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NAS CECIL FIELD
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HEALTH MONITORING AND SAFETY TRAINING PLAN FOR CONTAMINATION ASSESSMENT INVESTIGATIONS AT FIVE SITES NAS CECIL FIELD FL

11/1/1990

E.C. JORDAN COMPANY

HEALTH MONITORING AND SAFETY TRAINING PLAN

for

CONTAMINATION ASSESSMENT INVESTIGATIONS

at five sites

for

Naval Air Station Cecil Field
Jacksonville, Florida

Prepared for:

U.S. Navy
Southern Division, Naval Facilities Engineering Command

Contract: N62467-87-D-0263

E.C. Jordan Co. Project No. 7502-01

Prepared by

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1. INTRODUCTION

The E.C. Jordan Co. (Jordan) began a formal program of site risk assessment and implementation of mitigative health and safety programs in March 1981. At that time, existing departmental policies/practices were collected and reviewed, additional needs identified, and a corporate personnel health and safety plan drafted.

Currently, Jordan's 10-member Personnel Health and Safety Committee (PHSC) regularly reviews health and safety issues, updates practices as new information becomes available, oversees administration of the Health Monitoring Program, and provides guidance for personnel training as appropriate. The PHSC is a corporate entity, effectively precluding any departmental and contract pressures on health and safety policy decisions.

Prior to on-site activities, a site safety plan must be completed by the project engineer/scientist. This is accomplished by a review of available information on the site to assess the potential risks and provide an initial determination of personal protection requirements. The site safety plan is subsequently reviewed and must be approved by the office Safety Officer. The designated Site Safety Officer monitors actual site conditions and may alter these requirements as needed. In all cases, personnel safety is the paramount factor in decision-making.

This Health and Safety Plan (HASP) was prepared in conformance with the E.C. Jordan Health and Safety Program and is intended to meet the requirements found in 29CFR 1910.120. As such, the HASP addresses all of the activities associated with the site investigation at the Naval Activities in the Jacksonville, Fla., area. Compliance with this HASP is required of all Jordan personnel, contractor personnel, or third parties entering the site.

2. CORPORATE HEALTH MONITORING AND SAFETY PROGRAM

To protect the health and safety of employees assigned to work at sites, Jordan has developed and implemented a Health and Safety Program. This program is administered by a committee consisting of representatives of Jordan technical department staffs with support from medical advisors. All personnel on-site must be enrolled in the Health Monitoring Program and each must receive training appropriate for this assigned function.

In addition to Jordan employees, subcontractors and consultants working on Navy sites will be enrolled in an equivalent Health Monitoring Program and receive health and safety indoctrination prior to commencing work on the site. Indoctrination, training, and periodic follow-up is conducted as appropriate. Indoctrination and training include:

- site history,
- inventory of site chemicals known or suspected (will be updated and reviewed at each stage of the field investigation program),
- project organization,
- work plan review,
- project documentation,
- review of site safety plan (site safety plans are updated as new information becomes available),
- review of decontamination procedures,
- proper use and care of personal protection equipment,
- proper calibration and use of monitoring equipment,
- emergency response procedures,
- accident reporting procedures, and
- contingency plans.

Site-specific information on the items listed above will be presented at the beginning of this document. This will provide critical information on health and safety matters that may be needed at a moments notice at the site. The site-specific information will include:

- summary site safety plans,
- chemical hazard data sheets,
- miscellaneous reports, and
- heat stress casualty prevention plans

The formal E.C. Jordan Health and Safety Program including medical surveillance, personnel protection equipment, and emergency planning is presented in Appendix A.

3. SITE SPECIFIC GENERAL INFORMATION

The information contained in this section is site specific general information such as site contact and phone number, dates of investigation, and other information relating to general site safety.

Site: NAS Cecil Field, Jacksonville, Florida

Site Owner/Contact: John Dingwall, (904) 778-5620

Location: Jacksonville, Florida

Prepared by: Ken Busen Date: 10/08/90 Revision: _____

Approved by: Jack Davis Date: 10/22/90

Proposed Date(s) of Investigation: November 5 through December 7, 1990

Background Review: Complete _____ Preliminary: X

Overall Hazard: Serious _____ Moderate _____ Low X Unknown _____

4. SITE CHARACTERIZATION AND ANALYSIS

4.1 SCOPE OF WORK. The scope of work includes performing preliminary contamination assessments at the Motor Pool and Jet Engine Test Cell and contamination assessments at the North Fuel Farm, South Fuel Farm, and Day Tank 293-DT.

4.2 SITE HISTORY. Contamination assessment investigations will be conducted at the North Fuel Farm, South Fuel Farm, Day Tank 293-DT, the Motor Pool, and the Jet Engine Test Cell. The North Fuel Farm consists of six 595,000-gallon mounded tanks that contain JP-5. The tanks are numbered tank 76 through 76-E. Tanks 76 and 76-A had reported overfills or leaks in the past. Tank 342-DT at the South Fuel Farm is a 200,000-gallon, mounded, day tank that contains JP-5. Tank 293-DT is a 200,000-gallon, mounded, day tank that contains aviation gasoline. In 1981, a reported 497,000-gallon spill took place at this site. The Motor Pool consists of Tank 80-R, a 10,000-gallon underground tank containing gasoline, and Tank 80-UL, a 5,000-gallon underground tank containing unleaded gasoline. The Jet Engine Test Cell contains two 20,000-gallon underground tanks (339-TC1 and 339-TC2) that contain JP-5.

The contamination assessments will include soil borings, monitoring well installation, and soil and groundwater sampling. See the Work Plan for specific information at each of these sites.

4.3 SITE RISKS.

4.3.1 Health Hazards. The primary hazard at the site is from fire or explosion. There shall be no smoking allowed in the vicinity of the site. There must be adequate ventilation, especially when sampling in an enclosed or semi-enclosed (i.e., a pit) space. There shall always be a fire extinguisher within easy access. Contaminants to which personnel may be exposed are gasoline, diesel fuel, jet fuel, and their constituents. The primary constituents of gasoline, diesel fuel, and jet fuel that represent potential health hazards are described below and summarized in Table 4-1.

Benzene is a watery, colorless liquid with a pleasant aromatic odor. It is a moderate irritant in small amounts both as a gas and as a liquid. If inhaled in large amounts it attacks the central nervous system, possibly resulting in coma and/or respiratory arrest. Chronic poisoning causes leukemia.

Ethyl benzene is a colorless aromatic liquid. It is a moderate skin irritant in gaseous form. Inhalation of high concentrations of the gas may cause temporary irritation of the nose, dizziness, and depression. The liquid form can blister the skin if not washed off immediately.

Toluene is a watery, colorless liquid with a pleasant aromatic odor. It is a mild skin irritant. Inhalation of high concentrations of the gas can cause temporary smarting of the eyes or irritation of respiratory system. If the liquid form is allowed to remain on the skin for a long period of time smarting and reddening of the skin may occur. Ingestion or aspiration of the liquid

causes depressed respiration and pulmonary edema, and can result in kidney or liver damage.

Xylene is a colorless, watery liquid with a sweet odor. It is a moderate skin irritant. When present as a gas in high concentrations it can cause temporary slight smarting of the eyes or irritation of the respiratory system, headache, and dizziness. The liquid form may cause smarting or reddening of the skin if not washed off immediately. If the liquid is aspirated into the lungs it can result in severe coughing, distress, and rapidly developing pulmonary edema. If ingested, nausea, vomiting, cramps, headache, and coma can occur, and it may be fatal. Ingestion may also result in kidney and liver damage.

Tetraethyl lead is a colorless, oily liquid with a pleasant characteristic odor. It can cause intoxication by absorption through the skin or by inhalation. Ingestion causes fatigue, anemia, abdominal pains, constipation, and neurological damage.

1,2-Dibromomethane is a colorless, nonflammable liquid with a sweetish odor. It is a strong irritant to eyes and skin and is toxic by inhalation, ingestion and skin absorption. Laboratory tests have shown it to be carcinogenic in test animals.

Polunuclear aromatic hydrocarbons (PAHs) for the purposes of this plan and study include those listed as parameters for EPA Method 610. Some of the more notable PAHs from this method include acenaphthene, anthracene, chyrsene, fluorene, naphthalene, phenanthrene, and pyrene.

In addition, care will be taken to avoid contact with the base neutral compounds that include naphthalene, phenanthrene, fluorene, and anthracene. Details of these compounds are listed in Section 12.0.

All activities at this site will be conducted in unconfined areas. This will minimize the chances of on-site personnel to either high vapor concentrations or strong liquid concentrations of any of the substances described above.

4.3.2 Safety Hazards. Power substations, powerlines, underground utilities, and underground pipelines are to be avoided during drilling operations. Necessary work permits for activities at the naval activities will be obtained from the Public Works Department or the appropriate department (e.g., fire department, etc.)

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

Table 4-1—Contaminants of Concern

Health Monitoring and Safety Training Plan
Naval Air Station Cecil Field
Jacksonville, Florida

Chemical	Approximate odor threshold (ppm)	PEL (ppm)	Physical characteristics	Dermal toxicity	Remarks
Benzene	4.68	1	Colorless liquid, pleasant aromatic odor.	Moderate skin irritant	Inhalation of large amounts attacks central nervous system; chronic poisoning causes leukemia.
Ethyl benzene	140	100	Colorless liquid, aromatic.	Moderate skin irritant	Liquid blisters skin, inhalation results in dizziness, depression.
Toluene	0.17	200	Colorless liquid, pleasant aromatic odor.	Mild skin irritant	Ingestion or aspiration can cause pulmonary edema, depressed respiration.
Xylene	0.05	100	Colorless liquid, aromatic	Moderate skin irritant	Inhalation causes headache and dizziness; vapors irritate eyes; can be fatal in ingested.
Naphthalene		10	Colorless to brown solid with an odor of mothballs.	Moderate skin irritant	Inhalation causes headache and confusion; vapors irritate eyes.
Lead	--	0.05[1]	Bluish white or silvery gray solid appearance.	Mild skin irritant	Inhalation of large amounts of lead may cause seizures, coma, and death.

[1] Lead concentration is in milligrams per cubic meter.

Notes: PEL = permissable exposure limit.
ppm = parts per million.

4.4 INITIAL SITE ENTRY.

4.4.1 Initial Levels of Protection.

Task	Minimum Level
Installation of monitoring wells	D
All other tasks	D

4.4.2 Initial Monitoring. Where the development of site information either shows the potential for or is unable to rule out the possibility of ionizing radiation or "immediately dangerous to life or health" (IDLH) conditions, initial monitoring will consist at a minimum of an ionizing radiation survey and air monitoring using such devices as a combustible gas indicator, oxygen meter, and photo ionization detectors (PID). It is intended that real time monitoring instrumentation will be used to assist in the determination of the appropriate level of protection for the initial site entry team. Based on the available historical site information and current site conditions, the level of protection planned for initial site work at the naval activities is Level D. It should be noted, however, that this HASP allows for the upgrading of protection levels to conservatively preclude any potential for contamination to on-site personnel while not sacrificing efficiency.

5. SITE CONTROL

5.1 ZONATION. Because the level of contamination is low, zonation will not be conducted at the sites. All the sites are secured from general public access.

Care will be taken when drilling in contaminated areas to prevent spreading of the contamination to clean areas. All equipment will be decontaminated between each drilling or sampling point.

6. ENGINEERING CONTROLS, WORK PRACTICES, AND PERSONAL PROTECTIVE EQUIPMENT

6.1 ENGINEERING CONTROLS. Whenever needed, engineering controls (i.e., fans to blow volatilized chemicals away from the work area) will be used.

