWEVER, COMPLIANCE WITH THE REGULATIONS IS
AUTHORIZED ON AND AFTER JANUARY 1, 1991. (55 FR 52402, 12/21/90)

EXCEPT FOR EXPLOSIVES, INHALATION HAZARD AND INFECTIOUS SUBSTANCES, THE
EFFECTIVE DATE FOR HAZARD COMMUNICATION REQUIREMENTS IS EXTENDED TO
OCTOBER 1, 1993. (56 FR 47158, 09/

U.S. DEPARTMENT OF TRANSPORTATION SHIPP. UNIMEMO NUMBER, 49 CFR 172.101.
NITRIC ACID-UN 2031

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION, 49 CFR 172.101
CORROSIVE MATERIAL

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING GROUP, 49 CFR 173.155

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101
AND SUBPART E:
CORROSIVE

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS:
EXCEPTIONS: NONE

NON-BULK PACKAGING: 49 CFR 173.158

BULK PACKAGING: 49 CFR 173.243
U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS 49 CFR 172.101
PASSENGER AIRCRAFT OR RAILCAR: FORBIDDEN
CARGO AIRCRAFT ONLY: 0.5 L

TOXICITY

NITRIC ACID

TOXICITY DATA:

ANHYDROUS: 49 PPM 4 HOUR INHALATION-RAT LO50 (VAN WATER & ROSENE, INC
MSDS); 2500 PPM/1 HOUR INHALATION-RAT LO50 (DUPONT MSDS); 400 MG/KG
ORAL-HUMAN LO50; 50-500 MG/KG ORAL-UNSPECIFIED SPECIES LO50 (DUPONT MSDS);
110 MG/KG UNREPORTED-HUMAN LO50; REPRODUCTIVE EFFECTS DATA (RTECS);

MONOHYDRATE: NO DATA AVAILABLE
TRIHYDRATE: NO DATA AVAILABLE

GENOTOXICITY STATUS: NONE

LOCAL EFFECTS: CORROSIVE- INHALATION, SKIN, EYES, INGESTION

ACUTE TOXICITY LEVEL: HIGHLY TOXIC BY INHALATION; TOXIC BY INGESTION

TARGET EFFECTS: NO DATA AVAILABLE.
 AT INCREASED RISK FROM EXPOSURE: PERSONS WITH IMPAIRED PULMONARY FUNCTION,
 PRE-EXISTING EYE AND SKIN DISORDERS.

HEALTH EFFECTS AND FIRST AID

INHALATION:

NITRIC ACID:

CORROSIVE/HIGHLY TOXIC. 100 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.
 ACUTE EXPOSURE- INHALATION OF ACIDIC SUBSTANCES MAY CAUSE SEVERE RESPIRATORY
 IRRITATION WITH COUGHING, CHOKING, AND POSSIBLY YELLOWISH BURNS OF THE
 MUCOUS MEMBRANES. OTHER INITIAL SYMPTOMS MAY INCLUDE DIZZINESS, HEADACHE,
 NAUSEA, AND WEAKNESS. PULMONARY EDEMA MAY BE IMMEDIATE IN THE MOST SEVERE
 EXPOSURES, BUT MORE LIKELY WILL OCCUR AFTER A LATENT PERIOD OF 5-72 HOURS.
 THE SYMPTOMS MAY INCLUDE TIGHTNESS IN THE CHEST, DYSPNEA, DIZZINESS,
 FROTHY SPUTUM, AND CYANOSIS. PHYSICAL FINDINGS MAY INCLUDE HYPOTENSION,
 WEAK, RAPID PULSE, MOIST RALES, AND HEMOCONCENTRATION. IN NON-FATAL CASES
 COMPLETE RECOVERY MAY OCCUR WITHIN A FEW DAYS OR WEEKS OR, SINCE RECOVERY
 MAY BE PROLONGED WITH FREQUENT RELAPSES AND CONTINUED DYSPNEA AND OTHER
 SIGNS AND SYMPTOMS OF PULMONARY INSUFFICIENCY. IN SEVERE CASES, DEATH
 DUE TO ANOXIA MAY OCCUR WITHIN A FEW HOURS AFTER ONSET OF THE SYMPTOMS OF
 PULMONARY EDEMA OR FOLLOWING A RELAPSE.
 CHRONIC EXPOSURE- DEPENDS ON THE CONCENTRATION AND DURATION OF EXPOSURE.
 REPEATED OR PROLONGED EXPOSURE TO AN ACIDIC SUBSTANCE MAY CAUSE IRRITATION OF
 THE TRACHEA, BRONCHITIS, AND SENSITIVE CHANGES IN THE THYROID AND SUBCUTANEOUS
 AND MUCOSAL BRONCHIAL IRRITATION WITH PERSISTENT AND PROGRESSIVE BRONCHITIS.
 BRONCHIAL PNEUMONIA MAY OCCUR. GASTROINTESTINAL DISTURBANCES ARE ALSO
 POSSIBLE.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING
 HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD
 PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND
 AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. ADMINISTRATION OF OXYGEN
 SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION
 IMMEDIATELY.

SKIN CONTACT:

NITRIC ACID

CORROSIVE

ACUTE EXPOSURE- DIRECT CONTACT WITH LIQUID OR VAPOR MAY CAUSE SEVERE PAIN
 BURNS AND POSSIBLY YELLOWISH STAINING. BURNS MAY BE DEEP WITH SHARP
 EDGES AND HEAL SLOWLY WITH SCAR TISSUE FORMATION. DILUTE SOLUTIONS
 OF NITRIC ACID MAY PRODUCE MILD IRRITATION AND HARDEN THE EPIDERMIS
 WITHOUT DESTROYING IT. CONCENTRATED ACID SOLUTIONS APPLIED TO OVER 25% OF
 THE SKIN AREA IN RATS PRODUCED ELEVATED METHEMOGLOBIN AND BLOOD NITRATE
 LEVELS.

CHRONIC EXPOSURE- EFFECTS DEPEND ON THE CONCENTRATION AND DURATION OF
 EXPOSURE. REPEATED OR PROLONGED CONTACT WITH ACIDIC SUBSTANCES MAY RESULT
 IN DERMATITIS OR EFFECTS SIMILAR TO ACUTE EXPOSURE.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED
 AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO
 EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). IN CASE OF CHEMICAL
 BURNS, COVER AREA WITH STERILE, DRY DRESSING. BANDAGE SECURELY, BUT NOT
 TOO TIGHTLY. GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT

NITRIC ACID

CORROSIVE

ACUTE EXPOSURE- DIRECT CONTACT WITH ACIDIC SUBSTANCES MAY CAUSE PAIN AND LACRIMATION, PHOTOPHOBIA, AND BURNS, POSSIBLY SEVERE. THE DEGREE OF INJURY DEPENDS ON THE CONCENTRATION AND DURATION OF CONTACT. IN MILD BURNS, THE EPITHELIUM REGENERATES RAPIDLY AND THE EYE RECOVERS COMPLETELY. IN SEVERE CASES, THE EXTENT OF INJURY MAY NOT BE FULLY APPARENT FOR SEVERAL WEEKS. ULTIMATELY, THE WHOLE CORNEA MAY BECOME DEEPLY VASCULARIZED AND OPAQUE RESULTING IN BLINDNESS. IN THE WORST CASES, THE EYE MAY BE TOTALLY DESTROYED. CONCENTRATED NITRIC ACID MAY IMPART A YELLOW COLOR TO THE EYE UPON CONTACT.

CHRONIC EXPOSURE- EFFECTS DEPEND ON THE CONCENTRATION AND DURATION OF EXPOSURE. REPEATED OR PROLONGED EXPOSURE TO ACIDIC SUBSTANCES MAY CAUSE CONJUNCTIVITIS OR EFFECTS AS IN ACUTE EXPOSURE.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER (Frequently lifting upper and lower lids until no evidence of chemical remains at least 15-30 minutes). CONTINUE IRRIGATING WITH NORMAL SALINE UNTIL THE pH HAS RETURNED TO NORMAL (3-9) MINUTELY. COVER WITH STERILE BANDAGE. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION

ACUTE EXPOSURE- DIRECT CONTACT WITH ACIDIC SUBSTANCES MAY CAUSE PAIN AND LACRIMATION, PHOTOPHOBIA, AND BURNS, POSSIBLY SEVERE. THE DEGREE OF INJURY DEPENDS ON THE CONCENTRATION AND DURATION OF CONTACT. IN MILD BURNS, THE EPITHELIUM REGENERATES RAPIDLY AND THE EYE RECOVERS COMPLETELY. IN SEVERE CASES, THE EXTENT OF INJURY MAY NOT BE FULLY APPARENT FOR SEVERAL WEEKS. ULTIMATELY, THE WHOLE CORNEA MAY BECOME DEEPLY VASCULARIZED AND OPAQUE RESULTING IN BLINDNESS. IN THE WORST CASES, THE EYE MAY BE TOTALLY DESTROYED. CONCENTRATED NITRIC ACID MAY IMPART A YELLOW COLOR TO THE EYE UPON CONTACT. CHRONIC EXPOSURE- EFFECTS DEPEND ON THE CONCENTRATION AND DURATION OF EXPOSURE. REPEATED OR PROLONGED EXPOSURE TO ACIDIC SUBSTANCES MAY CAUSE CONJUNCTIVITIS OR EFFECTS AS IN ACUTE EXPOSURE. FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER (Frequently lifting upper and lower lids until no evidence of chemical remains at least 15-30 minutes). CONTINUE IRRIGATING WITH NORMAL SALINE UNTIL THE pH HAS RETURNED TO NORMAL (3-9) MINUTELY. COVER WITH STERILE BANDAGE. GET MEDICAL ATTENTION IMMEDIATELY.

FIRST AID- DO NOT USE GASTRIC LAVAGE OR EMESIS. DILUTE THE ACID IMMEDIATELY BY DRINKING LARGE QUANTITIES OF WATER OR MILK. IF VOMITING PERSISTS ADMINISTER FLUIDS REPEATEDLY. UNMELTED SOLIDS MUST BE DILUTED APPROPRIATELY TO AVOID RENDERING HARMLESS TO TISSUES. MAINTAIN AIRWAY AND TREAT BRONCHOPNEUMONIA. HANDELOR OF POISONING. GET MEDICAL ATTENTION IMMEDIATELY. IF VOMITING OCCURS, KEEP HEAD BELOW HIPS TO HELP PREVENT ASPIRATION.

ANTIDOTE: NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:
 REACTS EXOTHERMICALLY WITH WATER.

INCOMPATIBILITIES:

NITRIC ACID:

- ACETIC ACID: MAY REACT EXPLOSIVELY.
- ACETIC ANHYDRIDE: EXPLOSIVE REACTION BY FRICTION OR IMPACT.
- ACETONE: MAY REACT EXPLOSIVELY.
- ACETONITRILE: EXPLOSIVE MIXTURE.
- 4-ACETOXY-3-METHOXYBENZALDEHYDE: EXOTHERMIC REACTION.
- ACROLEIN: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- ACRYLONITRILE: EXPLOSIVE REACTION AT 90 C.
- ACRYLONITRILE-METHACRYLATE COPOLYMER: INCOMPATIBLE.
- ALCOHOLS: POSSIBLE VIOLENT REACTION OR EXPLOSION; FORMATION OF EXPLOSIVE COMPOUND IN THE PRESENCE OF HEAVY METALS.
- ALKANETHIOLS: EXOTHERMIC REACTION WITH POSSIBLE IGNITION.
- 2-ALKOXY-1,3-DITHIA-2-PHOSPHOLANE: IGNITION REACTION.
- ALLYL ALCOHOL: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- ALLYL CHLORIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- AMINES (ALIPHATIC OR AROMATIC): POSSIBLE IGNITION REACTION.
- 2-AMINOETHANOL: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- 2-AMINOETHANOLE: EXPLOSIVE REACTION.
- AMMONIA (GAS): BURNS IN AN ATMOSPHERE OF NITRIC ACID VAPOR.
- AMMONIUM HYDROXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- AMMONIUM NITRATE: FORMS EXPLOSIVE MIXTURE.
- ANILINE: IGNITES ON CONTACT.
- ANILINIUM NITRATE: FORMS EXPLOSIVE SOLUTION.
- ANION EXCHANGE RESINS: POSSIBLE VIOLENT EXOTHERMIC REACTION.
- ANTIMONY: VIOLENT REACTION.
- ARSINE: EXPLOSIVE REACTION.
- ARSINE-BORON TRIBROMIDE: VIOLENT OXIDATION.
- BASES: REACTS.
- BENZENE: EXPLOSIVE REACTION.
- BENZIDINE: SPONTANEOUS IGNITION.
- BENZONITRILE: POSSIBLE EXPLOSION.
- BENZOTHIOPHENE DERIVATIVES: FORMATION OF POSSIBLY EXPLOSIVE COMPOUNDS.
- N-BENZYL-N-ETHYLANILINE: VIGOROUS DECOMPOSITION.
- 1,4-BIS(METHOXYMETHYL)2,3,5,6-TETRAMETHYLBENZENE: GAS EVOLUTION.
- BISMUTH: INTENSE EXOTHERMIC REACTION OR EXPLOSION.
- 1,3-BIS(TRIFLUOROMETHYL)BENZENE: POSSIBLE EXPLOSION.
- BORON: VIOLENT REACTION WITH INCANDESCENCE.
- BORON DECAHYDRIDE: EXPLOSIVE REACTION.
- BORON PHOSPHIDE: IGNITION REACTION.
- BROMINE PENTAFLUORIDE: IGNITION REACTION.
- N-BUTYL MERCAPTAN: IGNITION REACTION.
- N-BUTYRALDEHYDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- CADMIUM PHOSPHIDE: EXPLOSIVE REACTION.
- CALCIUM HYPOPHOSPHITE: IGNITION REACTION.
- CARBON (PULVERIZED): VIOLENT REACTION.
- CELLULOSE: FORMS EASILY COMBUSTIBLE ESTER.
- CHLORATES: REACTS.
- CHLORINE: INCOMPATIBLE.
- CHLORINE TRIFLUORIDE: VIOLENT REACTION.
- CHLOROBENZENE: POSSIBLE EXPLOSION.
- 4-CHLORO-2-NITROANILINE: FORMS EXPLOSIVE COMPOUND.