6.2 WORK PRACTICES. Workers will be expected to adhere to the established safe work practices for their respective specialities (e.g., drilling, laboratory analysis, construction, etc.). The need to exercise caution in the performance of specific work tasks is made more acute due to weather conditions, restricted mobility, and reduced peripheral vision caused by the protective gear itself, the need to maintain the integrity of the protective gear, and the increased difficulty in communication caused by respirators. Work at the site will be conducted according to established protocol and guidelines for the safety and health of all involved and will include the following.

- In any unknown situation, always assume the worst conditions and plan responses accordingly.
- Use the buddy system.
- Establish and maintain communication. In addition to radio communications, it is advisable to develop a set of hand signals.
- Because no personal protective equipment is 100-percent effective, all personnel must minimize contact with excavated or contaminated materials. Do not place equipment on drums or the ground. Do not sit on drums or other materials. Do not sit or kneel on the ground in the Exclusion Zone or CRZ. Avoid standing in or walking through puddles or stained soil.
- Smoking, eating, or drinking in the work area and before decontamination will not be allowed.
- Avoid heat and other work stresses related to wearing protective gear. Work breaks should be planned to prevent stress-related accidents or fatigue.
- To the extent feasible, handling of contaminated materials should be done remotely, particularly when drummed or other containerized hazardous waste materials are found on-site. Every effort should be made to identify the contents of containers found on-site before they are subject to material-handling applications.
- Personnel must be observant of not only one's own immediate surroundings, but also those of others. Everyone will be working under constraints; therefore, a team effort is needed to notice and warn of impending dangerous situations.
- Contact lenses are not allowed to be worn on-site; if corrosive or lachrymose substances enter the eyes, proper flushing is impeded.

- All facial hair that interferes with the face piece fit, must be removed prior to donning a respirator at all sites requiring Level C or B protection.

- Rigorous contingency planning and dissemination of plans to all personnel minimize the impact of rapidly changing safety protocols in response to changing site conditions.

- Personnel must be aware that chemical contaminants may mimic or enhance symptoms of other illnesses or intoxication. Avoid excess use of alcohol or working while ill during field investigation assignments.

6.3 PERSONAL PROTECTIVE EQUIPMENT. Check all that are to be used.

_____	SCBA/Airline Respirator	_____	Escape mask
_____	Full face cartridge respirator	__X__	Hard hat
_____	Disposable boot covers	__X__	Safety glasses
_____	Coated Tyveks	_____	Face shield
__X__	Chemical-resistant safety boots/shoes	__X__	Coveralls
__X__	Inner chemical-resistant gloves	__X__	Ear protection
_____	Outer chemical-resistant gloves		

6.3.1 Other Protective Equipment. Steel toe-steel shank rubber boots or work boots.

7. MONITORING

7.1 AIR SAMPLING. Check all that are to be used.

__X__ IDS Dual Detector (Combustible Gases/Oxygen Meter)

_____ ISD HS267 (Hydrogen Sulfide Detector)

__X__ PID (HNU/TIP/TE)

_____ Radiation Survey Meter

__X__ Dosimeter Badges

7.2 OTHER MONITORING EQUIPMENT. None.

7.3 CONTAMINANT LEVELS FOR MODIFICATION OF PROTECTIVE EQUIPMENT. Should the photoionization meter readings exceed 5.0 parts per million (ppm) in the ambient breathing zone, personnel will leave the site until the compounds can be identified and the proper level of protection identified for continued safe operation of work.

8. DECONTAMINATION/DISPOSAL

All personnel and/or equipment leaving contaminated site areas are subject to decontamination, which occurs in the CRZ.

In the event that any of the sites are upgraded from Level D, the following decontamination/disposal procedures will be followed.

8.1 PERSONNEL DECONTAMINATION. Decontamination procedures are followed by all personnel leaving hazardous waste sites. Under no circumstances (except emergency evacuation) will personnel be allowed to leave the site prior to decontamination.

Disposable items (i.e., Tyvek coveralls, inner gloves, and latex overboots) will be changed on a daily basis unless there is a reason to change sooner. Dual respirator canisters will be changed daily, unless more frequent changes are deemed appropriate.

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

Respirators will be decontaminated daily and taken from the drop area, the masks will be disassembled, the cartridges discarded, and all other parts placed in a cleansing solution. After an appropriate time in the solution, the parts will be removed and rinsed with tap water. Old cartridges will be discarded in the contaminated trash container for disposal. In the morning, respirators will be reassembled and new cartridges installed.

8.2 SMALL EQUIPMENT DECONTAMINATION. Small equipment will be protected from contamination as much as possible by draping, masking, or otherwise covering the instruments with plastic (to the extent feasible) without hindering operation of the unit.

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

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

8.4 DISPOSAL OF DECONTAMINATED MATERIALS. All protective gear, decontamination fluids (for both personnel and equipment), and other disposable materials will

be disposed of at each site. Disposable materials (e.g., gloves and Tyveks) will be bagged and disposed of properly.

9. EMERGENCY/CONTINGENCY PLAN

This section identifies the emergency contingency planning undertaken for operations at this site should evacuation become necessary. Other sections provide further information to be used under emergency conditions. Refer to Appendix F for emergency telephone numbers, routes to emergency medical facilities, and emergency signals.

9.1 EVACUATION.

Withdrawal Upwind. When conditions warrant moving away from the work site, the crew will relocate upwind at a distance of approximately 100 feet or farther if need is indicated by site monitoring instruments. Donning an SCBA and a safety harness and line, the HSO and a member of the crew (the buddy system must be used) may return to the work site to determine if the condition noted was transient or persistent. If persistent, an alarm should be raised to notify on-site personnel of the situation and the need to leave the site or don an SCBA. An attempt to decrease emissions should be made only if greater respiratory protection is donned. Jordan's Health and Safety Supervisor (HSS) and the client will be notified of conditions. When site access is restricted, thus hindering escape, the crew may be instructed to evacuate the site rather than move upwind, especially if withdrawal upwind moves the crew away from escape routes.

Site Evacuation. When conditions warrant site evacuation, the work party will proceed upwind of the work site and notify the security force, Health and Safety Officer (HSO), and field office of site conditions. If the decontamination area is upwind and greater than 500 feet from the work site, the crew will pass quickly through decontamination to remove contaminated outer suits. If the hazard is toxic gas, respirators will be retained. The crew will proceed to the field office to assess the situation.

Evacuation of Surrounding Area. When the HSO determines that conditions warrant evacuation of downwind residences and commercial operations, local agencies will be notified and assistance requested. Designated on-site personnel will initiate evacuation of the immediate off-site area without delay.

9.2 EMERGENCY MEDICAL TREATMENT/FIRST AID. First aid will be rendered to any person injured on-site, as appropriate. The injured person will then be transported to medical personnel for further examination and/or treatment. The preferred transport method is a professional emergency transportation service; however, when this is not readily available or would result in excessive delay, other transport is authorized. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment.

When an injury occurs in a downrange position, provisions for decontamination of the victim will be made. However, life threatening conditions may preclude normal decontamination procedures. In such cases, arrangements will be made with the medical facility and transporter to provide for the situation.

10. OTHER

10.1 ILLUMINATION. Site operations will not be permitted without adequate lighting. Therefore, unless provisions are made for artificial light, operations must halt in time to permit personnel and equipment to exit the site before dusk. Conversely, operations will not be permitted to begin until lighting is adequate. All field operations will take place during daylight hours (sunrise to sunset).

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

10.3 EXCAVATION. Site excavations created during site operations will be shored or sloped to prevent accidental collapse, and otherwise conducted in accordance with 29 CFR 1926 (Subpart P). Under no circumstances will site personnel enter excavations that are not adequately shored or sloped. When entry into an excavation does occur, and the excavation is considered a confined space, such an entry will be done in accordance with the confined space entry program (see Appendix C).

10.4 CONFINED SPACE ENTRY. Confined space entry presents special problems and substantial risks to involved personnel (including those who might be called upon to attempt a rescue of initial entrants). Therefore, entry into a confined space is a MEANS OF LAST RESORT, and will only be permitted where no other mechanism is feasible to achieve the desired goal. If confined space entry is necessary, it will be conducted under provisions outlined in Appendix C.

11. ADMINISTRATIVE

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

Certified E.C. Jordan Co. Team Personnel:

HSO: Mark Diblin[1,2]	J. Michael Wilson[1,2]
Ken Busen[1,2]	Kathelene O'Neill[1,2]
Eric Blomberg[1,2]	Kevin Warner[1,2]
Harry Hooper[1,2]	Frances Hartnett[1,2]
Andrew DeSandro[1,2]	

Other Certified Personnel:

_____ _____

[1]Current First Aid Training. [2]Current CPR Training.

11.2 FIELD TEAM REVIEW. I have read and reviewed the HASP, understand the information contained, and agree to comply.

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Site/project: _____

11.3 MEDICAL DATA SHEET. This Medical Data Sheet will be completed by all on-site personnel and will be kept in the Support Zone during site operations. It is in no way a substitute for the Medical Surveillance Program requirements consistent with the E.C. Jordan Corporate Health and Safety Program for Hazardous Waste Sites. This data sheet will accompany any personnel when medical assistance or transport to hospital facilities is required. If more information is required, use the back of this sheet.

Project: _____

Name: _____

Home address: _____

Home Phone: Area Code ( ) _____

DOB: _____ Height: _____ Weight: _____

In case of emergency, contact: _____ (spouse) _____

Address: _____

Telephone (home): _____

Do you wear contacts? ( ) Yes ( ) No

Allergies: _____

List medication taken regularly: _____

Particular sensitivities: _____

Previous/recent illnesses or exposures to hazardous chemicals: _____

_____

Name of Personal Physician: _____

Telephone: Area Code ( ) _____

12. CHEMICAL HAZARD DATA

ANTHRACENE

ATH

Common Synonyms	Solid	White to yellow	Weak aromatic odor
Anthracin Paranaphthalene Green oil	Sinks in water.		

Stop discharge if possible. Keep people away.
Avoid contact with solid and dust.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Dust cloud may explode if ignited in an enclosed area.
Extinguish with water, dry chemicals, foam, or carbon dioxide.

Exposure

CALL FOR MEDICAL AID.

DUST
Irritating to eyes, nose and throat.
If inhaled will cause coughing or difficult breathing.
If in eyes, hold eyelids open and flush with plenty of water.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

SOLID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Should be removed
Chemical and physical treatment

2. LABEL

2.1 **Category:** None
2.2 **Class:** Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Not listed
3.2 **Formula:** $C_{14}H_{10}$
3.3 **IMO/UN Designation:** Not listed
3.4 **DOT ID No.:** Data not available
3.5 **CAS Registry No.:** 120-12-7

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Solid
4.2 **Color:** White to yellow
4.3 **Odor:** Weak aromatic

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Dust mask; goggles or face shield; rubber gloves
5.2 **Symptoms Following Exposure:** Inhalation of dust irritates nose and throat. Contact with eyes causes irritation.
5.3 **Treatment of Exposure:** INHALATION: move to fresh air. EYES: flush with water for 15 min.
5.4 **Threshold Limit Value:** Data not available
5.5 **Short Term Inhalation Limits:** Data not available
5.6 **Toxicity by Ingestion:** Data not available
5.7 **Late Toxicity:** Data not available
5.8 **Vapor (Gas) Irritant Characteristics:** Data not available
5.9 **Liquid or Solid Irritant Characteristics:** Data not available
5.10 **Odor Threshold:** Data not available
5.11 **IDLH Value:** Data not available

6. FIRE HAZARDS

6.1 **Flash Point:** 250°F
6.2 **Flammable Limits in Air:** 0.6% LEL
6.3 **Fire Extinguishing Agents:** Water, foam, dry chemical, carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Data not available
6.5 **Special Hazards of Combustion Products:** Data not available
6.6 **Behavior in Fire:** Data not available
6.7 **Ignition Temperature:** 1004°F
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** Not pertinent
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** Data not available
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data not available
7.8 **Reactivity Group:** Data not available

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 5 ppm/24 hr/trout & bluegill/no effect
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** Data not available
8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Various fluorescence grades; Scintillation grade; Technical grade, 90-98%
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

II

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Not listed
11.2 **NAS Hazard Rating for Bulk Water Transportation:** Not listed
11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	1
Reactivity (Yellow)	-

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Solid
12.2 **Molecular Weight:** 178.23
12.3 **Boiling Point at 1 atm:** 646.2°F = 341.2°C = 614.4°K
12.4 **Freezing Point:** 421.7°F = 216.5°C = 489.7°K
12.5 **Critical Temperature:** Not pertinent
12.6 **Critical Pressure:** Not pertinent
12.7 **Specific Gravity:** 1.24 at 20°C (solid)
12.8 **Liquid Surface Tension:** Not pertinent
12.9 **Liquid Water Interfacial Tension:** Not pertinent
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** Not pertinent
12.12 **Latent Heat of Vaporization:** Not pertinent
12.13 **Heat of Combustion:** -17,100 Btu/lb = -9,510 cal/g = -398 X 10^3 J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** 38.70 cal/g
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** Data not available

NOTES

BENZENE

BNZ

Common Synonyms	Watery liquid	Colorless	Gasoline-like odor
Benzol Benzole	Floats on water. Flammable, irritating vapor is produced. Freezing point is 42°F.		

Avoid contact with liquid and vapor. Keep people away.
Wear goggles and self-contained breathing apparatus.
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-high flammability
Restrict access

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Aromatic Hydrocarbon
3.2 **Formula:** C_6H_6
3.3 **IMO/UN Designation:** 3.2/1114
3.4 **DOT ID No.:** 1114
3.5 **CAS Registry No.:** 71-43-2

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Aromatic; rather pleasant aromatic odor; characteristic odor

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Hydrocarbon vapor canister, supplied air or a hose mask; hydrocarbon-insoluble rubber or plastic gloves; chemical goggles or face splash shield; hydrocarbon-insoluble apron such as neoprene.
5.2 **Symptoms Following Exposure:** Dizziness, excitation, pallor, followed by flushing, weakness, headache, breathlessness, chest constriction. Coma and possible death.
5.3 **Treatment of Exposure:** SKIN: flush with water followed by soap and water; remove contaminated clothing and wash skin. EYES: flush with plenty of water until irritation subsides. INHALATION: remove from exposure immediately. Call a physician. IF breathing is irregular or stopped, start resuscitation, administer oxygen.
5.4 **Threshold Limit Value:** 10 ppm
5.5 **Short Term Inhalation Limits:** 75 ppm for 30 min.
5.6 **Toxicity by Ingestion:** Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 **Late Toxicity:** Leukemia
5.8 **Vapor (Gas) Irritant Characteristics:** If present in high concentrations, vapors may cause irritation of eyes or respiratory system. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 4.68 ppm
5.11 **IDLH Value:** 2,000 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** 12°F C.C.
6.2 **Flammable Limits in Air:** 1.3%-7.9%
6.3 **Fire Extinguishing Agents:** Dry chemical, foam, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective
6.5 **Special Hazards of Combustion Products:** Not pertinent
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back
6.7 **Ignition Temperature:** 1097°F
6.8 **Electrical Hazard:** Class I, Group D
6.9 **Burning Rate:** 6.0 mm/min.
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data not available
7.8 **Reactivity Group:** 32

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 5 ppm/6 hr/minnow/lethal/distilled water
20 ppm/24 hr/sunfish/TL_m/tap water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 1.2 lb/lb, 10 days
8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

9.1 **Grades of Purity:**
Industrial pure .....99+%
Thiophene-free .....99+%
Nitration .....99+%
Industrial 90% .....85+%
Reagent ..... 99+%
9.2 **Storage Temperature:** Open
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Flammable liquid
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	3
Water Pollution	
Human Toxicity	3
Aquatic Toxicity	1
Aesthetic Effect	3
Reactivity	
Other Chemicals	2
Water	1
Self Reaction	0

11.3 **NFPA Hazard Classification:**

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 78.11
12.3 **Boiling Point at 1 atm:** 176°F = 80.1°C = 353.3°K
12.4 **Freezing Point:** 42.0°F = 5.5°C = 278.7°K
12.5 **Critical Temperature:** 552.0°F = 288.9°C = 562.1°K
12.6 **Critical Pressure:** 710 psia = 48.3 atm = 4.89 MN/m^2
12.7 **Specific Gravity:** 0.879 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 28.9 dynes/cm = 0.0289 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 35.0 dynes/cm = 0.035 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** 2.7
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.061
12.12 **Latent Heat of Vaporization:** 169 Btu/lb = 94.1 cal/g = 3.94 X 10^5 J/kg
12.13 **Heat of Combustion:** −17,460 Btu/lb = −9698 cal/g = −406.0 X 10^5 J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** 30.45 cal/g
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** 3.22 psia

NOTES

ETHYLBENZENE

ETB

Common Synonyms	Liquid	Colorless	Sweet, gasoline-like odor
Phenylethane EB	Floats on water. Flammable, irritating vapor is produced.		

Avoid contact with liquid and vapor. Keep people away.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Aromatic hydrocarbon
3.2 **Formula:** $C_6H_5CH_2CH_3$
3.3 **IMO/UN Designation:** 3.3/1175
3.4 **DOT ID No.:** 1175
3.5 **CAS Registry No.:** 100-41-4

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Aromatic

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Self-contained breathing apparatus; safety goggles.
5.2 **Symptoms Following Exposure:** Inhalation may cause irritation of nose, dizziness, depression. Moderate irritation of eye with corneal injury possible. Irritates skin and may cause blisters.
5.3 **Treatment of Exposure:** INHALATION: if ill effects occur, remove victim to fresh air, keep him warm and quiet, and get medical help promptly; if breathing stops, give artificial respiration. INGESTION: induce vomiting only upon physician's approval; material in lung may cause chemical pneumonitis. SKIN AND EYES: promptly flush with plenty of water (15 min. for eyes) and get medical attention; remove and wash contaminated clothing before reuse.
5.4 **Threshold Limit Value:** 100 ppm
5.5 **Short Term Inhalation Limits:** 200 ppm for 30 min.
5.6 **Toxicity by Ingestion:** Grade 2; LD_{50} = 0.5 to 5 g/kg (rat)
5.7 **Late Toxicity:** Data not available
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.
5.10 **Odor Threshold:** 140 ppm
5.11 **IDLH Value:** 2,000 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** 80°F O.C.; 59°F C.C.
6.2 **Flammable Limits in Air:** 1.0%-6.7%
6.3 **Fire Extinguishing Agents:** Foam (most effective), water fog, carbon dioxide or dry chemical.
6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent
6.5 **Special Hazards of Combustion Products:** Irritating vapors are generated when heated.
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel considerable distance to the source of ignition and flash back.
6.7 **Ignition Temperature:** 860°F
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** 5.8 mm/min.
6.10 **Adiabatic Flame Temperature:** Data Not Available

(Continued)

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data Not Available
7.8 **Reactivity Group:** 32

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 29 ppm/96 hr/bluegill/TL_m/fresh water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 2.8% (theor.), 5 days
8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Research grade: 99.98%; pure grade: 99.5%; technical grade: 99.0%
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Flammable liquid
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	3
Health	
Vapor Irritant	2
Liquid or Solid Irritant	2
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 106.17
12.3 **Boiling Point at 1 atm:** 277.2°F = 136.2°C = 409.4°K
12.4 **Freezing Point:** —139°F = —95°C = 178°K
12.5 **Critical Temperature:** 651.0°F = 343.9°C = 617.1°K
12.6 **Critical Pressure:** 523 psia = 35.6 atm = 3.61 MN/m^2
12.7 **Specific Gravity:** 0.867 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 29.2 dynes/cm = 0.0292 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 35.48 dynes/cm = 0.03548 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.071
12.12 **Latent Heat of Vaporization:** 144 Btu/lb = 80.1 cal/g = 3.35×10^5 J/kg
12.13 **Heat of Combustion:** —17,760 Btu/lb = —9877 cal/g = -413.5×10^5 J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** Data Not Available
12.26 **Limiting Value:** Data Not Available
12.27 **Reid Vapor Pressure:** 0.4 psia

6. FIRE HAZARDS (Continued)

6.11 **Stoichiometric Air to Fuel Ratio:** Data Not Available
6.12 **Flame Temperature:** Data Not Available

ETHYLENE DIBROMIDE

EDB

Common Synonyms

1. 2-Dibromoethane
Ethylene bromide
Bromofume
sym-Dibromoethane
Dow-fume 40, W-10, W-15, W-40
Glycol dibromide

Liquid Colorless Sweet odor

Sinks in water. Poisonous vapor is produced.
Freezing point is 50°F.

Stop discharge if possible. Keep people away.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
POISONOUS GASES ARE PRODUCED WHEN HEATED.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
POISONOUS IF INHALED.
Irritating to eyes, nose and throat.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED.
Irritating to skin and eyes.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Halogenated hydrocarbon
3.2 Formula: $BrCH_2CH_2Br$
3.3 IMO/UN Designation: 6.1/1605
3.4 DOT ID No.: 1605
3.5 CAS Registry No.: 106-93-4

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Mildly sweet; like chloroform

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Canister type mask or self-contained air mask; neoprene gloves; chemical safety goggles.
5.2 Symptoms Following Exposure: Local inflammation, blisters and ulcers on skin; irritation in lungs and organic injury to liver and kidneys; may be absorbed through skin.
5.3 Treatment of Exposure: Remove from exposure. Remove contaminated clothing. Wash skin with soap and water. Flush eyes with plenty of water. Consult physician.
5.4 Threshold Limit Value: 2 ppm
5.5 Short Term Inhalation Limits: 50 ppm for 5 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect if temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: 400 ppm

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Decomposition gases are toxic and irritating.
6.6 Behavior in Fire: Decomposes into toxic irritating gases. Reacts with hot metals such as aluminum and magnesium.
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data Not Available
6.11 Stoichiometric Air to Fuel Ratio: Data Not Available
6.12 Flame Temperature: Data Not Available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data Not Available
7.8 Reactivity Group: 36

8. WATER POLLUTION

8.1 Aquatic Toxicity: 18 mg/l/48 hr/bluegill/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Commercial
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-X

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A

11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	0
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	3
Water Pollution	
Human Toxicity	3
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 187.86
12.3 Boiling Point at 1 atm: 268°F = 131°C = 404°K
12.4 Freezing Point: 49.6°F = 9.8°C = 283.0°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 2.180 at 20°C (liquid)
12.8 Liquid Surface Tension: 38.75 dynes/cm = 0.03875 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.54 dynes/cm = 0.03654 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.109
12.12 Latent Heat of Vaporization: 82.1 Btu/lb = 45.6 cal/g = 1.91×10^5 J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 13.79 cal/g
12.26 Limiting Value: Data Not Available
12.27 Reid Vapor Pressure: 0.4 psia