CHLOROSULFONIC ACID: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 COAL: EXPLOSIVE MIXTURE.
 COATINGS: MAY BE ATTACKED.
 CRESOL: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 CROTONALDEHYDE: VIOLENT DECOMPOSITION WITH IGNITION.
 CUMENE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 CUPRIC NITRIDE: EXPLOSIVE REACTION.
 CUPROUS NITRIDE: VIOLENT REACTION.
 CYANATES: POSSIBLE EXPLOSIVE REACTION.
 CYCLOHEXANONE: VIOLENT REACTION.
 CYCLOHEXYLAMINE: FORMS EXPLOSIVE COMPOUND.
 CYCLOPENTADIENE: EXPLOSIVE REACTION.
 1,2-DIAMINOETHANE BIS(TRIMETHYL GOLD): EXPLOSIVE REACTION
 DIBORANE: SPONTANEOUS IGNITION.
 DI-2-BUTOXYETHYL ETHER: VIOLENT DECOMPOSITION REACTION.
 2,6-DI-T-BUTYL PHENOL: FORMATION OF EXPLOSIVE COMPOUND.
 DICHLOROETHANE: FORMS SHOCK AND HEAT SENSITIVE MIXTURE.
 DICHLOROETHYLENE: FORMS EXPLOSIVE COMPOUND.
 DICHLOROMETHANE: FORMS EXPLOSIVE SOLUTION.
 DICYCLOPENTADIENE: SPONTANEOUS IGNITION.
 DIENES: IGNITION REACTION.
 DIETHYLAMINO ETHANOL: POSSIBLE EXPLOSION
 DIETHYL ETHER: POSSIBLE EXPLOSION.
 5,6-DIHYDRO-1,2-DI-OXAZINE: EXPLOSIVE INTERACTION
 DIBENZOYL ETHER: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER
 DIETHYLAMINOETHYL PEROXIDE: VIOLENT DECOMPOSITION WITH IGNITION
 DIMETHYL ETHER: FORMS EXPLOSIVE COMPOUND
 DIMETHYL HYDRAZINE: IGNITES ON CONTACT
 DIMETHYL SULFOXIDE + 1,4-DIOXANE: EXPLOSION
 DIMETHYL SULFOXIDE + 14% WATER: EXPLOSIVE REACTION
 DINITROBENZENE: EXPLOSION HAZARD
 DINITROTOLUENE: EXPLOSIVE REACTION.
 DIOXANE + PERCHLORIC ACID: POSSIBLE EXPLOSION
 DIPHENYL DISTIBENE: EXPLOSIVE OXIDATION.
 DIPHENYL MERCURY + CARBON DISULFIDE: VIOLENT REACTION
 DIPHENYL TIN: IGNITION REACTION.
 DISODIUM PHENYL ORTHOPHOSPHATE: VIOLENT EXPLOSION
 DIVINYL ETHER: POSSIBLE IGNITION REACTION
 EPICHLOROHYDRIN: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER
 ETHANESULFINAMIDE: EXPLOSIVE REACTION.
 ETHOXY-ETHYLENE DITHIOPHOSPHATE: IGNITION ON CONTACT
 N-ETHYL ANILINE: IGNITION REACTION.
 ETHYLENE DIAMINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER
 ETHYLENE GLYCOL: FORMS SHOCK AND HEAT SENSITIVE MIXTURE
 ETHYLENEIMINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER
 5-ETHYL-2-METHYL PYRIDINE: EXPLOSIVE REACTION.
 ETHYL PHOSPHINE: IGNITION REACTION
 5-ETHYL-2-PICOLINE: FORMS EXPLOSIVE COMPOUND
 FERROUS OXIDE (POWDERED): INTENSE EXOTHERMIC REACTION.
 FLUORINE: POSSIBLE EXPLOSIVE REACTION
 FORMIC ACID: EXOTHERMIC REACTION WITH RELEASE OF TOXIC GASES.
 2-FORMYLAMINO-1-PHENYL-1,3-PROPANEDIOL: POSSIBLE EXPLOSION.
 FUEL OIL (BURNING): EXPLOSION.
 FULMINATES: REACTS.
 FURFURYLIDENE KETONES: IGNITES ON CONTACT.
 GERMANIUM: VIOLENT REACTION.
 GLYCEROL: POSSIBLE EXPLOSION.
 GLYOXAL: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.

HEXALITHIUM DISILICIDE: EXPLOSIVE REACTION.
 HEXAMETHYLBENZENE: POSSIBLE EXPLOSION.
 2,2,4,4,6,6-HEXAMETHYLTRITHIANE: EXPLOSIVE OXIDATION.
 HEXENAL: EXPLODES ON HEATING.
 HYDRAZINE: VIOLENT REACTION.
 HYDRAZOIC ACID: ENERGETIC REACTION.
 HYDROGEN IODIDE: IGNITION REACTION.
 HYDROGEN PEROXIDE: FORMS UNSTABLE MIXTURE.
 HYDROGEN PEROXIDE AND KETONES: FORMS EXPLOSIVE PRODUCTS.
 HYDROGEN PEROXIDE AND MERCURIC OXIDE: FORMS EXPLOSIVE COMPOUNDS.
 HYDROGEN PEROXIDE AND THIOUREA: FORMS EXPLOSIVE COMPOUNDS.
 HYDROGEN SELENIDE: IGNITION REACTION.
 HYDROGEN SULFIDE: INCANDESCENT REACTION.
 HYDROGEN TELLURIDE: IGNITION AND POSSIBLE EXPLOSIVE REACTION.
 INOANE AND SULFURIC ACID: EXPLOSIVE REACTION.
 ISOPRENE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 KETONES (CYCLIC): VIOLENT REACTION.
 LACTIC ACID + HYDROFLUORIC ACID: EXPLOSIVE REACTION.
 LITHIUM: IGNITION REACTION.
 LITHIUM SILICIDE: INCANDESCENT REACTION.
 MAGNESIUM: EXPLOSIVE REACTION.
 MAGNESIUM + 2-NITROANILINE: MAY IGNITE ON CONTACT.
 MAGNESIUM FERRIPIRIDE: INCANDESCENT REACTION.
 MAGNESIUM SILICIDE: VIOLENT REACTION.
 MAGNESIUM-TITANIUM ALLOY: FORMS HARD AND BRITTLE MIXTURE.
 MANGANESE POWDER: INCANDESCENT REACTION.
 MESTYLENE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 MESTYLENE: POSSIBLE EXPLOSIVE REACTION.
 METALS: VIOLENT REACTION WITH EXPLOSION OR IGNITION.
 METAL ACETYLIDES: VIOLENT OR EXPLOSIVE REACTION.
 METAL CARBIDES: VIOLENT OR EXPLOSIVE REACTION.
 METAL CYANIDES: EXPLOSIVE REACTION.
 METAL FERRICYANIDE OR FERROCYANIDE: VIOLENT REACTION.
 METAL SALICYLATES: FORMS EXPLOSIVE COMPOUNDS.
 METAL THIOCYANATES: POSSIBLE EXPLOSION.
 2-METHYL-BENZIMIDAZOLE + SULFURIC ACID: POSSIBLE EXPLOSIVE REACTION.
 4-METHYLCYCLIMETHANE: EXPLOSIVE REACTION.
 2-METHYL-5-ETHYLPIRIDINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 METHYL THIOPHENE: IGNITION REACTION.
 NEODYMIUM PHOSPHIDE: VIOLENT REACTION.
 NICKEL TETRAPHOSPHIDE: IGNITION REACTION.
 NITRO AROMATIC HYDROCARBONS: FORMS HIGHLY EXPLOSIVE PRODUCTS.
 NITROBENZENE: EXPLOSIVE REACTION, ESPECIALLY IN THE PRESENCE OF WATER.
 NITROMETHANE: EXPLOSIVE REACTION.
 NITRONAPHTHALENE: EXPLOSION HAZARD.
 NON-METAL OXIDES: EXPLOSIVE REACTION.
 OLEUM: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 ORGANIC MATERIALS: FIRE AND EXPLOSION HAZARD.
 ORGANIC SUBSTANCES AND PERCHLORATES: POSSIBLE EXPLOSION.
 ORGANIC SUBSTANCES AND SULFURIC ACID: POSSIBLE EXPLOSION.
 PHENYL ACETYLENE + 1-1-DIMETHYLHYDRAZINE: VIOLENT REACTION.
 PHENYL ORTHOPHOSPHORIC ACID DISODIUM SALT: FORMS EXPLOSIVE PRODUCTS.
 PHOSPHINE + OXYGEN: SPONTANEOUS IGNITION.
 PHOSPHONIUM IODIDE: IGNITION REACTION.
 PHOSPHORUS VAPOR: IGNITES WHEN HEATED.
 PHOSPHOROUS HALIDES: IGNITION REACTION.
 PHOSPHORUS TETRAOXIDE: VIGOROUS REACTION.

PHOSPHORUS TRICHLORIDE: EXPLOSIVE REACTION.
 PHTHALIC ACID AND SULFURIC ACID: POSSIBLE EXPLOSIVE REACTION.
 PHTHALIC ANHYDRIDE: EXOTHERMIC REACTION AND FORMS EXPLOSIVE PRODUCTS.
 PICRATES: REACTS.
 PLASTICS: MAY BE ATTACKED.
 POLYALKENES: INTENSE REACTION.
 POLYDIBROMOSILANES: EXPLOSIVE REACTION.
 POLY(ETHYLENE OXIDE) DERIVATIVES: POSSIBLE EXPLOSION.
 POLYPROPYLENE: TEMPERATURE AND PRESSURE INCREASE IN A CLOSED CONTAINER.
 POLY(SILYLENE): IGNITION.
 POLYURETHANE (FOAM): VIGOROUS REACTION.
 POTASSIUM HYPOPHOSPHITE: EXPLOSIVE REACTION.
 POTASSIUM PHOSPHINATE: EXPLODES ON EVAPORATION.
 8-PROPIOLACTONE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 PROPIOPHENONE + SULFURIC ACID: EXOTHERMIC REACTION ABOVE -5 C.
 PROPYLENE GLYCOL + HYDROFLUORIC ACID + SILVER NITRATE: EXPLOSIVE MIXTURE.
 PROPYLENE OXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 PYRIDINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 PYROCATECHOL: IGNITES ON CONTACT.
 REDUCING AGENTS: POSSIBLE EXPLOSIVE OR IGNITION REACTION.
 RESORCINOL: POSSIBLE EXPLOSION.
 RUBBER: VIGOROUS REACTION, POSSIBLE EXPLOSION.
 SELENIUM: VIGOROUS REACTION.
 SELENIUM HYDRIDE: IGNITION OR INDEPENDENT REACTION.
 SELENIUM DIOPHOSPHIDE: EXPLOSIVE REACTION.
 SILICON: VIOLENT REACTION.
 SILICONES: VIOLENT REACTION.
 SILICON TRIFLUORIDE: EXPLOSION.
 SODIUM ACETATE: EXPLOSIVE REACTION.
 SODIUM BROMATE: EXPLOSION.
 SODIUM PENTANE: IGNITION.
 SODIUM ACIDE: EXOTHERMIC REACTION.
 SODIUM HYDROXIDE: TEMPERATURE AND PRESSURE INCREASE IN A CLOSED CONTAINER.
 STIBINE: EXPLOSIVE REACTION.
 SUCROSE (SOLID): VIGOROUS REACTION.
 SULFAMIC ACID: VIOLENT REACTION WITH EVOLUTION OF TOXIC NITROUS OXIDE.
 SULFIDES: REACTS.
 SULFUR DIOXIDE: EXPLOSIVE REACTION.
 SULFUR HALIDES: VIOLENT REACTION.
 SULFURIC ACID + GLYCERIDES: EXPLOSIVE REACTION.
 SULFURIC ACID + TEREPHTHALIC ACID: VIOLENT REACTION.
 SURFACTANTS + PHOSPHORIC ACID: EXPLOSION HAZARD.
 TERPENES: SPONTANEOUS IGNITION.
 TETRABORANE: EXPLOSIVE REACTION.
 TETRABORANE TETRAHYDRIDE: EXPLOSIVE REACTION.
 TETRAPHOSPHOROUS DIOCTAISELENICE: EXPLOSIVE REACTION.
 TETRAPHOSPHOROUS IODIDE: IGNITES ON CONTACT.
 TETRAPHOSPHOROUS TETRAOXIDE TRISULFIDE: VIOLENT REACTION.
 THIOALDEHYDES: VIOLENT REACTION.
 THIOKETONES: VIOLENT REACTION.
 THIOPHENES: EXPLOSIVE REACTION.
 TITANIUM: FORMS SHOCK-SENSITIVE COMPOUND.
 TITANIUM ALLOYS: POSSIBLE EXPLOSIVE REACTION.
 TITANIUM-MAGNESIUM ALLOY: POSSIBLE EXPLOSION ON IMPACT.
 TOLUENE: VIOLENT REACTION.
 TOLUIDENE: IGNITION REACTION.
 1,3,5-TRIACETYLHEXAHYDRO-1,3,5-TRIAZINE + TRIFLUOROACETIC ANHYDRIDE:
 EXPLOSIVE REACTION.
 TRIAZINE: VIOLENTLY EXPLOSIVE REACTION.
 TRICADMIUM DIPHOSPHIDE: EXPLOSIVE REACTION.

TRIETHYLGALLIUM MONOETHYL ETHER COMPLEX: IGNITION REACTION.
 TRIMETHYLTRIOXANE: INTENSE REACTION.
 TRIS(IODOMERCURI)PHOSPHINE: VIOLENT DECOMPOSITION.
 TRITHIOACETONE: EXPLOSIVE REACTION.
 TURPENTINE: EXPLOSIVE MIXTURE.
 UNSYMMETRICAL DIMETHYL HYDRAZINE: SPONTANEOUS IGNITION.
 URANIUM: EXPLOSIVE REACTION.
 URANIUM ALLOY: VIOLENT REACTION.
 URANIUM DISULFIDE: VIOLENT REACTION.
 URANIUM-NEODYMIUM ALLOYS: EXPLOSIVE REACTION.
 VINYL ACETATE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 VINYLIDENE CHLORIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER
 WOOD: POSSIBLE IGNITION.
 P-XYLENE: INTENSE REACTION IN PRESENCE OF SULFURIC ACID.
 ZINC: INCANDESCENT REACTION.
 ZINC ETHOXIDE: POSSIBLE EXPLOSION.
 ZIRCONIUM-URANIUM ALLOYS: EXPLOSIVE REACTION.

DECOMPOSITION:
 THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC OXIDES OF NITROGEN.

POLYMERIZATION:
 RADICAL POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

 STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

++STORAGE++

PROTECT AGAINST PHYSICAL DAMAGE. SEPARATE FROM METALLIC POWDERS, CARBIDES, HYDROGEN SULFIDE, TURPENTINE, ORGANIC ACIDS, AND ALL COMBUSTIBLE, ORGANIC OR OTHER EASILY OXIDIZABLE MATERIALS. PROVIDE GOOD VENTILATION AND AVOID DIRECT SUNLIGHT. NFPA 49 HAZARDOUS CHEMICALS DATA, 1975.

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

THRESHOLD PLANNING QUANTITY (TPQ):
 THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 302 REQUIRES THAT EACH FACILITY WHERE ANY EXTREMELY HAZARDOUS SUBSTANCE IS PRESENT IN A QUANTITY EQUAL TO OR GREATER THAN THE TPQ ESTABLISHED FOR THAT SUBSTANCE NOTIFY THE STATE EMERGENCY RESPONSE COMMISSION FOR THE STATE IN WHICH IT IS LOCATED. SECTION 303 OF SARA REQUIRES THESE FACILITIES TO PARTICIPATE IN LOCAL EMERGENCY RESPONSE PLANNING (40 CFR 355.30).

++DISPOSAL++

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40 CFR 261, EPA HAZARDOUS WASTE NUMBER D001, 100 POUND CERCLA SECTION 103 REPORTABLE QUANTITY.

NITRIC ACID:

- - 50 PPM- ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS-FLOW MODE.
- 100 PPM- ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
● ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
- ANY AIR-PURIFYING, FULL-FACEPIECE RESPIRATOR (GAS MASK) WITH A
● CHIN-STYLE, FRONT- OR BACK-MOUNTED CANISTER PROVIDING
● PROTECTION AGAINST NITRIC ACID.*
- ANY CHEMICAL CARTRIDGE RESPIRATOR WITH A FULL FACEPIECE AND
● CARTRIDGE(S) PROVIDING PROTECTION AGAINST NITRIC ACID *
- ESCAPE- ANY AIR-PURIFYING, FULL-FACEPIECE RESPIRATOR (GAS MASK) WITH A
● CHIN-STYLE, FRONT- OR BACK-MOUNTED CANISTER PROVIDING PROTECTION
● AGAINST NITRIC ACID.*
- ANY APPROPRIATE ESCAPE-TYPE, SELF-CONTAINED BREATHING APPARATUS.
- * ONLY NONOXIDIZABLE SORBENTS ARE ALLOWED (NOT CHARCOAL).
- FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS
- ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS
● OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE
- ANY SUPPLIED-AIR RESPIRATOR THAT HAS A FULL FACEPIECE AND IS OPERATED IN A
● PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE IN COMBINATION WITH AN
● AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND
● OR OTHER POSITIVE-PRESSURE MODE.
- CLOTHING:
● EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT
● TO PREVENT ANY POSSIBILITY OF SKIN CONTACT WITH THIS SUBSTANCE.
- GLOVES:
● EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS
● SUBSTANCE.
- EYE PROTECTION:
● EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A
● FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.
- EMERGENCY WASH FACILITIES:
● WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND OR SKIN MAY BE
● EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN
● AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

● AUTHORIZED - FISHER SCIENTIFIC, INC.
● CREATION DATE: 12/04/94 REVISION DATE: 07/16/92

THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST
INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF
MERCHANTABILITY OR OF OTHER WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO
THIS INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS
SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE
INFORMATION FOR THEIR PARTICULAR PURPOSES.

1000 POUNDS SARA SECTION 302 THRESHOLD PLANNING QUANTITY

SULFURIC ACID
 SULFURIC ACID
 SULFURIC ACID

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
 CHEMICAL DIVISION
 1 REAGENT LANE
 FAIR LAWN NJ 07410
 (201) 796-7100

EMERGENCY NUMBER: (201) 796-7100
 CHEMTREC ASSISTANCE: (800) 424-9300

THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION FOR THEIR PARTICULAR PURPOSES.

SUBSTANCE IDENTIFICATION

CAS-NUMBER 7664-93-9

SUBSTANCE: **SULFURIC ACID**

TRADE NAME(S) SYNONYMS:

OIL OF VITRIOL; BOV; DIPPING ACID; VITRIOL BROWN OIL; HYDROGEN SULFATE;
 NORDHAUSEN ACID; BIHYDROGEN SULFATE; SULPHURIC ACID; MATTING ACID;
 CITHIONIC ACID; ST004930040; UN 1830; A300; A300C; A300SI; A300S;
 A300B; A510; A468; S0A174; A484; SA170; SA176; A302; A305; H204S;

CHEMICAL FAMILY:
 INORGANIC ACID

MOLECULAR FORMULA: H₂S-O₄

MOLECULAR WEIGHT: 98.07

OSHA RATINGS (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=2 PERSISTENCE=0
 NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=0 REACTIVITY=2

COMPONENTS AND CONTAMINANTS

COMPONENT: SULFURIC ACID PERCENT: 70.0-100.0
 CAS# 7664-93-9

COMPONENT: WATER PERCENT: 0-30.0

OTHER CONTAMINANTS: NONE.

EXPOSURE LIMITS:

SULFURIC ACID:

- 1 MG/M3 OSHA TWA
- 1 MG/M3 ACGIH TWA, 3 MG/M3 ACGIH STEL
- 1 MG/M3 NIOSH RECOMMENDED TWA
- 1 MG/M3 DFG MAK TWA
- 2 MG/M3 DFG MAK 5 MINUTE PEAK, MOMENTARY VALUE, 8 TIMES/SHIFT

MEASUREMENT METHOD: SILICA GEL TUBE; SODIUM BICARBONATE/SODIUM CARBONATE;
 ION CHROMATOGRAPHY: (NIOSH VOL. III # 7903, INORGANIC ACIDS).

1000 POUNDS SARA SECTION 302 THRESHOLD PLANNING QUANTITY
1000 POUNDS SARA SECTION 304 REPORTABLE QUANTITY
1000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY
SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

PHYSICAL DATA

DESCRIPTION: OORLESS, CLEAR, COLORLESS, DENSE HYGROSCOPIC OILY LIQUID WITH
A MARKED ACID TASTE WHEN PURE. BOILING POINT: 626 F (330 C)
MELTING POINT: 50 F (10 C) SPECIFIC GRAVITY: 1.84
VAPOR PRESSURE: <0.001 @ 20 C PH: <3 SOLUBILITY IN WATER: SOLUBLE
ODOR THRESHOLD: 1 MG/M3 (MIST) VAPOR DENSITY: 3.4
SOLVENT SOLUBILITY: DECOMPOSES IN ALCOHOL.
@ 340 C IT DECOMPOSES INTO SULFUR TRIOXIDE AND WATER

FIRE AND EXPLOSION DATA

• FIRE AND EXPLOSION HAZARD:
• EXTREMELY TOXIC HAZARD WHEN EXPOSED TO HEAT OR FLAME
• OXIDIZER, OXIDIZERS DECOMPOSE, ESPECIALLY WHEN HEATED, TO YIELD OXYGEN OR
OTHER GASES WHICH WILL INCREASE THE BURNING RATE OF COMBUSTIBLE MATTER.
• CONTACT WITH EASILY OXIDIZABLE, ORGANIC, OR OTHER COMBUSTIBLE MATERIALS
MAY RESULT IN IGNITION, VIOLENT COMBUSTION OR EXPLOSION.

FIREFIGHTING MEDIA:

• DRY CHEMICAL OR CARBON DIOXIDE
• 1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800 5

• FOR LARGER FIRES, FLOOD AREA WITH WATER FROM A DISTANCE
• 1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800 5

FIREFIGHTING:

• DO NOT GET WATER INSIDE CONTAINER. DO NOT SET SOLID STREAM OF WATER ON
SPILLED MATERIAL. MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO IT WITHOUT RISK.
• APPLY COOLING WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED TO FLAMES UNTIL
WELL AFTER FIRE IS OUT. STAY AWAY FROM ENDS OF TANKS (1990 EMERGENCY RESPONSE
GUIDEBOOK, DOT P 5800 5 GUIDE PAGE 39)

• USE AGENT SUITABLE FOR TYPE OF FIRE. USE FLOODING AMOUNTS OF WATER AS A FOG
COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER. APPLY FROM AS FAR A DISTANCE
AS POSSIBLE. AVOID BREATHING CORROSIVE VAPORS. KEEP UPWIND.

TRANSPORTATION DATA

• DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49-CFR 172.101.
• CORROSIVE MATERIAL

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49-CFR 172.101 AND
SUBPART E:
CORROSIVE

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49-CFR 173.272
EXCEPTIONS: 49-CFR 173.244

FINAL RULE ON HAZARDOUS MATERIALS REGULATIONS (HMR, 49 CFR PARTS 171-180),
DOCKET NUMBERS HM-181, HM-181A, HM-181B, HM-181C, HM-181D AND HM-204.
EFFECTIVE DATE OCTOBER 1, 1991. HOWEVER, COMPLIANCE WITH THE REGULATIONS IS
AUTHORIZED ON AND AFTER JANUARY 1, 1991. (55 FR 52402, 12/21/90)

EXCEPT FOR EXPLOSIVES, INHALATION HAZARDOUS, AND INFECTIOUS SUBSTANCES, THE
EFFECTIVE DATE FOR HAZARD COMMUNICATION REQUIREMENTS IS EXTENDED TO
OCTOBER 1, 1993. (56 FR 47158, 09/18/91)

U.S. DEPARTMENT OF TRANSPORTATION SHIPPING NAME-ID NUMBER: 49 CFR 172.101
SULFURIC ACID-UN 1200

U.S. DEPARTMENT OF TRANSPORTATION HAZARD CLASS OR DIVISION: 49 CFR 172.101
8 - CORROSIVE MATERIAL

U.S. DEPARTMENT OF TRANSPORTATION PACKING GROUP: 49 CFR 172.101
III

U.S. DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS: 49 CFR 172.101
AND SUBPART E:
CORROSIVE

U.S. DEPARTMENT OF TRANSPORTATION PACKAGING AUTHORIZATIONS:
EXCEPTIONS: NONE
NON-BULK PACKAGING: 49 CFR 173.200
BULK PACKAGING: 49 CFR 173.240

U.S. DEPARTMENT OF TRANSPORTATION QUANTITY LIMITATIONS 49 CFR 172.101:
PASSENGER AIRCRAFT OR RAILCAR: 1 L
CARGO AIRCRAFT ONLY: 30 L

TOXICITY

SULFURIC ACID
IRRITATION DATA: 250 MG EYE-RABBIT SEVERE; 5 MG/30 SECONDS RINSED EYE-RABBIT
SEVERE

TOXICITY DATA: 3 MG/M3, 24 WEEKS INHALATION-HUMAN TOLD; 510 MG/M3, 4 HOURS
INHALATION-RAT LC50; 320 MG/M3, 2 HOURS INHALATION-MOUSE LC50; 13 MG/M3
INHALATION-GUINEA PIG LC50; 2140 MG/KG ORAL-RAT LD50; 125 MG/KG
UNREPORTED-MAN LC50; MUTAGENIC DATA (ATECS); REPRODUCTIVE EFFECTS DATA
N/A

CARCINOGEN STATUS: NONE. AN EPIDEMIOLOGICAL STUDY OF WORKERS AT A REFINERY
AND CHEMICAL PLANT SUGGESTS AN INCREASED RISK OF LARYNGEAL CANCER FROM
EXPOSURE TO HIGH CONCENTRATIONS OF SULFURIC ACID.

LOCAL EFFECTS: CORROSIVE- INHALATION, SKIN, EYE AND INGESTION
ACUTE TOXICITY LEVEL: HIGHLY TOXIC BY INHALATION; MODERATELY TOXIC BY
INGESTION

TARGET EFFECTS: NO DATA AVAILABLE.

HEALTH EFFECTS AND FIRST AID

INHALATION:

SULFURIC ACID:

CORROSIVE/HIGHLY TOXIC. 80 MG/M3 IMMEDIATELY DANGEROUS TO LIFE OR HEALTH. ACUTE EXPOSURE- INHALATION OF MISTS MAY CAUSE MUCOUS MEMBRANE IRRITATION PRINCIPALLY AFFECTING THE RESPIRATORY TRACT EPITHELIUM. LOW CONCENTRATIONS, 0.35-5 MG/M3, MAY CAUSE INCREASED PULMONARY AIR FLOW RESISTANCE AND SUBSEQUENT SHALLOWER AND MORE RAPID BREATHING. HOT CONCENTRATED MISTS MAY CAUSE RAPID LOSS OF CONSCIOUSNESS WITH POSSIBLE DAMAGE TO LUNG TISSUE. VAPORS MAY CAUSE EYE SECRETIONS, SNEEZING, A BURNING OR TICKLING SENSATION IN THE NOSE AND THROAT AND RETROSERIAL REGION, FOLLOWED BY COUGH, RESPIRATORY DISTRESS, TRACHEBRONCHITIS, CHEMICAL PNEUMONITIS AND POSSIBLE SPASM OF THE VOCAL CORDS. HIGH CONCENTRATIONS MAY PRODUCE BLOODY NASAL SECRETIONS AND SPUTUM, HEMATEMESIS, GASTRITIS, AND PULMONARY EDEMA. A SINGLE OVEREXPOSURE MAY LEAD TO LARYNGEAL, TRACHEBRONCHIAL AND PULMONARY EDEMA. ONE INDIVIDUAL SPRAYED IN THE FACE WITH SULFURIC ACID LIQUID EXPERIENCED DELAYED SYMPTOMS OF PULMONARY FIBROSIS, RESIDUAL BRONCHITIS, AND PULMONARY EDEMA. VAPORS FROM DILUTE SOLUTIONS MAY IRRITATE MUCOUS MEMBRANES. THE LETHAL DOSE REPORTED IN RAT IS 510 MG M3 2 HOURS.

CHRONIC EXPOSURE- REPEATED EXPOSURE TO THE MIST MAY CAUSE IRRITATION OF THE UPPER RESPIRATORY TRACT. CHRONIC BRONCHITIS AND EMPHYSEMA OF THE CENTRAL ENVELOPE, THE VENTRAL AND LATERAL INCISORS ARE PRIMARILY AFFECTED. REPEATED EXCESSIVE EXPOSURE MAY ALSO RESULT IN ATHELECTASIS, BRONCHITIS, BRONCHOPNEUMONITIS, PHARYNGITIS, RESIDENT RESPIRATORY TRACT INFLAMMATION, BRONCHITIS, STOMATITIS AND GINGIVITIS. CHRONIC INHALATION MAY CAUSE PLASMA DEPLETION OF THE BLOOD PRODUCING AN ACIDOSIS WHICH AFFECTS THE NERVOUS SYSTEM AND PRODUCES ANASTHESIA, HESITANT GAIT AND GENERALIZED WEAKNESS. AN EPIDEMIOLOGICAL STUDY OF WORKERS AT A REFINERY AND CHEMICAL PLANT SUGGESTS AN INCREASED RISK OF LARYNGEAL CANCER FROM EXPOSURE TO HIGH CONCENTRATIONS OF SULFURIC ACID. REPRODUCTIVE EFFECTS HAVE BEEN REPORTED IN ANIMALS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. ADMINISTRATION OF OXYGEN SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:

SULFURIC ACID

CORROSIVE.

ACUTE EXPOSURE- CONTACT WITH CONCENTRATED SULFURIC ACID MAY CAUSE SEVERE SECOND AND THIRD DEGREE SKIN BURNS WITH NECROSIS DUE TO ITS AFFINITY FOR WATER AND SUBSEQUENT SEVERE DEHYDRATING ACTION, AND ITS EXOTHERMIC REACTION WITH MOISTURE. POSSIBLE CHARRING MAY OCCUR LEADING TO SHOCK AND COLLAPSE DEPENDING ON THE AMOUNT OF TISSUE INVOLVED. THE RESULTING WOUNDS MAY BE LONG IN HEALING AND MAY CAUSE EXTENSIVE SCARRING THAT MAY RESULT IN FUNCTIONAL IMPAIRMENT. CONTACT WITH DILUTE SOLUTIONS MAY CAUSE SKIN IRRITATION.

CHRONIC EXPOSURE- REPEATED CONTACT WITH LOW CONCENTRATIONS MAY CAUSE SKIN DESICCATION AND ULCERATION OF THE HANDS, AND PARONYCHIA OR CHRONIC PURULENT INFLAMMATION AROUND THE NAILS. REPEATED CONTACT WITH DILUTE SOLUTIONS MAY CAUSE DERMATITIS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). IN CASE OF CHEMICAL BURNS, COVER AREA WITH STERILE, DRY DRESSING. BANDAGE SECURELY, BUT NOT TOO TIGHTLY. GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
SULFURIC ACID:
CORROSIVE.

ACUTE EXPOSURE- EXPOSURE TO THE VAPORS MAY CAUSE A BURNING OR STINGING SENSATION IN THE EYES WITH LACRIMATION, BLURRED VISION AND CONJUNCTIVAL CONGESTION. SPLASHES OF ACID IN THE EYES MAY PRODUCE DEEP CORNEAL ULCERATION, KERATO-CONJUNCTIVITIS AND PALPEBRAL LESIONS WITH SEVERE SEQUELAE. IRREPARABLE CORNEAL DAMAGE AND BLINDNESS AS WELL AS SCARRING OF THE EYELIDS MAY OCCUR. SEVERE SULFURIC ACID EYE BURNS HAVE INCLUDED GLAUCOMA AND CATARACT AS COMPLICATIONS IN THE MOST SEVERE CASES. CONTACT WITH DILUTED ACID MAY PRODUCE MORE TRANSIENT EFFECTS FROM WHICH RECOVERY MAY BE COMPLETE.

CHRONIC EXPOSURE- REPEATED EXPOSURE MAY RESULT IN LACRIMATION AND CHRONIC CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS UNTIL NO EVIDENCE OF CHEMICAL REMAINS AT LEAST 15-20 MINUTES. CONTINUE IRRIGATING WITH NORMAL SALINE UNTIL THE pH RETURNS TO NORMAL (3-8) MINUTES. COVER WITH STERILE BANDAGE. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
SULFURIC ACID:
CORROSIVE.

ACUTE EXPOSURE- INGESTION MAY CAUSE BURNING PAIN IN THE MOUTH, THROAT, ESOPHAGUS AND ABDOMEN, A SOUR TASTE AND NAUSEA FOLLOWED BY VOMITING AND DIARRHEA OF CHARRED BLACK STOMACH CONTENTS. DEHYDRATION AND CARBONIZATION OF TISSUE MAY OCCUR WITH ESCHARS ON THE LIPS AND MOUTH. BROWNISH OR YELLOWISH STAINS MAY BE FOUND AROUND THE MOUTH. INTENSE THIRST, DIFFICULT SWALLOWING, ACIDEMIA, STOMATITIS, RAPID AND WEAK PULSE, SHALLOW BREATHING, SHOCK AND POSSIBLE CONVULSIONS AND DEATH MAY OCCUR. ALBUMIN, BLOOD AND CASTS IN URINE, ANURIA, ESOPHAGEAL AND DELAYED GASTRIC STENOSIS HAS BEEN REPORTED. POSSIBLE PERFORATION OF THE GASTROINTESTINAL TRACT MAY RESULT IN PERITONITIS.

CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- DO NOT USE GASTRIC LAVAGE OR EMESIS. DILUTE THE ACID IMMEDIATELY BY DRINKING LARGE QUANTITIES OF WATER OR MILK. IF VOMITING PERSEVERE, ADMINISTER FLUIDS REPEATEDLY. INGESTED ACID MUST BE DILUTED APPROXIMATELY 100 FOLD TO RENDER IT HARMLESS TO TISSUES. MAINTAIN AIRWAY AND TREAT SHOCK (BREITBACH, HANDBOOK OF POISONING, 12TH ED.) GET MEDICAL ATTENTION IMMEDIATELY. IF VOMITING OCCURS, KEEP HEAD BELOW HIPS TO HELP PREVENT ASPIRATION.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:

SULFURIC ACID:

VIOLENT EXOTHERMIC REACTION WITH WATER.

INCOMPATIBILITIES:

SULFURIC ACID:

- ACETALDEHYDE: VIOLENTLY POLYMERIZED BY CONCENTRATED ACID.
- ACETIC ANHYDRIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- ACETONE + NITRIC ACID: VIOLENT DECOMPOSITION
- ACETONE + POTASSIUM DICHROMATE: IGNITION.
- ACETONE CYANHYDRIN: PRESSURE INCREASE WITH POSSIBLE EXPLOSIVE RUPTURE OF VESSEL.
- ACETONITRILE: VIOLENT EXOTHERM ON HEATING, SULFUR TRIOXIDE REDUCES INITIATION TEMPERATURE.
- ACROLEIN: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- ACRYLONITRILE: VIGOROUS EXOTHERMIC POLYMERIZATION.
- ALCOHOL: EXOTHERMIC REACTION AND CONTRACTION OF VOLUME.
- ALCOHOL AND HYDROGEN PEROXIDE: POSSIBLE EXPLOSION.
- ALLYL ALCOHOL: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- ALLYL CHLORIDE: VIOLENT POLYMERIZATION.
- ALLYL NITRATE: MAY CAUSE VIOLENT REACTION.
- AMYL METHACRYLATE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- ANILINE: VIOLENT REACTION.
- ANILINE SULFONATE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- ANILINE SULFONATE: FIRE OR EXPLOSION HAZARD.
- ANILINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- ANILINE: VIOLENT REACTION.
- BENZYL ALCOHOL: MAY DECOMPOSE EXPLOSIVELY AT ABOUT 180°C.
- BENZONES + METALS: POSSIBLE IGNITION.
- BENZYL PENTACHLORIDE: VIOLENT REACTION WITH POSSIBLE IGNITION.
- tert-BUTYL METHYLENE: VIOLENT EXOTHERMIC REACTION WITHOUT AGITATION.
- tert-BUTYL PEROXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- BENZENE: HAZARDOUS MIXTURE.
- BENZENE: VIOLENT REACTION ON CONTACT.
- BENZENE: VIOLENT INTERACTION.
- 1-CHLORO-2-CHLOROPROPANE: VIOLENT INTERACTION.
- 4-CHLORONITROBENZENE AND SULFUR TRIOXIDE: POSSIBLE EXPLOSIVE REACTION.
- CHLORATES AND PERCHLORATES: WHEN BROUGHT IN CONTACT WITH SULFURIC ACID, MAY CAUSE AN EXPLOSIVE FLUORINE CHLORIDE GAS. A VIOLENT EXPLOSION IS USUAL.
- CHLORATES + METALS: POSSIBLE IGNITION.
- CHLORINE TRIFLUORIDE: VIOLENT REACTION.
- CHLOROSULFONIC ACID: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- CHLOROSULFONIC ACID: FIRE AND EXPLOSION HAZARD.
- CHLOROSULFONIC ACID: VIOLENT REACTION.
- COMBUSTIBLE MATERIALS (FINELY DIVIDED): MAY IGNITE.
- COPPER: EVOLUTION OF SULFUR DIOXIDE.
- CUPRIC NITRATE: VIOLENT REACTION.
- 1,3-DIAMINO-4-NITROBENZENE: DIAZONIUM HYDROGEN SULFATE: EXOTHERMIC REACTION.
- 1,3-DIAMINO-2-PROPANOL: VIOLENT REACTION WITH INCREASE IN PRESSURE.
- 1,4-DIAMINOBENZENE: VIOLENT OR EXPLOSIVE REACTION.
- 1,4-DIAMINOBENZENE: VIOLENT REACTION.
- 1,3-DIAMINOBENZENE: IGNITION FOLLOWED BY EXPLOSIVE REACTION.
- DIETHYLAMINE: EXOTHERMIC REACTION.
- DIBENZYL PEROXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
- DIMETHYLBENZYL CARBINOL + HYDROGEN PEROXIDE: EXPLODES.

DIMETHOXYANTHRAQUINONE: EXOTHERMIC REACTION ABOVE 150 C.
 4-DIMETHYLAMINOBENZALDEHYDE: EXOTHERMIC REACTION.
 2,5-DINITRO-3-METHYLBENZOIC ACID + SODIUM AZIDE: EXPLOSIVE REACTION.
 1,5-DINITRONAPHTHALENE + SULFUR: EXOTHERMIC REACTION.
 EPICHLOROHYDRIN: VIOLENT REACTION.
 ETHOXYLATED NONYLPHENOL: POSSIBLE IGNITION.
 ETHANOL + HYDROGEN PEROXIDE: POSSIBLE EXPLOSION.
 ETHYLENE CYANOHYDRIN: VIOLENT REACTION.
 ETHYLENE DIAMINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 ETHYLENE GLYCOL: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 ETHYLENIMINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 FULMINATES: EXTREMELY HAZARDOUS MIXTURE.
 HEXALITHIUM DISILICIDE: INCANDESCENT REACTION.
 HYDROCHLORIC ACID: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 HYDROGEN PEROXIDE (>50%): EXPLOSIVE REACTION AFTER EVAPORATION.
 HYDROFLUORIC ACID: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 IODINE + NITRIC ACID: POSSIBLE EXPLOSION.
 IODINE HEPTAFLUORIDE: THE ACID BECOMES EFFERVESCENT.
 IRON: POSSIBLE EXPLOSION DUE TO HYDROGEN GAS FROM THE ACID-METAL REACTION.
 ISOPRENE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 LITHIUM SILICIDE: INCANDESCENT REACTION.
 MERCURY NITRIDE: EXPLOSION ON CONTACT.
 MERICURIC OXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 METALS: MAY LIBERATE FLAMMABLE HYDROGEN GAS.
 METALS: EXTREMELY HAZARDOUS MIXTURE.
 METAL ACETYLIDES: IGNITION REACTION.
 METAL CARBIDES: VIOLENT REACTION. SILE PROPERLY STORED.
 METAL HYDROGEN SULFIDES: VIOLENT REACTION. SILE PROPERLY STORED.
 4-MER-CYANOPICOLINE: EXOTHERMIC REACTION.
 NITRATES: MAY DECOMPOSE EXPLOSIVELY ON CONTACT.
 NITRATES: INCOMPATIBLE.
 NITRIC ACID + GLYCERIDES: EXPLOSION.
 NITRIC ACID + ORGANIC MATERIAL: MAY CAUSE VIOLENT REACTION.
 NITRIC ACID + TOLUENE: POSSIBLE VIOLENT REACTION OR EXPLOSION.
 NITROARYL ESTERS AND DERIVATIVES: MAY CAUSE VIOLENT REACTION OR EXPLOSION.
 NITROBENZENE: EXOTHERMIC REACTION AT ELEVATED TEMPERATURES.
 3-NITROBENZENE SULFONIC ACID: EXOTHERMIC REACTION.
 NITROMETHANE: FORMATION OF EXPLOSIVE MIXTURE.
 N-NITRODIMETHYLAMINE: EXPLOSIVE DECOMPOSITION.
 4-NITRODIOLENE: EXPLOSIVE AT 80 C.
 OXALANIDE: VIOLENT EXOTHERMIC REACTION.
 PENTASILVER TRIHYDROXYDIAMIDOPHOSPHATE: EXPLOSION ON CONTACT.
 PERACETATES: POSSIBLE EXPLOSION.
 PERCHLORIC ACID: FORMATION OF DANGEROUS ANHYDROUS PERCHLORIC ACID.
 PERMANGANATES: FORMATION OF PERMANGANIC ACID.
 PERMANGANATES + BENZENE: POSSIBLE EXPLOSION.
 1-PHENYL-1-METHYL-2-PROPYL ALCOHOL + HYDROGEN PEROXIDE: POSSIBLE EXPLOSION.
 PHOSPHORUS (WHITE OR YELLOW): IGNITION IN CONTACT WITH BOILING ACID.
 PHOSPHORUS CYANIDE: VIOLENT REACTION.
 PHOSPHORUS TRISULFIDE: VIOLENT OXIDATION WITH POSSIBLE IGNITION.
 PICRATES: EXTREMELY HAZARDOUS MIXTURE.
 POLYESTER: ATTACKED.
 POLYSILOYLENE: EXPLOSION ON CONTACT.
 POTASSIUM: EXPLOSIVE INTERACTION.
 POTASSIUM TERT-BUTOXIDE: IGNITION.
 POTASSIUM CHLORATE: POSSIBLE FIRE AND EXPLOSION.
 POTASSIUM PERMANGANATE: POSSIBLE EXPLOSION IN THE PRESENCE OF MOISTURE.
 POTASSIUM PERMANGANATE + POTASSIUM CHLORIDE: VIOLENT EXPLOSION.

PROPIOLACTONE (BETA): TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 PROPYLENE OXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 3-PROPYNOL: POSSIBLE EXPLOSION UNLESS ADEQUATELY COOLED.
 PYRIDINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 REDUCING AGENTS: REACTS.
 RUBBER: ATTACKED.
 RUBIDIUM ACETYLIDE: IGNITION ON CONTACT.
 SILVER PERMANGANATE (MOIST): EXPLOSIVE REACTION.
 SILVER PEROXOCHROMATE: EXPLOSIVE REACTION.
 SODIUM: EXPLOSIVE REACTION WITH AQUEOUS ACID.
 SODIUM CARBONATE: VIOLENT REACTION.
 SODIUM CHLORATE: POSSIBLE FIRE OR EXPLOSION.
 SODIUM HYDROXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 SODIUM TETRAHYDROBORATE: VIOLENT, EXOTHERMIC REACTION.
 SODIUM THIOCYANATE: VIOLENT EXOTHERMIC WITH EVOLUTION OF CARBONYL SULFIDE.
 STEEL: POSSIBLE EXPLOSION DUE TO HYDROGEN GAS FROM THE ACID-METAL REACTION.
 STYRENE MONOMER: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 SUCROSE: FORMATION OF CARBON MONOXIDE.
 TETRAMETHYLBENZENES: VIOLENT REACTION IN CLOSED CONTAINERS.
 1,3,4,5-TETRAZINE: VIOLENT DECOMPOSITION ON CONTACT.
 THALLIUM II ACIDICITHIOCARBONATE: MAY EXPLODE ON CONTACT.
 1,3,5-TRIAZIN-2-ONE: VIOLENT DECOMPOSITION ON CONTACT.
 VINYL ACRYLATE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
 ZINC CARBONATE: LIKELY TO CAUSE FIRES AND EXPLOSIONS.
 ZINC OXIDE: VIOLENT INTERACTION.

DECOMPOSITION

HEAVY DECOMPOSITION MAY RELEASE TOXIC GASES OF SULFUR.

POLYMERIZATION

HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

 STORAGE AND DISPOSAL

OBSEVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

STORAGE

STORE IN COOL, DRY, WELL-VENTILATED LOCATION. SEPARATE FROM COMBUSTIBLES AND OTHER REACTIVE MATERIALS. SEPARATE FROM CARBIDES, CHLORATES, FULMINATES, NITRATES, PICRATES, AND POWDERED METALS. (NFPA 49, HAZARDOUS CHEMICALS DATA, 1991).

STORE IN A TIGHTLY CLOSED CONTAINER.

AVOID DIRECT SUNLIGHT.

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

THRESHOLD PLANNING QUANTITY (TPQ)

THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 302 REQUIRES THAT EACH FACILITY WHERE ANY EXTREMELY HAZARDOUS SUBSTANCE IS PRESENT IN A

QUANTITY EQUAL TO OR GREATER THAN THE TPQ ESTABLISHED FOR THAT SUBSTANCE NOTIFY THE STATE EMERGENCY RESPONSE COMMISSION FOR THE STATE IN WHICH IT IS LOCATED. SECTION 303 OF SARA REQUIRES THESE FACILITIES TO PARTICIPATE IN LOCAL EMERGENCY RESPONSE PLANNING (40 CFR 355.30).

****DISPOSAL****

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40 CFR 262, EPA HAZARDOUS WASTE NUMBER D002 100 POUND CERCLA SECTION 103 REPORTABLE QUANTITY

CONDITIONS TO AVOID

MAY IGNITE OTHER COMBUSTIBLE MATERIALS (WOOD, PAPER, OIL, ETC.) VIOLENT REACTION WITH WATER, FLAMMABLE, POISONOUS GASES MAY ACCUMULATE IN CONFINED SPACES, RUNOFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD

SPILL AND LEAK PROCEDURES

SOIL SPILL
DO NOT WALK IN SPILL AREA SUCH AS LAIDON. REMOVE OR ROT FOR DISPOSAL

USE FLOID OR SPILL KIT (SPECIAL DESIGN) TO CLEAN UP SPILL. USE AS MUCH AS POSSIBLE TO REMOVE SPILL

USE CEMENT POWDER OR FLY ASH TO ABSORB LIQUID SPILL

NEUTRALIZE SPILL WITH BLEAKED LIME, SODIUM CARBONATE OR CRUSHED LIMESTONE

AIR SPILL
APPLY WATER SPRAY TO KNOCK DOWN AND REDUCE VAPORS. KNOCK-DOWN WATER IS CORROSIVE AND TOXIC AND SHOULD BE DIZED FOR CONTAINMENT AND LATER DISPOSAL

WATER SPILL
NEUTRALIZE WITH ADOPTIVE LIME, BLEAKED LIME, OR CRUSHED LIMESTONE OR SODIUM CARBONATE

GENERAL SPILL
KEEP COMBUSTIBLES AWAY FROM SPILLED MATERIALS. DO NOT TOUCH SPILLED MATERIALS AND DO NOT USE WATER TO CLEAN UP SPILL. CLEAN UP SPILL WITH FLOID OR SPILL KIT. USE WATER SPRAY TO REDUCE VAPORS. DO NOT USE WATER TO CLEAN UP SPILL. AFTER CLEAN UP ONLY WATER AND OTHER CLEAN UP MATERIALS SHOULD BE LEFT FOR WATER DISPOSAL. DO NOT APPLY WATER UNLESS DIRECTED TO DO SO. IF NECESSARY REMOVE AWAY. ISOLATE HAZARD AREA AND SEAL OFF. VENTILATE TO REMOVE BEFORE ENTERING

REPORTABLE QUANTITY: ANY 1000 POUNDS
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT, 1994, SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY (RQ) FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 305.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-9303 OR (202) 462-4600 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6)

 PROTECTIVE EQUIPMENT

VENTILATION:
 PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS.

RESPIRATOR:

THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS; NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29 CFR 1910 SUBPART Z.

THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

SULFURIC ACID:

25 MG/M3- ANY POWERED AIR-PURIFYING RESPIRATOR WITH AN ACID GAS CARTRIDGE(S) AND HAVING A HIGH-EFFICIENCY PARTICULATE FILTER.
 ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.

50 MG/M3- ANY CHEMICAL CARTRIDGE RESPIRATOR WITH A FULL FACEPIECE AND ACID GAS CARTRIDGE(S) IN COMBINATION WITH A HIGH-EFFICIENCY PARTICULATE FILTER.
 ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
 ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
 ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ACID GAS CANISTER HAVING A HIGH-EFFICIENCY PARTICULATE FILTER.