NOTES

TOLUENE

TOL

Common Synonyms	Watery liquid	Colorless	Pleasant odor
Toluol Methylbenzene Methylbenzol	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Aromatic Hydrocarbon
3.2 Formula: $C_6H_5CH_3$
3.3 IMO/UN Designation: 3.2/1294
3.4 DOT ID No.: 1294
3.5 CAS Registry No.: 108-88-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Pungent; aromatic, benzene-like; distinct, pleasant

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Air-supplied mask; goggles or face shield; plastic gloves.
5.2 Symptoms Following Exposure: Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration.
5.3 Treatment of Exposure: INHALATION: remove to fresh air, give artificial respiration and oxygen if needed; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 Threshold Limit Value: 100 ppm
5.5 Short Term Inhalation Limits: 600 ppm for 30 min.
5.6 Toxicity by Ingestion: Grade 2; LD_{50} = 0.5 to 5 g/kg
5.7 Late Toxicity: Kidney and liver damage may follow ingestion.
5.8 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 Odor Threshold: 0.17 ppm
5.11 IDLH Value: 2,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: 40°F C.C.; 55°F O.C.
6.2 Flammable Limits in Air: 1.27%-7%
6.3 Fire Extinguishing Agents: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires.
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.
6.7 Ignition Temperature: 997°F
6.8 Electrical Hazard: Class I, Group D
6.9 Burning Rate: 5.7 mm/min.
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 32

8. WATER POLLUTION

8.1 Aquatic Toxicity: 1180 mg/l/96 hr/sunfish/TL_m/fresh water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0%, 5 days; 38% (theor), 8 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research, reagent, nitration-all 99.8 + %; industrial: contains 94 + %, with 5% xylene and small amounts of benzene and nonaromatic hydrocarbons; 90/120: less pure than industrial.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 NFPA Hazard Classification:

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 92.14
12.3 Boiling Point at 1 atm: 231.1°F = 110.6°C = 383.8°K
12.4 Freezing Point: —139°F = —95.0°C = 178.2°K
12.5 Critical Temperature: 605.4°F = 318.6°C = 591.8°K
12.6 Critical Pressure: 596.1 psia = 40.55 atm = 4.108 MN/m^2
12.7 Specific Gravity: 0.867 at 20°C (liquid)
12.8 Liquid Surface Tension: 29.0 dynes/cm = 0.0290 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 36.1 dynes/cm = 0.0361 N/m at 25°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): 1.089
12.12 Latent Heat of Vaporization: 155 Btu/lb = 86.1 cal/g = 3.61×10^5 J/kg
12.13 Heat of Combustion: —17,430 Btu/lb = —9686 cal/g = —405.5 $\times 10^5$ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 17.17 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 1.1 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

m-XYLENE

XLM

Common Synonyms	Watery liquid	Colorless	Sweet odor
1,3-Dimethylbenzene Xylol	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose, and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Aromatic Hydrocarbon
3.2 **Formula:** m-$C_6H_4(CH_3)_2$
3.3 **IMO/UN Designation:** 3.2/1307
3.4 **DOT ID No.:** 1307
3.5 **CAS Registry No.:** 108-38-3

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Like benzene; characteristic aromatic

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 **Symptoms Following Exposure:** Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma; can be fatal. Kidney and liver damage can occur.
5.3 **Treatment of Exposure:** INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 **Threshold Limit Value:** 100 ppm
5.5 **Short Term Inhalation Limits:** 300 ppm for 30 min.
5.6 **Toxicity by Ingestion:** Grade 3; LD_{50} = 50 to 500 g/kg
5.7 **Late Toxicity:** Kidney and liver damage.
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 0.05 ppm
5.11 **IDLH Value:** 10,000 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** 84°F C.C.
6.2 **Flammable Limits in Air:** 1.1%-6.4%
6.3 **Fire Extinguishing Agents:** Foam, dry chemical, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective.
6.5 **Special Hazards of Combustion Products:** Not pertinent
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 **Ignition Temperature:** 986°F
6.8 **Electrical Hazard:** Class I, Group D
6.9 **Burning Rate:** 5.8 mm/min.
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data not available
7.8 **Reactivity Group:** 32

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 22 ppm/96 hr/bluegill/TL_m/fresh water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 0 lb/lb, 5 days; 0% (theor.), 8 days
8.4 **Food Chain Concentration Potential:** Data not available

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Research: 99.99%; Pure: 99.9%; Technical: 99.2%
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Flammable liquid
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 106.16
12.3 **Boiling Point at 1 atm:** 269.4°F = 131.9°C = 405.1°K
12.4 **Freezing Point:** —54.2°F = —47.9°C = 225.3°K
12.5 **Critical Temperature:** 650.8°F = 343.8°C = 617.0°K
12.6 **Critical Pressure:** 513.8 atm = 34.95 psia = 3.540 MN/m²
12.7 **Specific Gravity:** 0.864 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 28.6 dynes/cm = 0.0286 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 36.4 dynes/cm = 0.0364 N/m at 30°C
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.071
12.12 **Latent Heat of Vaporization:** 147 Btu/lb = 81.9 cal/g = 3.43 X 10^5 J/kg
12.13 **Heat of Combustion:** —17,554 Btu/lb = —9752.4 cal/g = —408.31 X 10^5 J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** 26.01 cal/g
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** 0.34 psia

NOTES

o-XYLENE

XLO

Common Synonyms	Watery liquid	Colorless	Sweet odor
1,2-Dimethylbenzene Xylol	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Aromatic Hydrocarbon
3.2 **Formula:** $o\text{-}C_6H_4(CH_3)_2$
3.3 **IMO/UN Designation:** 3.2/1307
3.4 **DOT ID No.:** 1307
3.5 **CAS Registry No.:** 95-47-6

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Benzene-like; characteristic aromatic

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 **Symptoms Following Exposure:** Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma. Can be fatal. Kidney and liver damage can occur.
5.3 **Treatment of Exposure:** INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 **Threshold Limit Value:** 100 ppm
5.5 **Short Term Inhalation Limits:** 300 ppm for 30 min.
5.6 **Toxicity by Ingestion:** Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 **Late Toxicity:** Kidney and liver damage.
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 0.05 ppm
5.11 **IDLH Value:** 10,000 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** 63°F C.C.; 75°F O.C.
6.2 **Flammable Limits in Air:** 1.1%-7.0%
6.3 **Fire Extinguishing Agents:** Foam, dry chemical, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective.
6.5 **Special Hazards of Combustion Products:** Not pertinent
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 **Ignition Temperature:** 869°F
6.8 **Electrical Hazard:** Class I, Group D
6.9 **Burning Rate:** 5.8 mm/min.
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data not available
7.8 **Reactivity Group:** 32

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** >100 mg/l/96 hr/D. magna/TL_m/fresh water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 0 lb/lb, 5 days; 2.5% (theor.), 8 days
8.4 **Food Chain Concentration Potential:** Data not available

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Research: 99.99%; Pure: 99.7%; Commercial: 95+%
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No reaction
9.4 **Venting:** Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

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11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Flammable liquid
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 106.16
12.3 **Boiling Point at 1 atm:** 291.9°F = 144.4°C = 417.6°K
12.4 **Freezing Point:** −13.3°F = −25.2°C = 248.0°K
12.5 **Critical Temperature:** 674.8°F = 357.1°C = 630.3°K
12.6 **Critical Pressure:** 541.5 atm = 36.84 psia = 3.732 MN/m^2
12.7 **Specific Gravity:** 0.880 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 30.53 dynes/cm = 0.03053 N/m at 15.5°C
12.9 **Liquid Water Interfacial Tension:** 36.06 dynes/cm = 0.03606 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.068
12.12 **Latent Heat of Vaporization:** 149 Btu/lb = 82.9 cal/g = 3.47×10^5 J/kg
12.13 **Heat of Combustion:** −17,558 Btu/lb = −9754.7 cal/g = -408.41×10^3 J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** 30.64 cal/g
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** 0.26 psia

NOTES

p-XYLENE

XLP

Common Synonyms
1, 4-Dimethylbenzene
Xylol

Watery liquid | Colorless | Sweet odor

Floats on water. Flammable, irritating vapor is produced.
Freezing point is 56°F.

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Should be removed
Chemical and physical treatment

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Aromatic Hydrocarbon
3.2 **Formula:** $p\text{-}C_6H_4(CH_3)_2$
3.3 **IMO/UN Designation:** 3.2/1307
3.4 **DOT ID No.:** 1307
3.5 **CAS Registry No.:** 106-42-3

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Like benzene; characteristic aromatic

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Approved canister or air-supplied mask; goggles or face shield; plastic gloves and boots.
5.2 **Symptoms Following Exposure:** Vapors cause headache and dizziness. Liquid irritates eyes and skin. If taken into lungs, causes severe coughing, distress, and rapidly developing pulmonary edema. If ingested, causes nausea, vomiting, cramps, headache, and coma. Can be fatal. Kidney and liver damage can occur.
5.3 **Treatment of Exposure:** INHALATION: remove to fresh air; administer artificial respiration and oxygen if required; call a doctor. INGESTION: do NOT induce vomiting; call a doctor. EYES: flush with water for at least 15 min. SKIN: wipe off, wash with soap and water.
5.4 **Threshold Limit Value:** 100 ppm
5.5 **Short Term Inhalation Limits:** 300 ppm for 30 min.
5.6 **Toxicity by Ingestion:** Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 **Late Toxicity:** Kidney and liver damage.
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 0.05 ppm
5.11 **IDLH Value:** 10,000 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** 81°F C.C.
6.2 **Flammable Limits in Air:** 1.1%-6.6%
6.3 **Fire Extinguishing Agents:** Foam, dry chemical, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective.
6.5 **Special Hazards of Combustion Products:** Not pertinent
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 **Ignition Temperature:** 870°F
6.8 **Electrical Hazard:** Class I, Group D
6.9 **Burning Rate:** 5.8 mm/min.
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data not available
7.8 **Reactivity Group:** 32

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 22 ppm/96 hr/bluegill/TL_m/fresh water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 0 lb/lb in 5 days
8.4 **Food Chain Concentration Potential:** Data not available

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Research: 99.99%; Pure: 99.8%; Technical: 99.0%
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Flammable liquid
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

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

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** 106.16
12.3 **Boiling Point at 1 atm:** 280.9°F = 138.3°C = 411.5°K
12.4 **Freezing Point:** 55.9°F = 13.3°C = 286.5°K
12.5 **Critical Temperature:** 649.4°F = 343.0°C = 616.2°K
12.6 **Critical Pressure:** 509.4 atm = 34.65 psia = 3.510 MN/m^2
12.7 **Specific Gravity:** 0.861 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 28.3 dynes/cm = 0.0283 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 37.8 dynes/cm = 0.0378 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** 1.071
12.12 **Latent Heat of Vaporization:** 150 Btu/lb = 81 cal/g = 3.4×10^5 J/kg
12.13 **Heat of Combustion:** −17,559 Btu/lb = −9754.7 cal/g = -408.41×10^5 J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** 37.83 cal/g
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** 0.34 psia

NOTES

XYLENOL

XYL

Common Synonyms	Solid or liquid	Light yellowish brown	Sweet tarry odor
Dimethylphenol 2, 6-Xylenol Cresylic acid 2-Hydroxy-m-xylene	May float or sink in water.		

Stop discharge if possible. Keep people away.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
POISONOUS GASES ARE PRODUCED IN FIRE.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemicals, foam or carbon dioxide.
Water may be ineffective on fire.

Exposure

CALL FOR MEDICAL AID.

DUST
Irritating to eyes, nose and throat.
Harmful if inhaled.
Move victim to fresh air.
If in eyes, hold eyelids open and flush with plenty of water.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID OR SOLID
Irritating to skin and eyes.
If swallowed or skin is exposed will cause nausea and vomiting.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-water contaminant
Restrict access
Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: 2, 6-$(CH_3)_2C_6H_3OH$
3.3 IMO/UN Designation: Not listed
3.4 DOT ID No.: 2261
3.5 CAS Registry No.: 1300-71-6

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid or liquid
4.2 Color: Light yellow-brown
4.3 Odor: Sweet tarry

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Organic canister mask; goggles or face shield; rubber gloves; other protective clothing to prevent contact with skin.

5.2 Symptoms Following Exposure: Vapor irritates eyes, nose, and throat and is readily absorbed through mucous membranes and lungs, producing general toxic symptoms (weakness, dizziness, headache, difficult breathing, twitching). Contact with skin causes temporary prickling and intense burning, then local anesthesia. Affected areas initially show white discoloration, wrinkling, and softening, then become red, then brown or black (signs of gangrene). Extensive burns may permit absorption of chemical to produce toxic symptoms described above. Ingestion causes irritation of mouth and stomach, nausea, abdominal pain, weakness, dizziness, headache, difficult breathing, and twitching.

5.3 Treatment of Exposure: Get medical attention at once following exposure to this compound. INHALATION: remove patient immediately to fresh air, irritation of nose or throat may be somewhat relieved by spraying or gargling with water until all odor is gone; 100% oxygen inhalation is indicated for cyanosis or respiratory distress; keep patient warm, but not hot. EYES: flood with running water for 15 min.; if physician is not immediately available, continue irrigation for another 15 min.; 2-3 drops of 0.5% pontocaine or equivalent may be instilled after first 15 min.; do not use oils or oily ointments unless ordered by physician. SKIN: wash affected areas with large quantities of water or soapy water until all odor is gone; then wash with alcohol or 20% glycerin solution and more water; keep patient warm, but not hot; cover chemical burns continously with compresses wet with saturated solution of sodium thiosulfate; apply no salves or ointments for 24 hrs after injury. INGESTION: give large quantities of liquid (salt water, weak sodium bicarbonate solution, milk, or gruel) followed by demulcent such as raw egg white or corn starch paste; if profuse vomiting does not follow immediately, give a mild emetic (such as 1 tbsp. mustard in glass of water), or tickle back of throat. Repeat procedure until vomitus is free of the odor. Some demulcent should be left in stomach after vomiting. Keep patient comfortably warm.

5.4 Threshold Limit Value: 45 ppm

5.5 Short Term Inhalation Limits: Data not available

(Continued)

6. FIRE HAZARDS

6.1 Flash Point: 186°F C.C.
6.2 Flammable Limits in Air: 1.4% (LFL)
6.3 Fire Extinguishing Agents: Water, dry chemical, foam, carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic vapors of unburned material may form in fire.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 1110°F
6.8 Electrical Hazard: Data not available
6.9 Burning Rate: Data not available
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity: (2, 6 isomer) 7-9 ppm/*/trout/lethal/fresh water
*Time period not specified.
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 31% of theoretical in 5 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: 99% 2, 6-Xylenol. Other commercial Xylenols include 2, 3-; 2, 4-; 2, 5-; 3, 4-; 3, 5-; and various mixtures of these. Properties are similar to those of the 2, 6- compound.
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-X-Y

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: ORM-A
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification: Not listed

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid or liquid
12.2 Molecular Weight: 122.2
12.3 Boiling Point at 1 atm: 413°F = 212°C = 485°K
12.4 Freezing Point: —40 to +106°F = —40 to +45°C = 233 to 318°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.01 at 20°C (liquid)
12.8 Liquid Surface Tension: (est.) 30 dynes/cm = 0.030 N/m at 30°C
12.9 Liquid Water Interfacial Tension: (est.) 25 dynes/cm = 0.025 N/m at 25°C
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: 212.74 Btu/lb = 118.19 cal/g = 4.9451×10^5 J/kg at 25°C
12.13 Heat of Combustion: —15,310 Btu/lb = —8,500 cal/g = -356×10^5 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

5. HEALTH HAZARDS (Continued)

5.6 Toxicity by Ingestion: Grade 2; oral LD_{50} = 1,070 mg/kg (mouse)
5.7 Late Toxicity: Damage to heart muscle, and changes in liver, kidney, and spleen in rats
5.8 Vapor (Gas) Irritant Characteristics: Data not available
5.9 Liquid or Solid Irritant Characteristics: Data not available
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

Lead (Pb)

Physical and Chemical Description: Pb, soft, ductile, gray metal, insoluble in water but dissolves slowly in water containing a weak acid. Because lead is an element, it will remain indefinitely if released to the environment.

Uses: Lead is used in electroplating, radiation protection devices, plastics, electronic equipment, storage batteries, gasoline anti-knock additives, and pigments.

Toxicity in Water: The hazards of human exposure to lead are well known. Symptoms of lead poisoning include fatigue, anemia, abdominal pains, constipation, and neurological damage. The Florida Primary Drinking Water Standard (FAC 17-22) for lead is 50 ug/l.

The toxic effects of lead on aquatic organisms is strongly dependent on the water hardness. To protect freshwater aquatic life at hardnesses of 50, 100, and 200 mg/l as $CaCO_3$, the concentrations of lead should not exceed 0.75, 3.8, and 20 ug/l, respectively. To protect saltwater life, lead should not exceed 25 ug/l.

Classification: Hazardous Substance (EPA)
Hazardous Waste Constituent (EPA)
Priority Toxic Pollutant (EPA)

Diesel Oil (fuel oil #2)

Physical and chemical description: Flammable, slightly viscous brown liquid obtained from the distillation of crude petroleum. Diesel oil is a mixture of hydrocarbons, predominately unbranched alkanes of 10 to 16 carbon atoms with smaller amounts of aromatic and polynuclear aromatic hydrocarbons (PAHs). Diesel oil floats on water, having a specific gravity of less than 1.

Uses: Because of their water solubility and carcinogenicity, benzene and PAHs are the chemicals of health concern in diesel oil. Benzene, found in trace amounts in diesel oil, is known to cause leukemia, a cancer of the blood forming cells. PAHs as a class (1-10% in diesel) are considered to be carcinogenic to a number of animal species. Benzo(1)pyrene is one of the most commonly found and carcinogenic PAH. The alkanes of 10 to 16 carbon atoms, which make up the bulk of diesel oil, are of less concern due to their very low water solubility and low toxicity.

Concentration Guidelines and Standards: The maximum tolerable concentration for diesel oil in drinking water is 100 ug/l, due to organoleptic (taste and smell) considerations. The EPA Office of Drinking Water recommends that the short term concentrations of PAHs in drinking water not exceed 25 ug/l. This is the 7-day suggested no adverse response level (SNARL) and does consider the long term cancer risk. These concentrations should be tolerated only in emergency situations where no other higher quality water source is available.

The World Health Organization has established an international standard for PAHs in drinking water of less than 0.2 ug/l. This recommendation is based upon the

composite analysis of six PAHs in drinking water: fluoranthene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)-pyrene. The selection of these six PAH was not made on the basis of health effects, but were selected as useful indicators of PAH pollution. The EPA estimated carcinogenic risk of 10^{-5} for a lifetime consumption of water with a concentration or total carcinogenic PAHs of 0.028 ug/l is not applicable in this study.

Naphthalene ($C_{10}H_8$)

Physical and Chemical Description: white crystalline solid with a characteristic "moth ball" odor. Naphthalene is more dense than water (specific gravity 1.145) and has a solubility of 30,000 to 40,000 ug/l at 25 °C. It melts at 80 °C but will sublime (volatilize from a solid) at room temperature. Naphthalene is considered a PAH.

Uses: intermediate in dye production and formation of solvents, lubricants, and motor fuels. Used directly as a moth repellant.

Toxicity: Napthalene may be absorbed by inhalation, ingestion, or skin or eye contact. Chronic exposure can cause cataracts, kidney disease, and red blood cell breakdown, especially in infants and individuals deficient in the enzyme G6PD. Naphthalene has been shown to be nonmutagenic and noncarcinogenic.

Classification: Hazardous Substance (EPA)
Hazardous Waste (EPA)
Priority Toxic Pollutant (EPA)

Persistence: Naphthalene can oxidize in the presence of light and air; 50% after 14 days in one study. Microbial degradation has also been demonstrated in the laboratory in solutions as concentrated as 3.3 ug/l. Little breakdown is expected, however, under the dark, anaerobic conditions characteristic of in-situ groundwater.

Phenanthrene ($C_{14}H_{10}$)

Physical and Chemical Description: colorless, monoclinic crystals soluble in water, 1,000 to 1,300 ug/l at 2.5 °C, specific gravity = 1.179. Phenanthrene is a PAH.

Uses: dyes, explosives, a natural constituent of coal tar and of diesel oil (0.35%).

Toxicity: Phenanthrene has been identified as a mild allergen and human dermal photosensitizer. Limited acute and chronic animal experiments show it to be of low to moderate toxicity.

Classification: none

Fluorene ($C_{13}H_{10}$)

Physical and Chemical Description: Combustible white solid having a density of 1.20 and a water solubility of 1,980 ug/l.

Uses: Manufacture of dyestuffs.

Toxicity: Little specific information is available about the toxicity of fluorene but it is a PAH, a group that contains known human carcinogens.

Classification: None

13. HEAT STRESS CASUALTY PREVENTION PLAN

Due to the increase in ambient air temperatures and the effects of protective outer wear decreasing body ventilation, there exists an increase in the potential for injury, specifically, heat casualties. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim, and the prevention of heat stress casualties.

13.1 IDENTIFICATION AND TREATMENT.

13.1.1 Heat Exhaustion.

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

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

13.1.2 Heat Stroke.

Symptoms: This is the most serious of heat casualties because the body excessively overheats. Body temperatures often are between 107 °F and 110 °F. The victim will have a red face and will not be sweating. First there is often pain in the head, dizziness, nausea, oppression, and a dryness of the skin and mouth. Unconsciousness follows quickly and death is imminent if exposure continues. The attack will usually occur suddenly. Heat stroke is always serious.

First Aid: Immediately evacuate the victim to a cool and shady area in the Decontamination Reduction Zone. Remove all protective outer wear and all personal clothing. Lay the victim on his back with the head and shoulders slightly elevated. It is imperative that the body temperature be lowered immediately. This can be accomplished by applying cold wet towels, ice bags, etc., to the head and groin. Sponge off the bare skin with cool water or rubbing alcohol, if available, or even place in a tub of cool water. The main objective is to cool without chilling. Give no stimulants. Transport the victim to a medical facility as soon as possible.

13.2 PREVENTION OF HEAT STRESS. One of the major causes of heat casualties is the depletion of body fluids. Fluids should be maintained in the support zone. Personnel should replace water and salts lost from sweating. Salts can be replaced by either a 0.1% salt solution, more heavily salted foods, or commercial

mixes such as Gatorade. The commercial mixes are advised for personnel on low sodium diets.

A work schedule will be established during warm weather so that the majority of the work day will be during the morning hours of the day before ambient air temperature levels reach their highs.

A work/rest schedule will be implemented for personnel required to wear Level B or C protection (i.e. impervious outer garment). A sufficient period will be allowed for personnel to "cool down." This may require shifts of workers during operations in addition to the breaks provided by required air tank changes (Level B). Maximum time between breaks at Level B or C shall be two hours regardless of temperature. At elevated temperatures, breaks should be scheduled as described below.

Ambient Temperatures	Maximum Time Between Cooldown Breaks
Above 90 °F	¼ hr.
85°-90 °F	½ hr.
80°-85 °F	1 hr
70°-80 °F	1½ hr.