80 MG/M3- ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE AND OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ACID GAS CANISTER HAVING A HIGH-EFFICIENCY PARTICULATE FILTER.
 ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

ANY SUPPLIED-AIR RESPIRATOR THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:

WEAR APPROPRIATE PROTECTIVE CLOTHING TO AVOID ANY POSSIBILITY OF SKIN CONTACT WITH LIQUIDS CONTAINING MORE THAN 1% SULFURIC ACID. AVOID REPEATED OR PROLONGED SKIN CONTACT WITH LIQUIDS CONTAINING 1% OR LESS SULFURIC ACID.

GLOVES:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS

SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A
FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

EMERGENCY WASH FACILITIES:
WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE
EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN
AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - FISHER SCIENTIFIC, INC.
CREATION DATE: 11/29/64 REVISION DATE: 06/23/92

-ADDITIONAL INFORMATION-

THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST
INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER, WE MAKE NO WARRANTY OF
MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT
TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM THE USE THEREOF.
BUYERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE
INFORMATION FOR THEIR PARTICULAR PURPOSES.

ATTACHMENT 7

HEAT STRESS MONITORING SOP

enop7-1



JACOBS ENGINEERING GROUP INC.
CORPORATE HEALTH AND SAFETY MANUAL

HEAT STRESS MONITORING
SOP NO. 7.1

REVISION NO. 1
DATE 2/91
PAGE 1 OF 7

APPROVED:


HEALTH AND SAFETY MANAGER

OBJECTIVE

This standard operating procedure describes the procedures for heat stress monitoring of personnel engaged in field work activities.

APPLICABILITY

This procedure applies to all Jacobs employees who perform field work in hot weather and who are at risk of developing heat stress.

REFERENCES

NIOSH/OSHA/USCG/EPA, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, October 1985.

American Conference of Governmental Industrial Hygienists, Threshold Limit Values and Biological Exposure Indices for 1990-91, Cincinnati, Ohio, 1990.

PROCEDURE

Heat-induced physiological stress (heat stress) occurs when the body fails to maintain a normal body temperature. A number of physical reactions can occur ranging from mild (such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement) to fatal. Because the incidence of heat stress depends on a variety of factors, all workers, even those not wearing protective equipment, should be monitored.

For workers wearing permeable clothing (e.g., standard cotton or synthetic work clothes), follow the ACGIH Threshold Limit Value recommendations for suggested work/rest schedules listed in Table 7-1-1. This work/rest schedule is determined by the Wet Bulb Globe Temperature Index (WBGT), a measure of environmental factors which most nearly correlate with deep body temperature and other physiological responses to heat. WBGT values are calculated by the following equations:



**JACOBS ENGINEERING GROUP INC.
CORPORATE HEALTH AND SAFETY MANUAL**

**HEAT STRESS MONITORING
SOP NO. 7.1**

REVISION NO. 1
DATE 2/91
PAGE 2 OF 7

1. Outdoors with solar load

$$\text{WBGT} = 0.7 \text{ NWB} + 0.2 \text{ GT} + 0.1 \text{ DB}$$

2. Indoors or Outdoors with no solar load

$$\text{WBGT} = 0.7 \text{ NWB} + 0.3 \text{ GT}$$

where:

WBGT = Wet Bulb Globe Temperature
NWB = Natural Wet Bulb Temperature
DB = Dry-Bulb Temperature
GT = Globe Temperature

The determination of WBGT requires the use of a black globe thermometer, a natural (static) wet-bulb thermometer, and a dry-bulb thermometer. Commercially available instruments can be used for convenient measurement of WBGT.

For workers wearing semipermeable or impermeable encapsulating ensembles and/or levels of protection A, B, or C, the recommendations listed in Table 7-1-1 cannot be used. For these situations, workers should be monitored when the temperature in the work area is above 70°F (21°C).

To monitor these workers, measure:

1. Heart rate. Count the radial pulse during a 30-second period as early as possible in the rest period.
 - a. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.
 - b. If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.
2. Oral temperature. Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).

enr07-1



**JACOBS ENGINEERING GROUP INC.
CORPORATE HEALTH AND SAFETY MANUAL**

**HEAT STRESS MONITORING
SOP NO. 7.1**

REVISION NO. 1
DATE 2/91
PAGE 3 OF 7

TABLE 7-1-1
WORK - REST REGIMEN ¹

WBGT TEMPERATURE IN WHICH VARIOUS WORK LOADS ARE PERFORMED [F°(C°)]			
WORK-REST REGIMEN	LIGHT ²	MODERATE ³	HEAVY ⁴
Continuous work permitted	86.0 (30.0)	80.1 (26.7)	77.0 (25.0)
75% work 25% rest, each hour	87.1 (30.6)	82.4 (28.0)	78.6 (25.9)
50% work 50 % rest, each hour	88.5 (31.4)	84.9 (29.4)	82.2 (27.9)
25% work 75% rest, each hour	90.0 (32.2)	88.0 (31.1)	86.0 (30.0)

¹ Adapted from "Permissible Heat Exposure Threshold Limit Values" in Threshold Limit Values and Biological Exposure Indices for 1990-1991, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio, 1990, p. 69.

² Light work (up to 200 Kcal/hr or 800 Btu/hr): e.g., sitting or standing to control machines, performing light hand or arm work, etc.

³ Moderate work (200-300 Kcal/hr or 800-1400 Btu/hr): e.g., walking about with moderate lifting and pushing, etc.

⁴ Heavy work (350-500 Kcal/hr or 1400-2000 Btu/hr): e.g., sampling work, pick and shovel work, etc.



**JACOBS ENGINEERING GROUP INC.
CORPORATE HEALTH AND SAFETY MANUAL**

**HEAT STRESS MONITORING
SOP NO. 7.1**

REVISION NO. 1
DATE 2/91
PAGE 4 OF 7

TABLE 7-1-2

**SUGGESTED FREQUENCY OF
PHYSIOLOGICAL MONITORING FOR FIT AND
ACCLIMATIZED WORKERS⁵**

ADJUSTED TEMPERATURE ⁶	NORMAL WORK ENSEMBLE ⁷	IMPERMEABLE ENSEMBLE
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

Source: NIOSH/OSHA/USCG/EPA, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, October 1985, p. 8-22.

⁵ For work levels of 250 kilocalories/hour.

⁶ Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

⁷ A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.



**JACOBS ENGINEERING GROUP INC.
CORPORATE HEALTH AND SAFETY MANUAL**

**HEAT STRESS MONITORING
SOP NO. 7.1**

REVISION NO. 1
DATE 2/91
PAGE 5 OF 7

- a. If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period.
 - b. If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following work cycle by one-third.
 - c. Do not permit a worker to wear a semipermeable or impermeable garment when his/her oral temperature exceeds 100.6°F (38.1°C).
3. **Body water loss.** Measure weight on a scale accurate to ± 0.25 lb. at the beginning and end of each work day to see if enough fluids are being taken to prevent dehydration. Weights should be taken while the employee wears similar clothing or, ideally, is nude. The body water loss should not exceed 1.5 percent total body weight loss in a work day.

Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work (see Table 7-1-2). The length of the work cycle will be governed by the frequency of the required physiological monitoring.

PREVENTION

Proper training and preventative measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat injuries. One or more of the following recommendations will help reduce heat stress:

1. **Adjust work schedules:**
 - a. **Modify work/rest schedules according to monitoring requirements.**
 - b. **Mandate work slowdowns as needed.**
 - c. **Rotate personnel: alternate job functions to minimize overstress or overexertion at one task.**
 - d. **Add additional personnel to work teams.**
 - e. **Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.**
2. **Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.**



**JACOBS ENGINEERING GROUP INC.
CORPORATE HEALTH AND SAFETY MANUAL**

**HEAT STRESS MONITORING
SOP NO. 7.1**

REVISION NO. 1
DATE 2/91
PAGE 6 OF 7

3. Maintain workers' body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat, i.e., 8 fluid ounces (0.23 liters) of water must be ingested for approximately every 16 ounces (0.23 kg) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:
 - a. Maintain water temperature at 50^o to 60^oF (10^o to 15.6^oC).
 - b. Provide small disposable cups that hold about 4 ounces (0.1 liter).
 - c. Have workers drink 16 ounces (0.5 liters) of fluid (preferably water or dilute drinks) before beginning work.
 - d. Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.
 - e. Weigh workers before and after work to determine if fluid replacement is adequate.
4. Encourage workers to maintain an optimal level of physical fitness:
 - a. Acclimatize workers to site work conditions: temperature, protective clothing, and workload.
 - b. Urge workers to maintain normal weight levels.
5. Wear long cotton underwear under chemical protective clothing. Cotton will aid in absorbing perspiration and will hold it close to the skin, which will provide the maximum amount of cooling from the limited evaporation that takes place underneath the chemical resistant clothing.
6. Provide cooling devices to aid natural body heat exchange during prolonged work or severe heat exposure. Cooling devices include:
 - a. Field showers or hose-down areas to reduce body temperature and/or to cool off protective clothing.
 - b. Cooling jackets, vests, or suits.



JACOBS ENGINEERING GROUP INC.
CORPORATE HEALTH AND SAFETY MANUAL

HEAT STRESS MONITORING
SOP NO. 7.1

REVISION NO. 1
DATE 2/91
PAGE 7 OF 7

7. Train workers to recognize and treat heat stress. As part of training, identify the signs and symptoms of heat stress. These are:
 - a. Heat Rash: caused by continuous exposure to heat and humid air and aggravated by chafing clothes. Symptoms include a decreased ability to tolerate heat as well as being a nuisance.
 - b. Heat Cramps: caused by profuse perspiration with inadequate fluid intake and chemical replacement (especially salts). Signs: muscle spasm and pain in the extremities and abdomen.
 - c. Heat Exhaustion: caused by increased stress on various organs to meet increased demands to cool the body. Signs: shallow breathing; pale, cool moist skin; profuse sweating; dizziness and lassitude; nausea; fainting.
 - d. Heat Stroke: the most severe form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Body must be cooled immediately to prevent severe injury and/or death. Competent medical help must be obtained immediately. Signs and symptoms are: red, hot, dry skin; no perspiration; nausea; dizziness and confusion; strong, rapid pulse; coma.

Attachment 8 — Manual for Control of Radiation



DEPARTMENT OF THE ARMY
U.S. ARMY ABERDEEN PROVING GROUND
ABERDEEN PROVING GROUND, MARYLAND 21005-5001



25 OCT 1993

REPLY TO
ATTENTION OF

Office of the Deputy
Installation Commander

Mr. Gary Corbell
Welenco Geophysical Services
4817 District Boulevard
Bakersfield, California 93313

Dear Mr. Corbell:

In accordance with the Code of Federal Regulations, Title 32, Part 666, Welenco Geophysical Services is hereby authorized to utilize a cesium 137 radioactive source at Aberdeen Proving Ground. Source use will be in accordance with your letter of September 20, 1993 and the following conditions:

- Mr. Ralph A. Cardenuto, Aberdeen Proving Ground Radiation Protection Officer, must be notified (410-278-9025) at least 24 hours prior to the source arrival at Aberdeen Proving Ground.

- The Aberdeen Proving Ground Radiation Protection Officer must be informed of each day's work location, source storage location at the end of each day, and upon completion of source use at Aberdeen Proving Ground.

- In the event of source leakage, Welenco is responsible for restoring the property to Nuclear Regulatory Commission unrestricted use criteria.

- The Aberdeen Proving Ground Radiation Protection Officer will be immediately notified of any accident/incident, equipment damage, equipment malfunction, sticking of source in a well bore or any other occurrence that could result in contamination or excess radiation exposure.

2. My point of contact for further information or any questions is Mr. Ralph A. Cardenuto, Directorate of Safety, Health and Environment, Environmental Compliance Division, 410-278-9025.

Sincerely,

John M. Taylor
Colonel, U.S. Army
Deputy Installation Commander



GEOPHYSICS

MANUAL

FOR

CONTROL OF RADIATION

4817 DISTRICT BOULEVARD • BAKERSFIELD • CALIFORNIA 93313 • (805) 834-8100

1. Radiation Program management and Responsibility

- a. The Radiation Safety Officer is to be designated overall manager for the radiation program.
- b. The duties of the Radiation Safety Officer include the delegation of authority to persons responsible for carrying out the radioactive logging programs and other duties such as the responsibility for records, surveys and in general the administrative procedures for the entire radiation program. The Radiation Safety Officer is Gary Corbell.

2. The Radiation Safety Officer is to conduct or cause to be conducted the following duties:

- a. Site Surveys
- b. Records, personnel monitoring records and compilation.
- c. Vehicle Survey Records.
- d. Training and qualifying personnel.
- e. Conducts periodic safety checks to assure the radiation protection program.

3. Personnel Monitoring Procedures

All personnel directly related to activity involving radioactive materials will wear a film badge or a suitable acceptable dosimeter. Film badge records will be quarterly and monitoring will be at least on a quarterly basis.

It is clearly understood that maximum acceptable dose levels are not to exceed 1.25 Rem per calendar quarter or no more than 5.0 Rem per calendar year.

It is also clearly understood that in the event these doses are greater than those listed above that proper notification will be posted with the licensing authority. Also reports of dosages will be maintained on at least a quarterly basis.

4. Storing and Securing Radioactive Materials

Upon receipt of the radioactive materials the receiving records will be placed in a properly marked file. The materials will be placed in a secure area that is properly marked with appropriate signs around the perimeter. This area will be either a room, a storage area or a storage bunker, but will in any case contain a door or lock type top. Materials when not in use will remain in the storage area properly locked and secured.

5. Posting Restricted Area, Vehicles and Labelling Containers

- a. Posting restricted areas-storage area and areas where radiation levels are expected to achieve 2 mR/hr will be labelled with signs stating "Caution-Radiation Area" or "Caution Radioactive Materials". These signs will bear the radiation symbol and be magenta and safety yellow in color. The signs will be conspicuous and obvious from all directions. In the event that the levels exceed 5 mR/hr then a sign stating "Caution-High Radiation Area", magenta and safety yellow in color will be conspicuously posted, in the event the levels are approaching 100 mR/hr then a warning device such as a blinking red light or a bell or both will accompany the posting.

A proper Notice to Employees will also be posted where it is obvious to employees.

- b. All containers carrying or storing or used for transporting radioactive materials will bear a tag with the identification of the radioactive material, the quantity of the radioactive material and the date that the radioactive material was that particular quantity. The tag will also state "Caution-Radioactive Material".

6. Records Management

- a. Utilization Log-This log will contain the master file on each type or shipment of radioactive material received and the distribution of each such shipment. This master file will be maintained at the facility.
- b. Receipt and transfer records will be maintained in files to show at all times where material is to be located or if it is disposed of.
- c. Personnel exposure records-film badge, TLD or dosimeter reports-will be maintained in a separate file along with proper quarterly reports on each person using radioactive materials.
- d. Leak test records on all sealed sources will be maintained on each sealed source. These records will indicate leak testing at six month intervals.
- e. Survey records which include building or storage areas surveys on a quarterly basis will be maintained in a file. These surveys will reflect in milliroentgens readings at a point on each side and the top of the storage area.
- f. Vehicle surveys will be conducted at monthly intervals and these surveys will be maintained in a file.
- g. Surveys will be conducted by monitoring a well bore at the surface prior to use of any radioactive material and remonitoring the well bore upon completion of the work. These numbers will be recorded. A survey meter or tool which is acceptable will be used for the monitoring process. Records of this survey performed on each job will be maintained in a file.

7. Procedures for Transporting Radioactive Materials

a. Radioactive materials may be transported by company vehicle or private vehicle provided the vehicle is marked properly and the material transported is properly packaged and marked. An identification will be on each container transported and the vehicle will be placarded with the proper D.O.T. markings.

b. Transport

All radioactive material sources used will be stored in the anchored storage metal chamber or in their shielded transport containers. They will be removed from the downhole storage vault with remote handling tools, and placed in the logging tool being tested or into the transport shields for transportation to the field sites for field testing of new tools. When transporting to field sites, they will be locked to an intergal part of the vehicle.

8. Procedures for Storing Sealed Sources of Radioactivity Materials.

a. Storage

Radioactive sources must be locked in their shield and kept in a controlled area either at a remote site or in workshop area.

(1) Portable Storage Container

This container is approved by the U.S. Department of transportation. Examples of the container can be seen in this manual under "containers".

(2) All storage containers must be posted "Caution-Radioactive Material".

9. Procedures for Use of Radioactive Sources

Company personnel directly in charge of the logging operations, either field testing or testing in the research facility are responsible for the health protection of all personnel associated with the sources and the general public who may be associated at all times. The above personnel (Company) must personally supervise all source handling operations, transportation, storage and shipping according to the following regulations:

- (1) Company personnel who have been trained in handling sealed sources shall be the only ones who perform operations involving the sources. At field sites, all customer personnel shall be required to be remote to these operations.
- (2) Only the company approved handling tools will be used. See enclosed drawings.
- (3) All sources are to be transported in the approved handling locked source shipping containers.
- (4) Using the remote handling tools the source is removed from the shipping or transport container. The source is attached to the logging tool and placed inside of the well. When logging operation is finished the driller will return source to surface, the logging operator will remove tool from well, utilizing remote handling tool, the source will be removed from the tool and placed into the storage container. The time-distance factors must be used effectively when working with radioactive sources to keep exposure to a minimum. When utilizing the remote handling tools a safe distance is provided, but care and practice are needed to decrease the handling exposure time.
- (5) Any sources that you are not familiar with, in handling and usage, contact the area engineer or the Radiation Safety Officer before using them in a logging job.

(1) Fire and other Emergencies

- (a) notify all personnel in the area immediately.
- (b) attempt to put out all fires if a radiation hazard is not immediately present.
- (c) notify the fire department.
- (d) notify the Radiation Safety Officer.
- (e) The Radiation Safety Officer will set up restriction governing the fire fighting and other emergency activities.
- (f) following the emergency, monitor the area and ascertain the emergency devices that are necessary for safe decontamination.
- (g) decontaminate.
- (h) The Radiation Safety Officer will have to approve the area before work can be resumed.
- (i) monitor all persons involved in combating the emergency.
- (j) prepare a complete history of the accident and report to the Radiation Safety Officer who will in turn report it to the proper State Agency.

(2) Leaking Source

- (a) if a source is leaking, which the logging tool would indicate, shut the operations down.
- (b) notify contractor and immediately call Radiation Safety Officer for instructions
- (c) set up control procedures for keeping personnel out of the immediate area until instructions are received from the Radiation Safety Officer.

e. Leak Test Procedures

Wipe tests on all sources must be performed at intervals not exceeding six months.

Source will be wipe tested with Gulf Nuclear, Inc. Model LTK-1 Leak Test Kit.

Leak tests will be mailed to Radiation Detection Company at Sunnyvale, California for counting.

Reports will be sent back to licensee with Leak Test Certificate.

f. Procedure for lost Source Downhole

When using the test tools at job sites on customer wells:

- (1) When source is lost, notify the well owner or his representative that a source is stuck in the well. As soon thereafter as possible, hand him a drawing of the source and housing model. This will enable him to know before he starts the fishing operation, the quantity, and type of radioactive material and the mechanical construction of the capsule and tool involved.
Immediately notify the State Radiation Control Agency involved and the Atomic Energy Commission that the source has been lost and keep them informed of the progress toward recovery of the source.

- (2) Client-to be notified.
- (3) Dosimeters will be furnished to all rig personnel and company personnel. The owner will be advised that these are for their protection and intended primarily for a record of trivial or no exposures to his employees.
- (4) During the critical fishing operations, the mud being circulated should be monitored using gamma ray equipment with the downhole tool in the mud.
- (5) You have only time and distance factors available to reduce the radiation field and personnel exposure while the source is being fished out. Where practical, everyone except the driller and enough personnel to cover the hole should remain in the unexposed area. All handling of the drilling rig equipment should be handled by the customer and actual handling of the source should be done by the service company engineer assisted by one of the officers if necessary.

g. Emergency Procedures

Emergencies vary greatly in their respective hazards. These are sometimes in the form of spills, fires, explosions or vehicle wrecks which, consequently, result in the spread of radioactive material contamination. The National Bureau of Standards Handbook Number 48, Emergency Guides, are used as a guide for the procedures. These procedures are general and any specific emergency would certainly involve additional procedures not covered in this outline.

(1) Vehicle Wreck

In the event of an accident while transporting radioactive materials, efforts should be made to minimize the exposure of any persons. This would include roping off the area, notification of the investigating officer, and Radiation Safety Officer at the home office should be notified immediately, making sure that the area is not left unattended. This will enable the Radiation Safety Officer to notify the proper governmental agency.

PROCEDURES FOR LOST SOURCE DOWNHOLE

- A. Decision on Recovery of a Source
- B. The Company's Responsibilities
- C. Recovery or Abandonment of a Source
- D. Summary

- A. Factors influencing the decision on recovery of a source when stuck in an oil well.
1. Cost of the tool versus best estimate of minimum cost and probable maximum cost of recovery.
 2. The risk of sticking a drill stem and fishing tools, especially if all zones of interest are above the tool.
 3. Interference of the tool with potential production and deeper drilling.
 4. Value of clearing the hole for additional logs
- B. When a radioactive source is associated with stuck equipment, the Company becomes more actively involved. Our responsibilities are:
1. Remain in contact with the client and offer our best advice and recommendations regarding safe fishing procedures.
 2. Take care to recognize the possibility that a fishing procedure might damage a source capsule.
 3. Notify the Nuclear Regulatory Commission or State if it becomes apparent that it be desirable to or advisable to abandon the source in the well.
- C. The introduction of the regulatory agencies does not alter the main objectives: to recover the source intact or abandon it in such a way as to protect personnel and property in the future.
1. If abandonment of a source appears imminent, the Company notifies the Nuclear Regulatory Commission and State by telephone. We then attempt to determine which line of action is to the best interest of all concerned, what the client wishes to and can reasonably do, and to present a packaged proposal to the agencies for final approval or further recommendations.

2. Abandonment of a source in a dry hole is simple. All records, including those of the state agency issuing permits for or controlling the drilling of oil and gas wells, should contain information regarding the depth, date, type and quantity of radioactive materials. The well head, if left above the surface, should contain the same information on an engraved durable metal placard.
3. A source left below a producing zone presents little difficulty. In most cases the normal cementing of the production string of casing or tubing will isolate the source (Figure 1). If the well is to be produced from open hole completion, cement should be spotted around and/or above it to prevent the movement of fluids past the capsule and eventual destruction of the capsule through abrasion (Figure 2).
4. In questionable cases the life of the capsule and the solubility of radioactive materials might influence the acceptance of the proposal. (The Company's source capsules have an estimated life of 500 years in undisturbed salt water. The solubility of the radioactive materials is in the order of one part per billion per week).
5. Production of gas, water or oil past a source should be prohibited unless the capsule is protected from abrasion. Casing or tubing should be adequate. The spotting of cement, if practical and feasible, adds to the protection (Figure 3). Care should be taken in setting casing past the location of the tool to avoid dislodging it. A gamma-ray survey run after the casing is below the zone will give assurance that the tool and source will not be encountered and damaged at a lower level.
6. In the event a source is left in a producing zone it should be cemented in place if possible. Extreme caution should be used in side tracking to avoid re-entering the original hole and damaging the source container (Figure 4). Normally, the source is at or near the bottom of the tool. If there were sufficient clearance to place cement around the source the tool would, in most cases, be retrievable. However, the drilling mud would probably harden in a short time to prevent appreciable flow of fluids by the source. In addition, the separation between the new and

original hole would reduce the rate of flow at the tool to a very small figure. It is recommended that the new and old holes be separated by at least 15 feet to preclude any possibility of damage to the source by perforating.

A gamma-ray source abandoned in a well cannot "induce" radioactivity in gas, oil, water, or other materials. For all practical purposes the same may be said of 3 curie, 5 curie and 20 curie AmBe neutron sources. Although neutron flux at one foot from a 3 curie, 5 curie or 20 curie source, is negligible in this respect. For example, the flux in a reactor used to activate a cobalt-60 "Pip" tag to 10 microcuries is hundreds of millions times greater than that at one foot from a 5 curie source. Although it is not precisely correct to say that there is no activation, induced radioactivity would be almost immeasurable initially and through decay would be totally obscured by natural background radiation long before the material reached the surface.

D. Summary

1. All precautions should be taken to avoid rupture of a radioactive source during fishing operation. Although each source has been individually pressure tested to 25,000 psi, it is small and will not withstand milling, drilling, or pounding fishing operations.
2. A radioactive source which is intact may be safely abandoned in the well. The decision as to whether to abandon a tool with a source would be based on the accepted considerations for abandoning any other type tool. Added guidelines are the safety aspect, the proper placarding of the well and entering the information in the well records.
3. There should be no costly delay in obtaining approval to abandon a radioactive source in as much as the Company keeps the agencies well advised of the progress of the fishing operations as events develop.
4. Responsibility for notifying the regulatory agencies and making all reports is the Company's.
5. It is the client's responsibility to deal with the State agencies issuing permits for drilling oil and gas wells and to furnish that agency with any information which may be required.