Periodic breaks for "cooldown" and liquid replenishment should also be scheduled while wearing any chemical resistant outer wear.

13.3 HEAT STRESS MONITORING. For monitoring the body's recuperative ability to excess heat, one or more of the following techniques should be used as a screening mechanism. Monitoring of personnel wearing impervious clothing should commence when the ambient temperature is 70 °F or above. Frequency of monitoring should increase as the ambient temperature increases or as slow recovery rates are indicated. When temperatures exceed 85 °F, workers should be monitored for heat stress after every work period. The following are important considerations.

Heart rate (HR) should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats/minute. If the HR is higher, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. If the pulse rate is 100 beats/minute at the beginning of the next rest period, the following work cycle should be shortened by 33 percent.

Body temperature should be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature (OT) at the beginning of the rest period should not exceed 99 °F. If it does, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. However, if the OT exceeds 99.7 °F at the beginning of the next period, the following work cycle should be further shortened by 33 percent. OT should be measured again at the end of the rest period to make sure that it has dropped below 99 °F.

Good hygienic standards must be maintained by frequent change of clothing and daily showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

14. MISCELLANEOUS REPORTS

14.1 SITE SAFETY FOLLOW-UP REPORT. To be completed for each field change in plan.

Was the HASP followed as presented? ___yes ___no

Describe in detail any changes to the HASP:

Reason for changes:

Approved by

Site Manager: _____ Date: _____

Site Safety Officer: _____ Date: _____

Evaluation of Health and Safety Plan

Was the HASP adequate? ___ yes ___ no

What changes would you recommend?

14.2 ACCIDENT REPORT.

Site: _____ Project No.: _____

Location: _____

Location of accident (if different from above): _____

_____

Name and address of injured: _____

_____

SSN: _____ DOB: _____ Sex: _____

Years of service: _____ Time on present job: _____ Department No.: _____

Title/Classification: _____

Date of accident: _____ Time of accident: _____

Name of witness: _____ Telephone No.: _____

Accident Category: __ Motor Vehicle __ Property Damage __ Fire
__ Chemical Exposure __ Near Miss __ Other

Severity of Injury or Illness: __ Non-disabling __ Disabling
__ Medical Treatment __ Fatality

Amount of Damage: $_____ Property Damaged: _____

Classification of Injury

__ Fractures
__ Dislocations
__ Sprains
__ Abrasions
__ Lacerations
__ Punctures
__ Bites
__ Respiratory Allergy
__ Other (explain) _____

__ Heat Burns
__ Chemical Burns
__ Radiation Burns
__ Concussion
__ Toxic-Respiratory
__ Toxic-Ingestion
__ Toxic Dermal

__ Cold Exposure
__ Heat Stroke
__ Faint/Dizziness
__ Blisters
__ Bruises
__ Poison Ivy
__ Headache

Parts of Body Affected: _____

Degree of Disability: _____

Date Medical Care was Received: _____ Emergency Service? _____

Name and Address of Medical Facility: _____

_____

Follow-up Exam Required? _____ Estimated No. of Days Away From Job: _____

Accident location (use the back of sheet as required)

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

Was weather a factor? How?

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

Unsafe act by injured and/or others contributing to the accident (be specific, must be answered):

Personal factors (improper attitude, lack of knowledge or skill, slow reaction, fatigue, inattention, horseplay):

Modifications

Level of personal protective equipment required in site safety plan: _____
Was injured using required equipment? _____
If not, how did actual equipment use differ from plan?

Was personal protective equipment required in site safety plan adequate for site conditions? _____

If no, what additional equipment was needed:

What can be done to prevent a reoccurrence of this type of accident? (modification of machine, mechanical guards, modification of work practices, training):

Detailed Narrative Description (how did accident occur, why; objects, equipment, tools used, circumstance, assigned duties. Be specific.):

Signature of Preparer: _____ Date: _____

Signature of Site Manager: _____ Date: _____

SEND COPIES OF COMPLETED FORM TO HUMAN RESOURCES
AND THE HEALTH AND SAFETY SUPERVISOR.

APPENDIX A

E.C. JORDAN HEALTH AND SAFETY PROGRAM

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APPENDIX A LIST OF FIGURES

1.0 INTRODUCTION

The E.C. Jordan Co. (Jordan) began a formal program of site risk assessment and implementation of mitigative health and safety programs in March 1981. At that time, existing departmental policies/practices were collected and reviewed, additional needs identified, and a corporate personnel health and safety plan drafted.

Currently, Jordan's Health and Safety Supervisor (HSS), with the aid of the 10-member Personnel Health and Safety Committee (PHSC), regularly reviews health and safety issues, updates practices as new information becomes available, oversees administration of the Health Monitoring Program, and provides guidance for personnel training as appropriate. The PHSC is a corporate entity, effectively precluding any departmental and contract pressures on health and safety policy decisions.

Each project site is classified hazardous or non-hazardous by the HSS after a review of available data. Prior to on-site activities at those sites classified as hazardous, a health and safety plan must be completed by the project engineer/scientist. This is accomplished by a review of available information on the site to assess the potential risks and provide an initial determination of personal protection requirements. The health and safety plan is subsequently reviewed and must be approved by the HSS. The designated Site Health and Safety Officer (HSO) monitors actual site conditions and may alter these requirements as needed. In all cases, personnel safety is the paramount factor in decision-making.

2.0 HEALTH MONITORING AND SAFETY PROGRAM

To protect the health and safety of employees assigned to work at hazardous waste sites, Jordan has developed and implemented a Health and Safety Program. This program is administered by the Health and Safety Supervisor with aid from a committee consisting of representatives of Jordan technical department staffs with support from medical advisors. All personnel on-site must be enrolled in the Health Monitoring Program and must receive training appropriate for their assigned function.

In addition to Jordan employees, subcontractors and consultants working on hazardous waste sites will be enrolled in an equivalent Health Monitoring Program and receive health and safety indoctrination prior to commencing work on the site. Indoctrination, training, and periodic followup is conducted as appropriate. Indoctrination and training include:

- site history,
- inventory of site chemicals known or suspected (will be updated and reviewed at each stage of the field investigation program),
- project organization,
- work plan review,
- project documentation,
- review of site safety plan (site safety plans are updated as new information becomes available),
- review of decontamination procedures,
- proper use and care of personal protective equipment,
- proper calibration and use of monitoring equipment,
- emergency response procedures,
- accident reporting procedures, and
- contingency plans.

The site-specific information required to address the areas noted above is presented in summary safety plans prepared for each site. The plans are intended to provide a framework within which information may be updated and ongoing decisions made regarding actual health and safety concerns at the site.

3. MEDICAL SURVEILLANCE PROCEDURES

3.1 HEALTH MONITORING PROGRAM. All onsite Jordan personnel and laboratory staff must be enrolled in the Health Monitoring Program, which is implemented through Environmental Medicine Resources, Inc, Atlanta, Georgia. Environmental Medicine Resources consists of a team of physicians and support personnel specializing in toxicology. This program consists of an initial medical examination to establish the employee's general health profile and provide important baseline laboratory data for later comparative study. The contents of the initial comprehensive physical examination and laboratory testing routine is given in Table 3-1. Follow-up examinations are completed for all personnel enrolled in the Health Monitoring Program on an annual basis, or more frequently if project assignments warrant testing following specific field activities. Followup examinations are tailored to the exposures recorded by the individual.

Table A3-1. Baseline Health Monitoring Program

Health Monitoring and Safety Training Plan
Appendix A
Naval Air Station Cecil Field
Jacksonville, Florida

Physical examination	Laboratory analysis
Medical history	Complete Blood counts and chemistries
Medical examination	
Vision:	white blood count
near/distant	differential cell counts
color	methemoglobin
Audiometry	uric acid
Radiology: PA/LAT	lactic dehydrogenase (LDH)
Spirometry	alkaline phosphatase
Electrocardiogram	calcium
	phosphorous
	cholesterol
	urea nitrogen (BUN)
	glucose
	albumin
	gobulin
	total protein
	total bilirubin
	serum glutamic oxalacetic transaminase (SGOT)
	hemoglobin and/or hematocrit
	Urinalysis
	color and character
	specific gravity
	pH
	protein
	acetone
	glucose
	microscopic examination

Special medical monitoring may be identified for certain sites.

3.2 REVIEW OF EXPOSURE SYMPTOMS. Symptoms of exposure to hazardous materials will be reviewed for each site to indicate to personnel the recognized signs of possible exposure to those materials. This information will be supplemented with a discussion of the need for objectivity in the personal health assessment to account for normal reaction to stressful situations. The HSO will be watchful for outward evidences of changes in worker health. These outward symptoms may include skin irritations, skin discoloration, eye irritation, muscular soreness, fatigue, nervousness or irritability, intolerance to heat or cold, or loss of appetite. Employees will routinely be asked to assess their general state of health during the project.

4.0 TRAINING

All personnel working on a Jordan site, who may potentially be exposed to toxic substances or hazardous materials, will have participated in an initial and annual refresher and/or supervisory training, as appropriate, as well as site specific training prior to the commencement of their on-site assignment. The initial Health and Safety Training Program consists of the 40 hour training required and designated by the OSHA standard 29 CFR 1910.120. In addition to the initial training, Jordan also employs 8 hour annual refresher and supervisory training elements. This general personnel training is augmented by site specific training regarding site hazards and specialized problems and protocols.

4.1 INITIAL TRAINING. All site assigned personnel who are potentially exposed to toxic substances or hazardous materials will be required to participate in a training course on hazardous waste site operations. This training is required under provisions of the OSHA standard and must consist of 40 hours covering the following subjects:

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

4.2 ANNUAL REFRESHER/SUPERVISORY TRAINING. On an annual basis, all personnel required to have participated in the initial training will be provided an 8 hour refresher training course. Those personnel with either site supervisory or health and safety responsibilities will also have 8 additional hours of training beyond the initial 40 hours. The eight (8) hour supervisory training meets the requirements of the annual refresher.

4.3 SITE SPECIFIC TRAINING. All personnel assigned to an E.C. Jordan site must participate in the site specific training presentation. The site specific training will cover the major elements of the site Health and Safety Plan (HASP)

as well as the health and safety procedures regarding an individual's specific job responsibilities and tasks. The site HSO or Health and Safety (H&S) designee shall provide this training before an individual is permitted to work in a downrange position on any site.

4.4 OTHER TRAINING. Additional training shall be provided as determined by the Health and Safety Manager (HSM) or the Health and Safety Supervisor (HSS). Such training may include additional refreshers on personal protective equipment, instrumentation, CPR, First Aid, or any other pertinent health or safety related subject.

5.0 PERSONAL PROTECTION LEVEL DETERMINATION

The level of personal protective equipment required shall be determined by the type and levels of waste or spill material present at the site where project personnel may be exposed. In situations where the types of waste or spill material on-site are unknown, the hazards are not clearly established, or the situation changes during on-site activities, the HSO must make a reasonable determination of the level of protection that will assure the safety of investigators and response personnel until the potential hazards have been determined through monitoring, sampling, information assessment, laboratory analyses, or other reliable methods. Once the hazards have been determined, protective levels commensurate with the hazards will be used. Protection requirements will be evaluated on a continuous basis to reflect new information as it is acquired.

Preparation of site-specific plans will be based on the site-specific information made available through site files, remedial action master plan (RAMP) and Field Investigation Team (FIT) reports, as well as any other sources identified.

The levels of protection utilized by E.C. Jordan Co. are presented below.