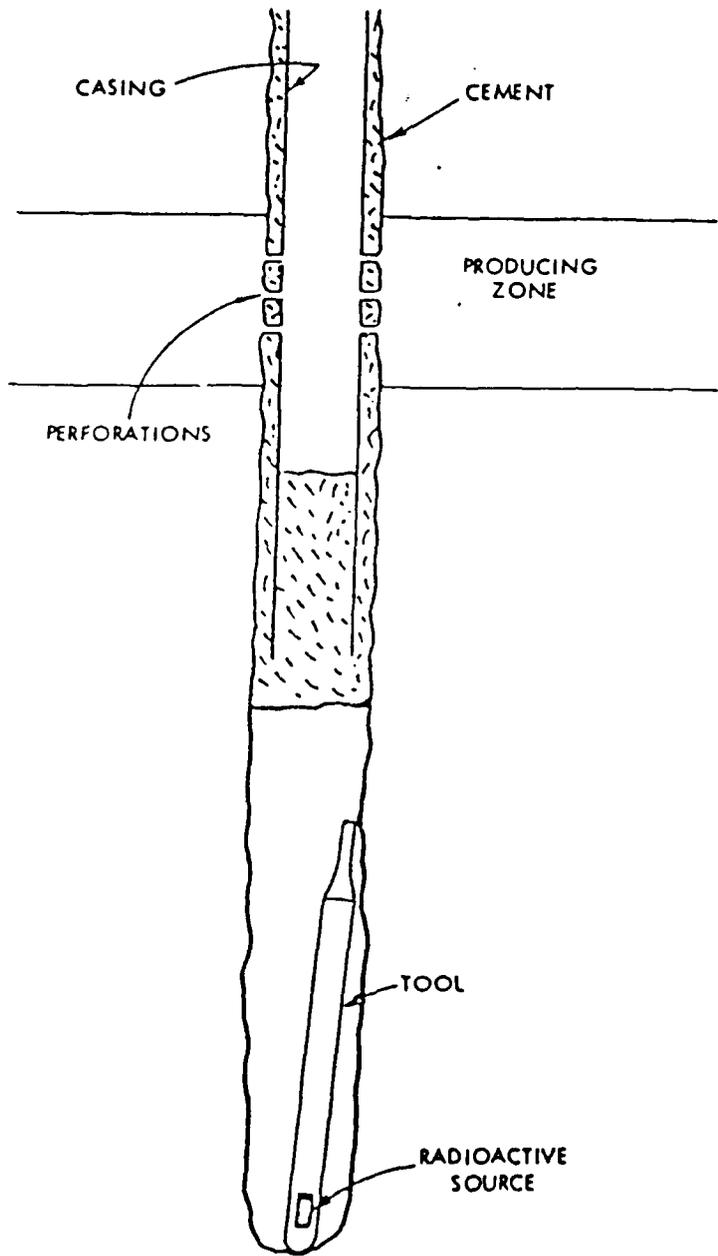


FIG. 1

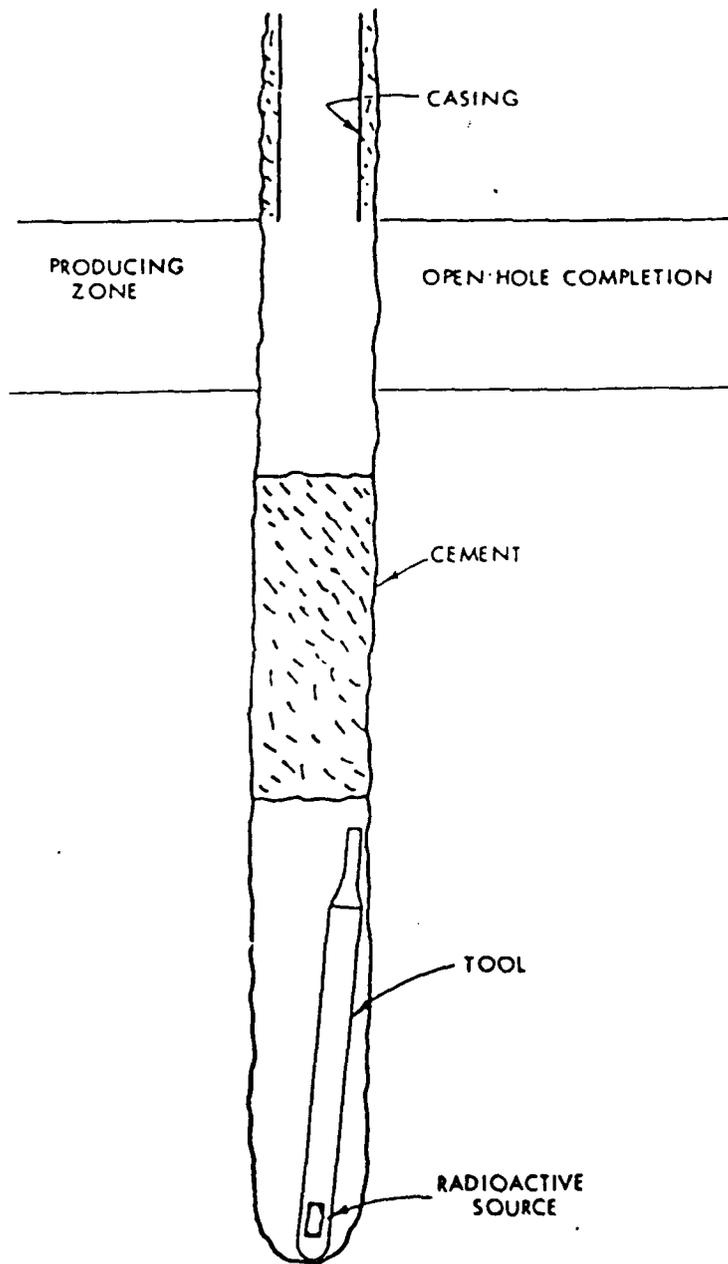


FIG. 2

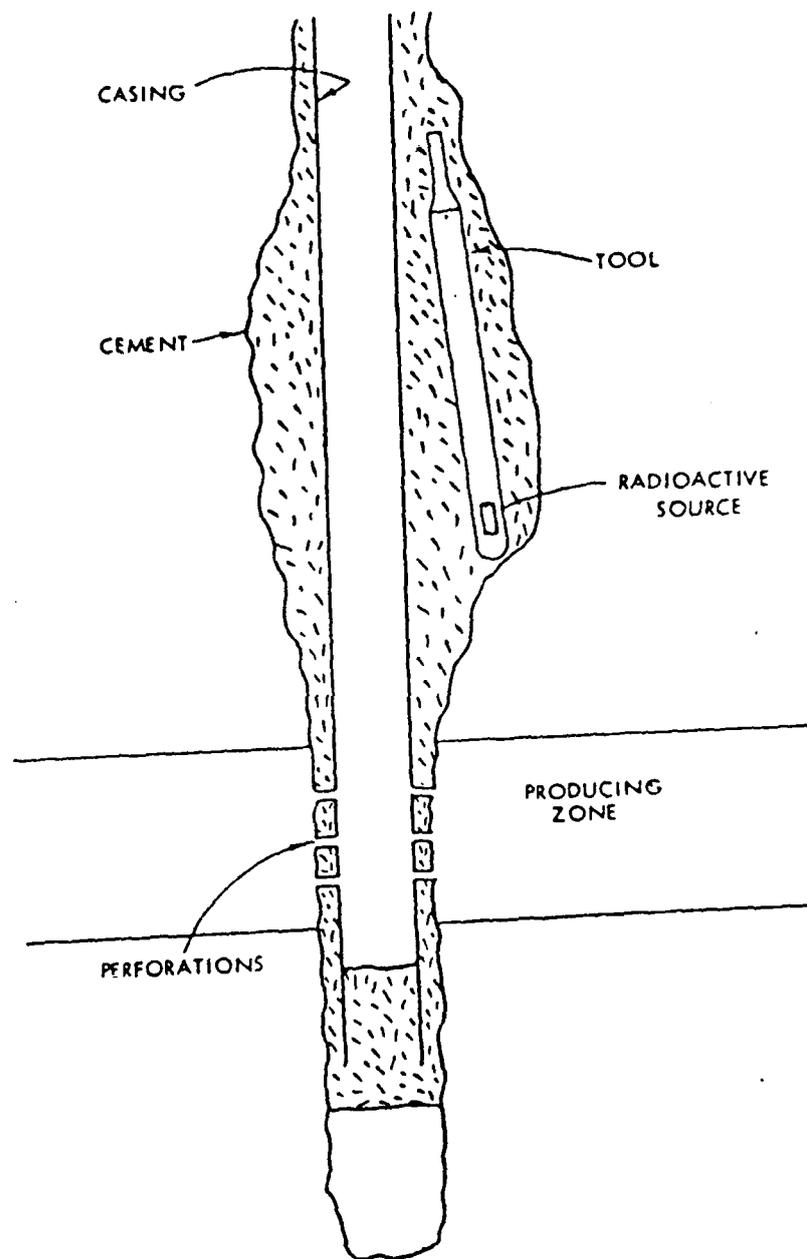


FIG. 3

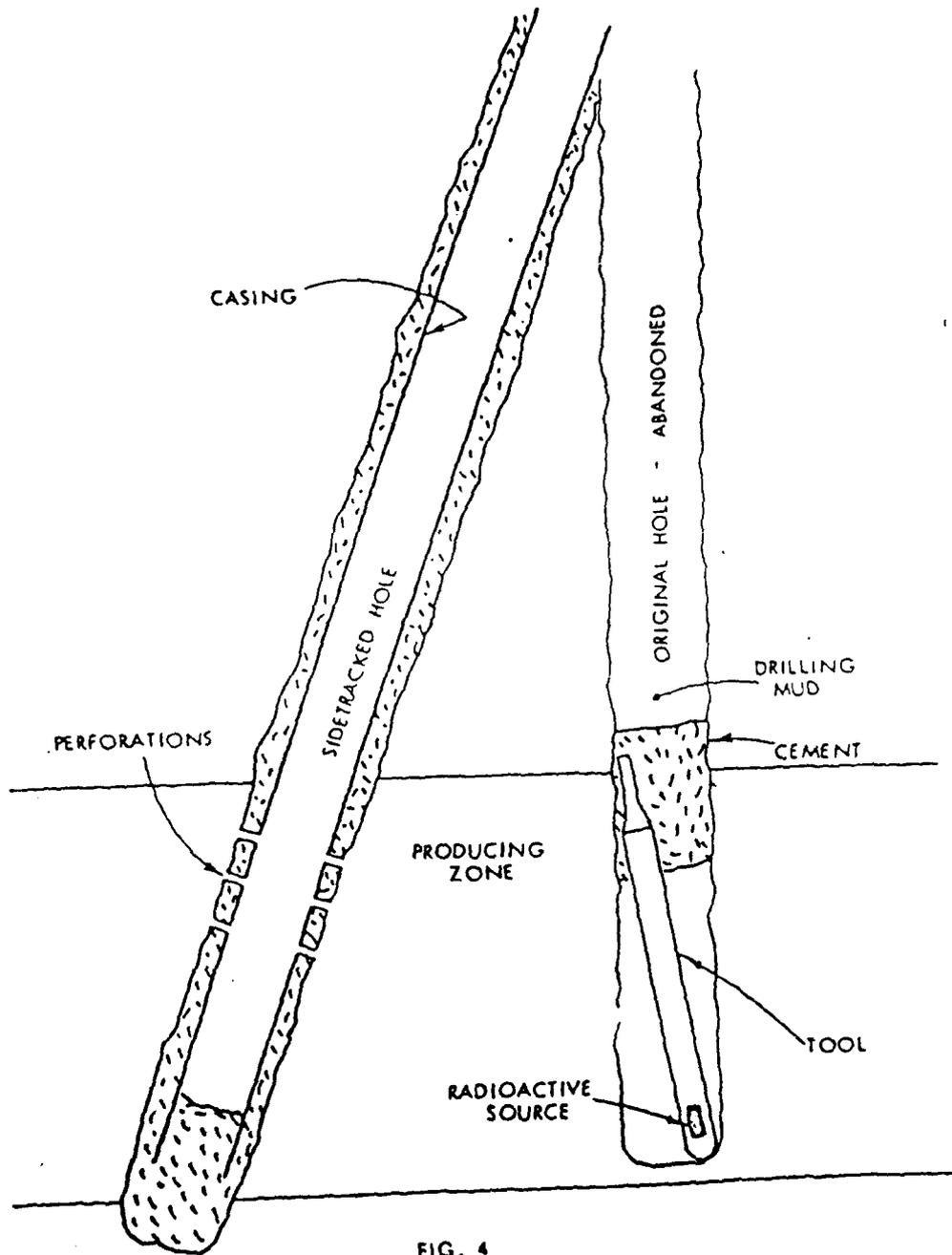
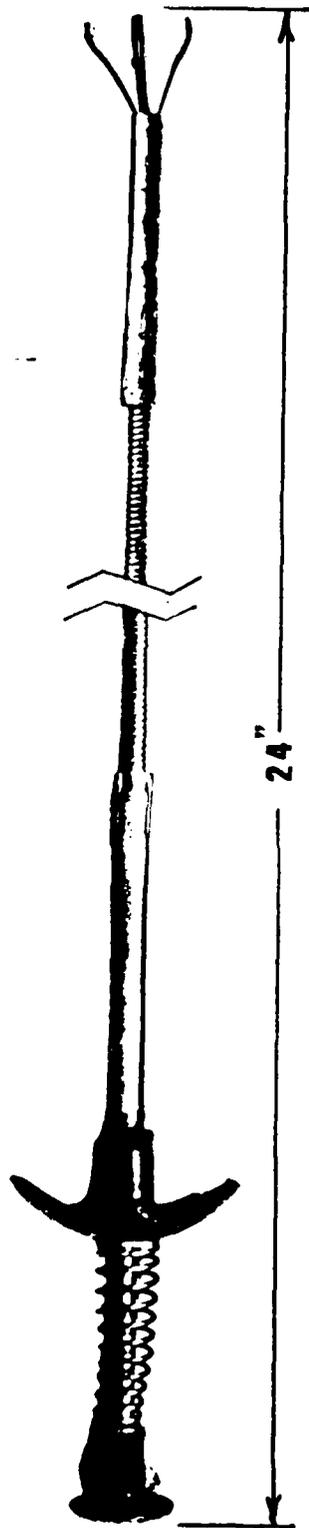


FIG. 4

HANDLING TOOL FOR CESIUM SOURCES

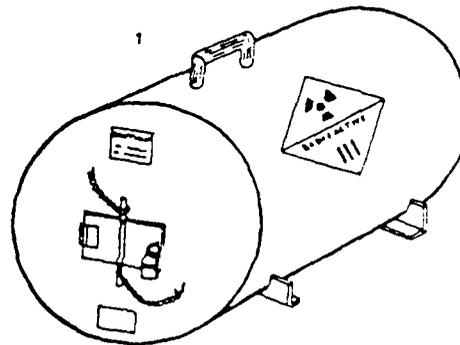
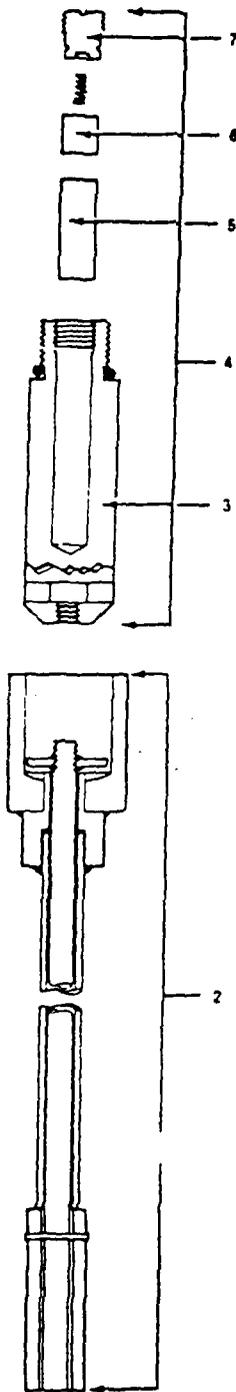


Use this tool for transferring the Cesium source between holder and logging tool by grasping the handle and squeezing until fingers open. Pick up source and insert into appropriate holder.

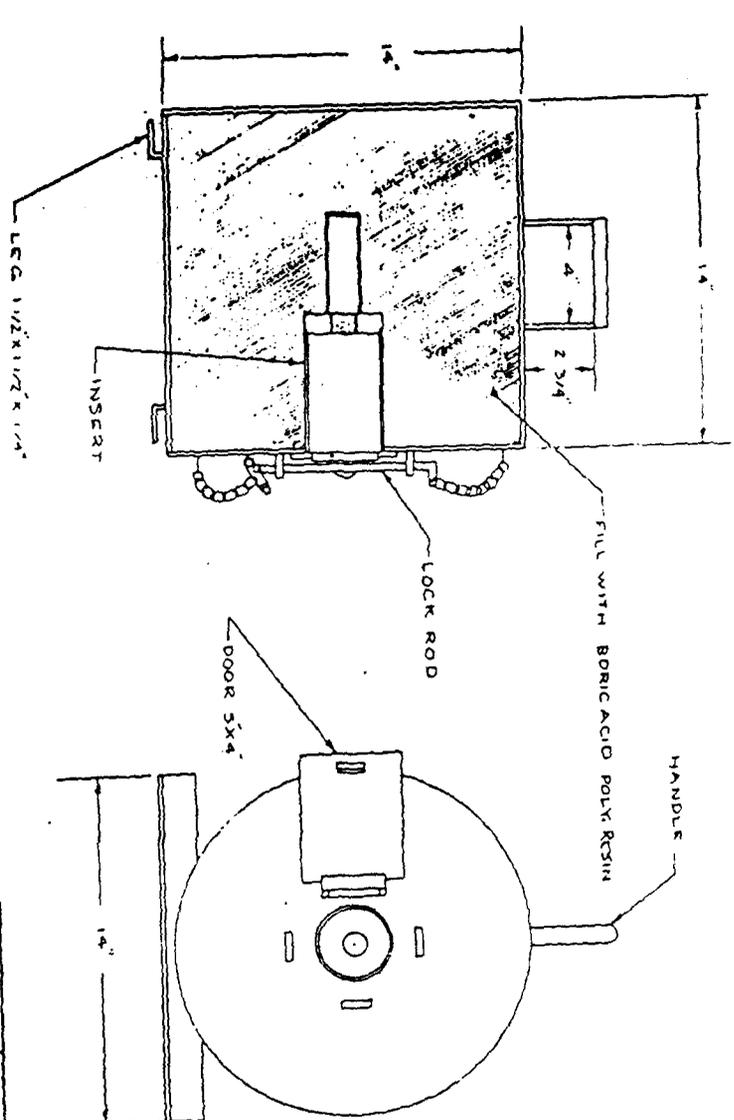
RADIOACTIVE MATERIAL HANDLING AND STORAGE

Handling and storage of radioactive materials must be performed in strict adherence to Nuclear Regulatory Commission and state health regulations. The Source Storage Assembly is approved by these agencies and by the Department of Transportation. This storage assembly was designed for the 6.6×10^6 N/S (3 curie) AmBe 241 Source and Source Holder.

The Source Holder is designed to accept the Source Handling Tool, which will permit the worker to maintain a distance of five feet from the source. The Source Handling Tool is threaded to capture the Source Holder while moving it to or from the storage assembly or downhole tool; it also has a deep socket to enable the worker to screw the Source Holder into either of these devices so that he need never approach the source.



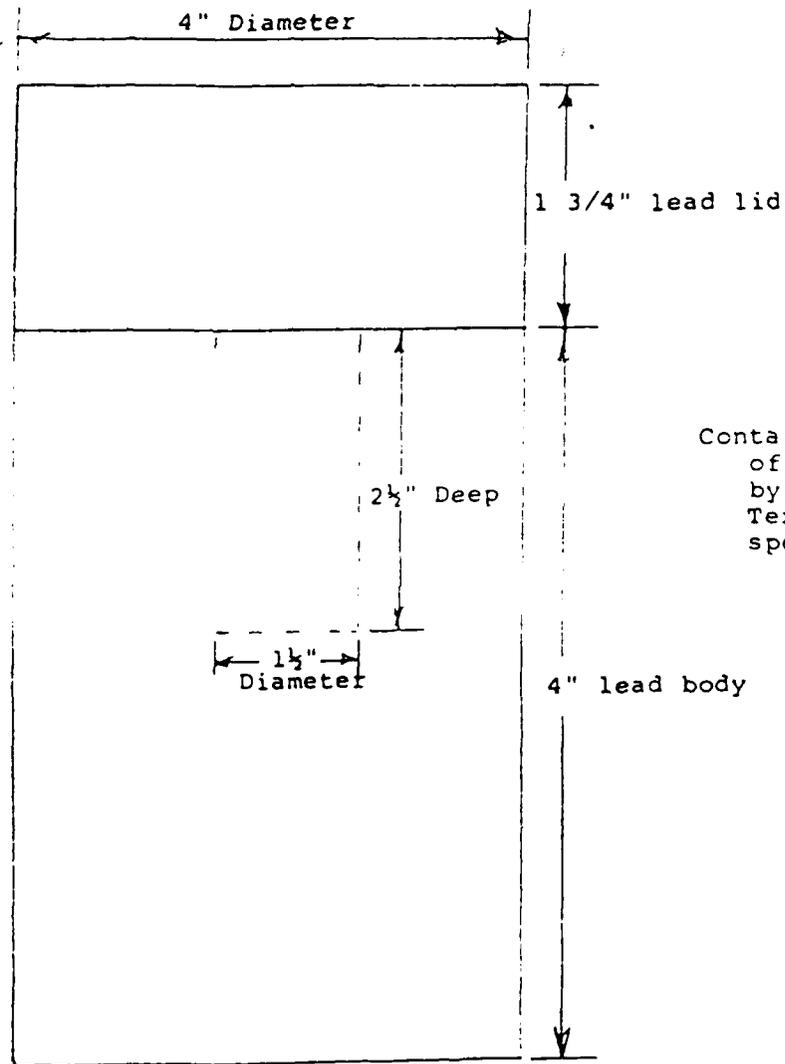
REF.	DESCRIPTION	PART NO.
1	Storage Assembly GN 6 5 TYPE A	015-2011-003
2	Source Handling Tool	002-9907-010
3	Source Holder	002-9200-034
4	Source Holder Assembly	002-9200-018
5	3 cu. AmBe 241 Neutron Source SCU AM BE 241	015-2009-048
6	Spacer	002-9200-036
7	Source Shield Cap (Neutron)	002-9200-037
Not Shown	Source Kit which consists of Items 1, 4, 5.	003-4710-003



REVISIONS		GULF NUCLEAR, INC.	
NO	DATE	BY	
1			
2			
3			
4			
5			

14X14 NEUTRON SHIELD (5, 51 S.C.I.)	SCALE 1/4"	MATERIAL H.S. 30.3
DRAWN BY M.P.A.	DATE 1-20-68	DRAWING NO. 1000-31-16
CHECKED BY	APPROVED BY	
TRACED		

CESIUM 137 STORAGE AND SHIPPING CONTAINER



Container is made entirely of lead and was constructed by Gulf Nuclear or Houston, Texas to transportation specifications.