Level A. Level A protection must be selected when the HSO makes a reasonable determination that the highest available level of respiratory, skin, and eye protection is needed. It should be noted that while Level A provides maximum available protection, it does not protect against all possible hazards. Consideration of the heat stress that can arise from wearing Level A protection should also enter into the subtask leaders decision. (Comfort is not a decision factor, but heat stress will influence work rate, scheduling, and other work practices.)

Level B. The HSO must select Level B protection when the highest level of respiratory protection is needed, but hazardous material exposure to the few unprotected areas of the body (e.g., the back of the neck) is unlikely.

Level C. The HSO may select Level C when the required level of respiratory protection is known, or reasonably assumed to be, not greater than the level of protection afforded by full face air purifying respirators; and hazardous materials exposure to the few unprotected areas of the body (e.g., the back of the neck) is unlikely. Level C requires carrying an emergency escape respirator.

Level D. Level D is the basic work uniform, selected when site hazards are judged to be minimal. Investigators and response personnel, however, must not be permitted to work in civilian clothes. Level D often requires carrying an escape respirator.

Fit testing of safety equipment is an important part of establishing adequate respiratory protection (see also Appendix B). Fit testing is accomplished prior to site explorations and each individual is assigned a fitted respirator for the duration of the project. These are tagged for identification. The equipment used for each level of protection is shown in Table 5.1.

Table A5-1
Protective Gear

Health Monitoring and Safety Training Plan
Appendix A
Naval Air Station Cecil Field
Jacksonville, Florida

	Protection level			
	Level D	Level C	Level B	Level A
Action level[1]	0	0 to 5	5 to 500	500 to 1,000
Respirator type[2]	Escape	Full Face and Escape	SCBA[3]	SCBA[3]
Clothing				
Boots	X	X	X	X
Safety glasses or equivalent	X	X	X	
Hard hat	X	X	X	
Gloves, inner and outer	X	X	X	X
Booties		X	X	X
Coveralls	X	X	X	
Chemical protective coveralls		X	X	
Totally encapsulated suit				X

[1]Action levels are defined as air quality degradation from background levels, in ppm, by volatile contaminants as measured by a photoionization meter calibrated in the clean (support) zone. The action required is review of contaminants and reassessment of appropriate protective gear by the Site Health and Safety Officer. It must be recognized that a photoionization meter's relative response varies with each compound. Action levels should be reviewed (when constituents are known) to determine appropriate modifications.

[2]Use of an air purifying respirator is allowed only where identification of constituents has occurred and appropriate respirator cartridges have been obtained. (Refer to Appendix B, Figure 1.)

[3]SCBA = Self contained breathing apparatus.

It should be recognized that situations exist where different combinations of respiratory and dermal protective gear are appropriate, e.g., where splash protection is required but no respiratory hazard exists. The HSO may elect a modification of the above specified combinations.

5.1 POTENTIAL HAZARDS ONSITE. Table 5-2 includes a typical data summary concerning the toxicity of chemicals that may be found in soil and water on-site. A similar table will be included in the summary site safety plan if appropriate.

A review of physical hazards must also be performed.

CHEMICAL TOXICITY AND OTHER INFORMATION

Chemical	TLV (ppm)	ACC or STEL (ppm)	Physical State	Skin Penetration	Dermal Toxicity	Potency	LD_{50} (mg/kg) oral (rat)	Remarks
Phenols carbolic acid monohydroxybenzene	5 skin	10	Colorless to brown-black; solid or thick liquid				414 344(mice)	Absorption from spilling phenolic solution on skin may be very rapid. Death has resulted due to absorption of phenol through skin. Symptoms: irritates eyes, nose, throat. May cause anorexia. Contact: Skin burn, tremor, convulsion Target Organ: liver, kidneys, skin, pancreas First Aid. Swallow: water, vomit. Skin: soap wash. Incompatibilities: Strong oxidizers; calcium hypochlorite Toxicity[1]: 3; Persistence[2]: 1
Acetone [CH_3COCH_3] Dimethyl ketone ketone propane	750	1000	liquid; mint-like odor	+++	local	++	9750 1297(mice)	Symptoms: irritates eyes, nose, throat; narcot: in high concentrations Target Organ: respiratory system, skin First Aid: Swallow: water, vomit Skin: soap wash Incompatibilities: oxidizing materials, acids. Fire hazard when exposed to heat or flame. Toxicity[1]: 1; Persistence[2]: 0
Chloroform* [$CHCl_3$] trichloromethane	10	50	colorless liquid sweet odor				800 LC_{LO}(mice) = 28 ppm	Causes irritation of the conjunctiva, dilation the pupils and reduces reaction to light. Prolonged inhalation will bring on paralysis accompanied by cardiac failure. Symptoms: dizziness, mental dullness, nausea, headache, fatigue, eye and skin irritant Target organs: liver, kidneys, heart First Aid: Swallow: Ipecac, vomit Skin: soap wash Incompatibilties: strong caustics; chemically active metals: Al, Mg-powder, Na, K Toxicity[1]: 2, Persistence[2]: 3

TABLE 5-2
CHEMICAL TOXICITY AND OTHER INFORMATION
(continued)

Chemical	TLV (ppm)	ACC or STEL (ppm)	Physical State	Skin Penetration	Dermal Toxicity	Potency	LD_{50} (mg/kg) oral (rat)	Remarks
Benzene* $[C_6H_6]$ benzol	1	25	colorless liquid with aromatic odor	++	local systematic	++ +++		Poisoning occurs most commonly through inhalation; also penetrates through skin. Symptoms: irritates eyes, nose, respiratory system, giddiness, head, nausea, staggered gait; fatigue, depresssion, abdominal pain Target organ: blood, CNS, skin, bone marrow eyes, respiratory system First Aid: Swallow: NO VOMIT Skin: soap wash Incompatibilities: strong oxidizers, chlorine, bromine with iron. Dangerous when exposed to heat or flame. Toxicity[1]: 2; Persistence[2]: 1
Trichloroethylene ethylene trichloride tridene TCE	50	200	colorless liquid, sweet odor				4920 1900(dog)	Symptoms: headache, vertigo, vision distortion, tremors, somnolence, nausea, vomit, irritates eyes, cardiac arrythmias, paresthesias Target organ: respiratory system, heart, live kidneys, CNS, skin. First Aid: Swallow: Ipecac, vomit Skin: soap wash immediately Incompatibles: strong caustics; chemically active metals: Ba, Li, Na, Mg, liquid O_2, Al, O_2, KNO_3, Ti Persistence[2]: 3

CHEMICAL TOXICITY AND OTHER INFORMATION
(continued)

Chemical	TLV (ppm)	ACC or STEL (ppm)	Physical State	Skin Penetration	Dermal Toxicity	Potency	LD_{50} (mg/kg) oral (rat)	Remarks
Toluene $[C_6H_5CH_3]$ toluol phenyl methane methyl benzene	100 skin	150	liquid	+	local systematic	+ +	5000 TC_{LO} Human = 200 ppm	Symptoms: fatigue, confusion, euphoria, dizzy, headache, dialated pupils, lack of appetite, nervousness, insomnia Target organ: CNS, liver, kidneys, skin First Aid: Swallow: NO VOMIT Skin: soap wash Incompatibilities: strong oxidizers Toxicity[1]: 2; Persistence[2]: 1
Xylene $[C_6H_4(CH_3)_2]$ xylol 1,2-dimethyl benzene	100	150	liquid, colorless; aromatic odors		local systematic		LD_{LO} = 500 mg/kg	Symptoms: dizziness, excitement, drowsiness incoordination, staggering gait, irritates eye nose and throat, corneal vacuolization, nausea vomit, abdominal pain Target organ: CNS, eyes, GI tract, blood, liver, kidneys, skin First Aid: Swallow: NO VOMIT Skin: soap wash Incompatibilities: strong oxidizers; dangerous when exposed to heat or open flame. Toxicity[1]: 2; Persistence[2]: 1
1,1,2,2-Tetrachloroethylene ethylene tetrachloride Perchloroethylene $[CCl_2=CCl_2]$	50		colorless liquid; sweet odor				LD_{LO} (dog) = 4000 TC_{LO} Human = 230 ppm	Liquid can cause injuries to eyes, toxic by inhalation. Symptoms: 200 ppm or higher causes irritation of nose, throat, vomiting, nausea, drowsiness Target organ: liver, kidneys, eyes, upper respiratory system, CNS First Aid: Swallow: Ipecac, vomit Skin: soap wash. Incompatibilities: strong oxidizers; chemicall active metals such as: Ba, Li, Be.

BLE 5-2
CHEMICAL TOXICITY AND OTHER INFORMATION
(continued)

Chemical	TLV (ppm)	ACC or STEL (ppm)	Physical State	Skin Penetration	Dermal Toxicity	Potency	LD_{50} (mg/kg) oral (rat)	Remarks
1,2-Dichloroethane* [$ClCH_2CH_2Cl$] ethylene chloride glycol dichloride ethylene dichloride	10	15	clear liquid with sweet odor	++	local systematic	++ ++	770	High to moderate toxicity via dermal and oral routes. It has specific effects on the cornea Dermatitis in man has been observed. Symptoms: irritation of eyes, nose and throat followed by dizziness, nausea, vomitting, increasing stuper, cyanosis, rapid pulse and of consciousness. Target organ: respiratory system, liver, kidn skin, eyes. First Aid: Swallow: Ipecac, vomit.
Chlorobenzene [C_6H_5Cl] monochlorobenzene chlorobenzol	75 (350 mg/m^3)	--	colorless liquid				2910	Symptoms: irritates eyes, nose, causes drowsi incoordination, skin irritation, Target organ: respiratory system, eyes, skin, ears, liver First Aid: NO VOMIT Incompatibilities: strong oxidizers, reacts violently with $AgClO_4$ Toxicity[1]: 2; Persistence[2]: 2
Ethyl benzene [$C_2H_5C_6H_3$] phenyl ethane ethyl benzol	100	125	colorless liquid with aromatic odor	++	local systematic	++ +++	3500 TC_{LO}(Human) = 100 ppm 4 hrs.	Symptoms: irritant to eyes and mucous membran headache, narcotic Target organ: eyes, upper respiratory system First Aid: NO VOMIT Incompatibilities: oxiding materials; dangerc when exposed to heat or flame.
1,2-dichloroethylene [ClCH=CHCl] acetylene dichloride dioform	200	250	colorless liquid slightly acrid odor				770	Has produced liver and kidney injury in experi mental animals. Symptoms: irritable to eyes, respitory systen causes depression. Target organ: respiratory system, eyes, ears

LE 5-2
CHEMICAL TOXICI.. AND OTHER INFORMATION
(continued)

Chemical	TLV (ppm)	ACC or STEL (ppm)	Physical State	Skin Penetration	Dermal Toxicity	Potency	LD_{50} (mg/kg) oral(rat)	Remarks
								First Aid: Swallow: Ipecac, vomit
								Incompatibilities: strong oxidizers, dangerous when exposed to heat or flame. Reacts violen with KOH, Na, NaOH.
Methylene chloride [CH_2Cl_2] dichloromethane methylene dichloride	100	500	colorless liquid	++	local systematic	++ +++	2136 TC_{LO}(Human) -500 ppm 8 hrs.	Dangerous to eyes. It induces narcosis; can ca dermatitis with prolonged exposure, highly volatile. It can decompose by contact with h surfaces and open flame and produce toxic fum
								Symptoms: fatigue, weak, sleepy; limbs numb o tingling Target organ: skin, CVS, eyes, CNS
								First Aid: Swallow: Ipecac, vomit
								Incompatibilities: reacts violently with Li, K, terbutoxite; strong oxidizers and caustic
Mesitylene [$(CH_3)_3C_6H_3$] 1,3,5-trimethyl benzene			liquid, peculiar odor				LD_{LO}1500 TC_{LO}(Human) = 10 ppm	Causes CNS disturbances. Incompatibilities: violent with HNO_3
Dioctyl phthalate di-sec-octyl phthalate	5 mg/m³		light, colored liquid				31,000	Toxicity: low to none via oral and dermal rou produce GI symptoms.
1,1,2-Trichloroethane $CHCl_2CH_2Cl$ vinyl trichloride beta trichloroethane	10		colorless liquid, sweet odor					Toxicity: high via subcutaneous and intraveno routes; has narcotic properties; low via inhal tion, oral or dermal
								Symptoms: local irritant to eyes, nose and l Target organs: CNS, eyes, nose, liver, kidne
								First Aid: Swallow: Ipecac, vomit Skin: soap wash
								Incompatibilities: strong oxidizers and caus active metals: Al, Mg powder, Na, K.