EMERGENCY PROCEDURES REPORT (CONT.)

8. Were there any suspected over-exposures and if so, who:

- 1. _____
- 2. _____
- 3. _____
- 4. _____

9. Personnel radiation survey, for those working in the Restricted Area:

Name	Head	Face	Body	Hands	Legs	Feet
1. _____	_____	_____	_____	_____	_____	_____
2. _____	_____	_____	_____	_____	_____	_____
3. _____	_____	_____	_____	_____	_____	_____
4. _____	_____	_____	_____	_____	_____	_____
5. _____	_____	_____	_____	_____	_____	_____
6. _____	_____	_____	_____	_____	_____	_____

10. On the sketch of the job site, mark the location of the exact spill.

11. Make an isodose chart if the level of the spill is greater than 10 mr @ 1 foot.

- a) one foot: _____
- b) three foot: _____
- c) six foot: _____

12. Check the air space for contamination: _____

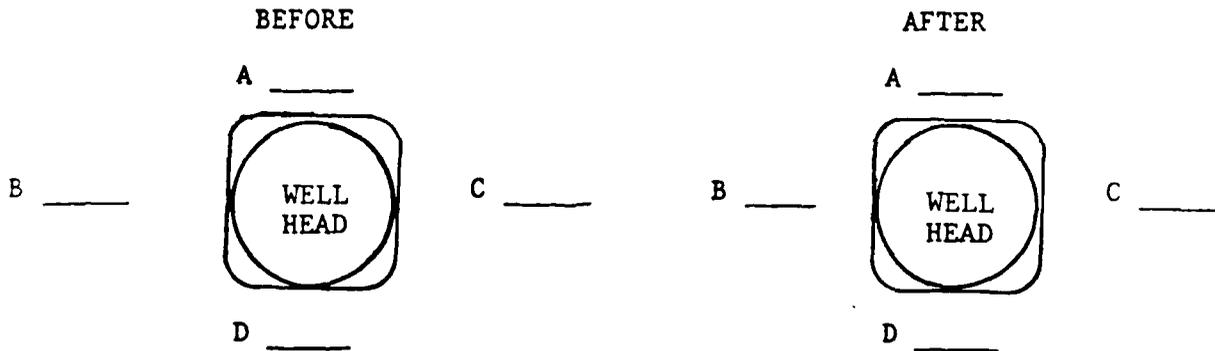
VEHICLE & JOB SITE RADIATION SURVEY

DATE _____ JOB TICKET # _____
 CUSTOMER _____ WELL # _____
 FIELD _____ COUNTY _____ STATE _____
 SERVICES PERFORMED _____
 OPERATOR _____ DISTRICT _____ TRUCK # _____
 SURVEY METER MOD.# _____ SERIAL # _____ CALIBRATION DATE _____
 SOURCE # _____ ISOTOPE _____ STRENGTH _____ UN # _____

VEHICLE SURVEY BEFORE LEAVING SHOP. TRUCK LOADED

BACKGROUND COUNT _____ mR/hr. (50 ft. clear of R/A material)
 REAR SIGN _____ FRONT SIGN _____ LEFT SIGN _____ RIGHT SIGN _____

JOB SITE SURVEY



VEHICLE SURVEY AT SHOP AFTER JOB. (R/A material removed & stored)

BACKGROUND COUNT _____ mR/hr. (50 ft. clear of R/A material)
 REAR SIGN _____ FRONT SIGN _____ LEFT SIGN _____ RIGHT SIGN _____

SURVEY TAKEN BY: _____

RADIOACTIVE MATERIAL TRANSFER

TRANSFERRED TO: _____

ADDRESS: _____

MATERIAL _____ QUANTITY _____

SERIAL NUMBER _____ MODEL _____

LICENSE NUMBER _____ EXPIRATION DATE _____

MODEL NO. AUTHORIZED _____

LEAK TEST EXPIRATION DATE _____ ENCLOSED? YES NO

I certify the above information has been completed and the licensee is authorized to receive the above material.

Date

Signature

RECEIPT OF TRANSFERRED MATERIAL

Received by (Name of Individual) _____

For (Company Name) _____

Title _____ Date _____

OCCUPATIONAL DOSE LIMITS FOR PERSONNEL MONITORING

Personnel monitoring of radiation workers is required by law if they are likely to receive a dose above 300 millirem per quarter for whole body radiation. Whole body includes external exposure to critical organs such as the head and trunk, active blood forming organs, eyes or gonads. Higher dose limits are allowed for non-penetrating radiations (beta-rays and superficial x-rays) which expose only the skin of the whole body. Still higher exposures are allowed if radiation exposure is limited to the extremities, namely the hands and forearms or feet and ankles.

Film and thermoluminescent dosimeters are the most commonly used personnel monitoring dosimeters. Both are capable of differentiating between penetrating and non-penetrating radiation. Finger ring and wrist badges may be worn to determine dose to the extremities. Personnel dosimeters are worn for fixed periods of time which are usually weekly, bi-weekly or monthly. The permissible occupational doses for these periods are given below in millirem:

OCCUPATIONAL DOSE LIMITING RATES

	<u>Weekly</u>	<u>Monthly</u>	<u>Quarterly*</u>	<u>Annual*</u>
Whole Body	100	400	1250	5000
Skin of Whole Body	600	2500	7500	30000
Extremities	1400	6000	18750	75000

* These are the only limits actually specified in AEC and state regulations.

The RDC dosimetry report provides a record of current whole body X or gamma dose in column 6 and non-penetrating dose in column 8. The minimum reported dose is 10 millirems. Any dose less than 100 millirems can be considered to be within permissible limits; however, the general policy is to avoid all unnecessary exposure to ionizing radiation. Columns 10 and 11 give the cumulative calendar quarter dose for penetrating and for non-penetrating radiation. Columns 12 and 13 give similar data for the calendar year. Columns 14 and 15 give the cumulative lifetime dose, or the dose acquired since the inception of service with Radiation Detection Company. Technical over-exposures are immediately reported to the client so that any required report can be made to the State or other appropriate Regulatory Agencies.

Please note that the average background dose received by the general population is approximately 100 millirems annually and that the average dose from medical and dental radiography is only slightly less than background. Occupational dose does not include the dose from medical or dental diagnosis or from medical therapy.

Each package required by this Section to be labeled with a RADIOACTIVE label must have two of these labels affixed to opposite sides of the package.

The following applicable items of information must be entered in the blank spaces on the RADIOACTIVE label by legible printing (manual or mechanical) using a durable weather resistant means of marking.

"Contents" - The name of the radionuclide, as taken from the listing of radionuclides in Section 173.435 (symbols which conform to established radiation protection terminology are authorized, i.e., ^{99}Mo , ^{60}Co , etc.). For mixtures of radionuclides, the most restrictive radionuclides on the basis of radiotoxicity must be listed as space on the label allows.

"Activity" - Units shall be expressed in appropriate curie units, i.e., curies (Ci), millicuries (mCi) or microcuries (uCi) (abbreviations are authorized). For a fissile material, the weight in grams or kilograms of the fissile radioisotope also may be inserted in addition to the activity.

"Transport Index" - (See Section 173.403(bb)).

TABLE 7
RADIOACTIVE MATERIALS PACKAGES LABELING CRITERIA
SECTION 172.403

Transport Index (T.I.)	Radiation Level at Package Surface (RL)	Fissile Criteria	Label Category ^{1/}
N/A	$RL \leq 0.5$ millirem per hour (mrem/h)	Fissile Class I Only No Fissile Class II or III	White - I
$T.I. \leq 1.0$	$0.5 \text{ mrem/h} < RL \leq 50$	Fissile Class I, Fissile Class II with $T.I. \leq 1.0$, No Fissile Class III	Yellow - II
$1.0 < T.I.$	$50 \text{ mrem/h} < RL$	Fissile Class II with $1.0 < T.I.$, Fissile Class III	Yellow - III

^{1/} Any package containing a "Highway Route Controlled Quantity" (Section 173.403 of this subchapter) must be labeled as Radioactive Yellow - III.

RADIOACTIVE MATERIAL LICENSE

Pursuant to the California Administrative Code, Title 17, Chapter 8, Subchapter 4, Group 2, Licensing of Radioactive Material, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, use, possess, transfer, or dispose of radioactive material listed below; and to use such radioactive material for the purpose(s) and at the place(s) designated below. This license is subject to all applicable rules, regulations, and orders of the Department of Health Services now or hereafter in effect and to any conditions specified in this license.

1. Licensee	Walenco, Inc.	2. License No.	2900-15	Amendment No. 15
3. Address	4817 District Boulevard Bakersfield, CA 93313	4. Expiration date	October 23, 1996	
Attendant:	Gary Corball Radiation Safety Officer	5. Inspection agency	Radiologic Health Branch - Los Angeles	

In response to the letter dated June 24, 1993 signed by Gary Corball, Radiation Safety Officer, License Number 2900-15 is hereby amended as follows:

- | 6. Nuclide | 7. Form | 8. Possession Limit |
|---------------------|--|--|
| A. Cesium 137 | A. Sealed Source (Gulf Nuclear Model VI-1) | A. 2 sources not to exceed 125 millicuries each. |
| B. Americium 241:Be | B. Sealed Source (Gulf Nuclear Model AmBe-71-1) | B. 4 sources not to exceed 5 Curies each. |
| C. Cesium 137 | C. Sealed Source (Nuclear Environmental Engineering Model CSV) | C. 2 sources not to exceed 10 microcuries each. |

9. Authorized Use

- A. and B. To be used as components of tools for oil well logging.
C. To be used for instrument calibration.

10. Radioactive materials may be used at temporary job sites of the licensee in areas not under exclusive federal jurisdiction throughout the State of California. Radioactive materials may be permanently stored only at:

- (a) 4817 District Boulevard, Bakersfield, California

For the State Department of Health Services

Date June 30, 1993

by

3

Radiologic Health Section
744 P Street, Sacramento, CA 95814

RADIOACTIVE MATERIAL LICENSE

License Number: 2900-15

Supplementary Sheet

Amendment Number: 15

11. This license is subject to an annual fee for sources of radioactive material authorized to be possessed at any one time as specified in Item 8 of this license. The annual fee for this license is required by and computed in accordance with Sections 30230-30232 of the California Radiation Control Regulations and is also subject to an annual cost-of-living adjustment pursuant to Section 113 of the California Health and Safety Code.

12. Radioactive material shall be used by, or under the supervision and in the physical presence of, the following individuals:

(a) Gary Corbell	(h) Joseph L. Newman
(b) Dirk L. Craig	(i) Michael C. Ridder
(c) David Jackson	(j) Steven R. Roberti
(d) William D. Christy	(k) Mark F. Sharpless
(e) Zbigniew Bobinski	(l) David Lockerbie
(f) Craig S. Newman	(m) Richard LaPorte
(g) Bailey J. McDuff	

13. Except as specifically provided otherwise by this license, the licensee shall possess and use radioactive material described in Items 6, 7, and 8 of this license in accordance with statements, representations, and procedures contained in the documents listed below. The Department's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.
 - (a) The application with attachments dated August 30, 1989, signed by Joseph L. Newman, as modified by the letter with attachments dated August 3, 1990, signed by Gary Corbell.
 - (b) The letter with attachments dated March 12, 1991, signed by Gary Corbell.
 - (c) The letter dated December 17, 1990 and letter with attachment received March 14, 1991, both signed by Gary Corbell.

14. The radiation safety officer in this program shall be Gary Corbell.

15. Sealed sources described in Subitems A and B of this license shall be tested for leakage and/or contamination at intervals not to exceed 6 months.

16. The following individuals are authorized to collect wipe test samples of sealed sources possessed under this license using leak test kits acceptable to the California Department of Health Services:
 - (a) The Radiation Safety Officer.
 - (b) Qualified individuals designated by the Radiation Safety Officer.

For the State Department of Health Services

Date: June 30, 1993

By:

Radiologic Health Branch
P.O. Box 942732

3

RADIOACTIVE MATERIAL LICENSE

License Number: 2900-15

Supplementary Sheet

Amendment Number: 15

17. Records of leak test results shall be kept in units of microcuries and maintained for inspection. Records may be disposed of following Department inspection. Any leak test revealing the presence of 0.005 microcuries or more of removable radioactive material shall be reported to the Department of Health Services, Radiologic Health Branch, 744 P Street, P.O. Box 942732, Sacramento, CA 94234-7320, within five days of the test. This report shall include a description of the defective source or device, the results of the test, and the corrective action taken.

18. Analytical tests for leakage and/or contamination of sealed sources shall be performed only by persons specifically authorized to perform that service.

19. The licensee is authorized to conduct well logging studies in test wells, subject to the following requirements:
 - (a) The wells shall be cased from the surface to levels below all potable water zones. If the wells terminate within potable water zones, the casing shall be sealed at the bottom. The casing shall be proven intact by methods acceptable to the Department. If the wells are not cased, they shall not penetrate potable water zones and shall be proven intact by methods acceptable to the Department. Nonpotable water is defined as having greater than 3000 milligrams per liter of total dissolved solids or the water is deemed to be otherwise nonpotable by the presence of toxic materials as established by state or federal regulatory agencies.

 - (b) The licensee shall maintain available for inspection such records as necessary to establish compliance with requirements of this condition for all radioactive material introduced into test wells. These records shall include the kinds and amounts of radioactive materials, dates introduced into test wells, and locations and identifications of the test wells. These records shall be maintained subject to inspection at the well site for the duration of the work at the site and at the address specified in Condition 10(a) following completion of such work.

20. Each source holder and logging tool containing radioactive materials shall bear a legible and visible marking. The marking shall bear the conventional radiation symbol and the following wording: **IF FOUND - DANGER - RADIOACTIVE - DO NOT HANDLE - NOTIFY CIVIL AUTHORITIES.**

For the State Department of Health Services

Date: June 30, 1993

By: _____ 3
 Radiologic Health Branch
 P.O. Box 942732
 Sacramento, CA 94234-7320

RADIOACTIVE MATERIAL LICENSE

License Number: 2900-15

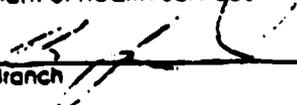
Supplementary Sheet

Amendment Number: 15

- 21. The licensee shall report by telephone within 24 hours to the Department of Health Services or to the nearest field office the loss or potential abandonment down-hole of any sealed source containing licensed material. In addition, a written report shall be submitted within 30 days for the lost or abandoned source which shall include information regarding isotopes, amount, location, depth, method of immobilization, sealing, placarding, and notations to be placed in public records.

For the State Department of Health Services

Date: June 30, 1993

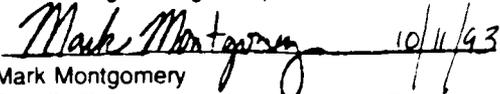
By:  3
 Radiologic Health Branch
 P.O. Box 942732

QUALITY ASSURANCE PROJECT PLAN
U.S. ARMY ABERDEEN PROVING GROUND, EDGEWOOD AREA
CANAL CREEK AREA GROUNDWATER MONITORING PLAN


George Moore
Quality Assurance
Jacobs Engineering Group, Inc.


Francine Gordon
Project Manager
Jacobs Engineering Group, Inc.

Robert Paquette
Task Leader
Jacobs Engineering Group, Inc.


Mark Montgomery
Battelle Environmental Management Operations

John Wrobel
Project Officer
U.S. Army Aberdeen Proving Ground, Edgewood Area
Directorate of Safety, Health, and Environment