BLE 5-2
CHEMICAL TOXI[illegible] AND OTHER INFORMATION
(continued)

Chemical	TLV mg/m³	ACC or STEL mg/m³	Physical State	Remarks
Cadmium* dust and fumes	.05	0.2	Silver/white/blue tinged metal compounds have different appearances.	Continuous exposure to cadmium may cause irreversible lung injury, abnormal lung function and kidney disease. Increased incidence of prostatic cancer, kidney and and respiratory cancer in cadmium workers has been observed. Dust or powder is flammable, toxic gases may be released in a fire. Symptoms: Inhalation: irritation of nose and throat, 0.5 to 2.5 mg/m³ exposure can cause non-fatal lung inflamation. 4 to 10 hours exposure - severe chest pain, persistent cough, and difficulty in breathing. Eye: Irritation Ingestion: A dose of 15-30 mg of metal or soluble salt may cause increased sal vation, chocking, vomiting, abdominal pain, etc. First Aid: Ingestion: Conscious person - give large amounts of water immediately and seek medical advice. Incompatabilities: Strong oxidizers, elemental sulfur, selenium, zinc, hydro-benzoic acid, ammonium nitrate.
Chromium (II) and (III) Hexavalent (VI)*	0.5 0.05		Steel gray metal or silver metal powder.	The toxicity of chromium varies with different chromium compounds. Chromic acid and chromates appear to be more toxic than chromium metal dust, insoluble chromi salts, and soluble chromic and chromous salts. Exposure to certain hexavalent chromium compounds is associated with an increased lung cancer incidence in huma Symptoms: Inhalation: Dust may cause irritation of nose, throat, respiratory passages, an lungs. Repeated or prolonged exposure to chromic acid or dust may cause ulceration and perforation of the nasal septum. Skin: Dermatitis, repeated exposure may cause an allergic skin rash. Incompatabilities: Alkalies, dil H_2SO_4 & HCl.
Copper Fume Dust & mist as copper	 0.2 1.0		Reddish Lustrous metal	Symptoms: Inhalation: Copper and Copper oxide fumes may cause metal fume fever - chills, fever, aching muscles, dry mouth and throat, headache, nausea, vomiting, diarrhea and stomach pains. Skin: May cause irritation - metal solutions can cause swelling and itchi Ingestion: May cause stomach pain, nausea, vomiting and diarrhea from ingesti of 10 mg of copper by an adult and 8.5 mg by a child. Long Term: No long term effects from inhalation or ingestion reported. Coppe fragment in cornea may cause cataracts. First Aid: Ingestion: Seek medical attention. (Pennillamine or triethylenetetramine dih chloride may be beneficial in reducing body burden.)

TABLE 5-2
CHEMICAL TOXICITY AND OTHER INFORMATION
(continued)

Chemical	TLV mg/m³	ACC or STEL mg/m³	Physical State	Remarks
				Incompatabilities: Acetylene gas, magnesium metal, oxidizing agents.
Cyanide Compounds KCN NaCN	5 (Skin)		White solids with faint almond odor	Cyanide compounds of sodium and potassium can affect the body if inhaled or in contact with eyes and skin or ingested. Sufficient cyanide may be absorbed through the skin to cause fatal poisioning. Symptoms: Low level of exposure causes weakness, headache, confusion, may cause nausea and vomiting. Irritation to nose and skin. High exposure causes rapid loss of consciousness, stop breathing and death. First Aid: Obtain medical advice immediately and follow instruction in first aid kit. A first aid kit should contain minimum of 48 ampules each of 0.3 ml amyl nitrate and complete instructions for use. Trained medical personnel should have physician's kit which includes an addition to amyl nitrate, sterile sodium nitrite solution 3% and sterile sodium thiosulfate solution (25%). Incompatibilities: In closed containers it may form toxic concentration of HCN gas. Strong oxidizers such as chlorates, nitrates, acid or acid salts Cyanide salt may react with CO_2 in air to form HCN
Hydrogen Cyanide (gas or liquid)			Colorless or pale blue liquid or gas, bitter almond odor.	Symptoms and First Aid are similar to cyanide. However, liquid or gas is very toxic and additional precautions are required. (HCN odor should be treated as poor warning. Although odor threshold of 0.1 ppm is below the permissible exposure limit the sense of smell is easily fatigued and wide individual variation in the minimum odor threshold is known.) First Aid: Same as cyanide. Incompatibilities: Bases - caustic and ammonia may cause violent polymerization and explosion. Liquid HCN will attack some forms of plastics, rubber and coatings.
Lead Lead Chloride* Lead Nitrate*	0.15	0.45	Bluish white or silvery gray solid.	Lead is a cumulative poison. Increasing amount builds up in the body and eventually a point is reached where symptoms and disability may occur. Lead dust carried home may cause symptoms in other family members. Symptoms: Long term exposure: decreased physical fitness, fatigue, sleep distrubances headache, aching bones, constipation, decreased appetite, and abdominal pain. Inhalation of large amounts of lead may lead to seizures, coma and death.

TABLE 5-2
CHEMICAL TOXICITY AND OTHER INFORMATION
(continued)

Chemical	TLV mg/m³	ACC or STEL mg/m³	Physical State	Remarks
				First Aid: Get medical attention. Ingestion: If victim is conscious, give water. Incompatibilities: Reacts violently with potassium.
Nickel and	1		Silvery White workable metal	Nickel is an insoluble metal, but most common salts are soluble.
Soluble Nickel Compounds	0.1	0.3	White or colored crystal or powder	Symptoms: (From nickel dust and salts.) Inhalation: Dust and mists can cause lung irritation, shortness of breath, coughing and wheezing. Skin: Itching, burning and sores referred to as "nickel itch". Eyes: Irritation and damage to cornea. Ingestion: Giddiness and nausea Long term exposure, in addition to symptoms listed above, impairment of sense of smell, chest pain, destruction of nasal tissues and asthmatic lung disease. Dust inhalation has been associated with an increased risk of lung and nasal cancer. First Aid: Ingestion: large amounts of water. Seek medical attention. Incompatibilities: Nickel dust is flammable. Reacts violently with fluorine, strong mineral acids ammonium nitrate, etc.
Zinc Zinc Chloride*			Blue powder	Zinc is considered an essential trace element, necessary for normal growth and development. Most zinc compounds have a relatively low order of toxicity however, occupational exposure to zinc chloride and zinc oxide has been associa with adverse health effects. Spontaneous combustion may occur if zinc dust is stored in a damp place. Zinc dust forms an explosive mixture with air. Symptoms: Inhalation: Inhalation of mists of fumes may cause respiratory or gastrointes-tional irritation, shortness of breath, a feeling of constriction in the chest and coughing with phlegm and bloody sputum. It may a produce a cyanosis, resulting in a blue color of the skin and lip. Exposure to freshly formed zinc oxide fumes can cause a flu-like i ness called metal fume fever, with symptoms similar to those encou ered with viral influenza. Skin: Skin contact with zinc chloride may produce dermatitis. Ingestion: 12 grams of zinc metal over two days has caused sluggishness, ligh headedness; a staggering gait and difficulty in writing. Incompatibilities: Acids, strong alkalies, amines, chlorides, chlorates, nitrates, oxides, fluroin S, CB_2.

TABLE 5-2
CHEMICAL TOXICITY AND OTHER INFORMATION
(continued)

NOTES

TLV - Threshold Limit Value
ACC - Acceptable Ceiling Concentration
STEL - Short Term Exposure Limit

* Suspected carcinogens, teratogens or mutagens.
** First Aid: Unless specified, first aid for all of the listed chemicals are as follows:
Eyes: immediately wash with copious quantity of cold water
Skin: Flush with water promptly
Breath: Artificial respiration
Swallow: Water, vomit
\+ Slight Hazard
++ Moderate Hazard
+++ Extreme Hazard

[1]Toxicity Ratings:

	Toxicity Rating	
No toxicity (none)	0	Material causes no harm in any condition or produces very unusual circumstances or toxic effects on humans in very large dosage.
Slight toxicity (low)	1	
Moderate toxicity	2	
Severe toxicity	3	

[2]Persistence or each hazardous substance is evaluated on its biodegradability as follows:

	Assigned Value
Easily biodegradable compounds	0
Straight chain hydrocarbons	1
Substituted and other ring compounds	2
Metals, polycyclic compounds and halogenated hydrocarbons	3

6.0 WORKER SAFETY PROCEDURES

6.1 GENERAL. Workers will be expected to adhere to the established safety practices for their respective specialties (e.g., drilling, laboratory analysis, construction, etc.). The need to exercise caution in the performance of specific work tasks is made more acute due to weather conditions, restricted mobility, and reduced peripheral vision caused by the protective gear itself, the need to maintain the integrity of the protective gear, and the increased difficulty in communicating caused by respirators. Work at the site will be conducted according to established protocol and guidelines for the safety and health of all involved. Among the most important of the principles for working at a hazardous waste site are as follows.

1. In any unknown situation, always assume the worst conditions and plan responses accordingly.

2. Employ the buddy system. Establish and maintain communication. In addition to radio communications, it is advisable to develop a set of hand signals as conditions may greatly impair verbal communications.

3. Minimize contact with excavated or contaminated materials. Plan work areas, decontamination areas, and procedures to accomplish this. Do not place equipment on drums or on the ground. Do not sit on drums or other materials.

4. Employ disposable items when possible to minimize risks during decontamination and possible cross-contamination during sample-handing. This will require a common sense approach to potential risks and costs.

5. Smoking, eating, or drinking after entering the work zone and before decontamination will not be allowed. Oral ingestion of contaminants is probably the second most likely means of introduction of the toxic substances into the body (inhalation being first).

6. Avoid heat and other work stresses related to wearing the protective gear. Work breaks should be planned to prevent stress related accidents or fatigue. Section 13.0 of the site plan report provides a summary heat stress casualty prevention plan.

7. Maintain monitoring systems. Conditions can change quickly if subsurface areas of contamination are penetrated.

8. Conflicting situations that may arise concerning safety requirements and working conditions must be addressed and resolved rapidly by the HSO to relieve any motivations or pressures to circumvent established safety policy.

9. Unauthorized breaches of specified safety protocol will not be allowed. Personnel unwilling or unable to comply with the established procedures will be replaced. Any changes in established procedure should be docu-

mented on the form provided. The change should have a very specific, valid basis and must be approved by the HSO.

10. Be observant of not only one's own immediate surroundings but also that of others. Everyone will be working under constraints to awareness and it is a team effort to notice and warn of impending dangerous situations. Extra precautions are necessary when working near heavy equipment while utilizing personnel protective gear. Vision, hearing, and communication are restricted by the protective gear.

11. Use of contact lenses will not be allowed on-site. These prevent proper flushing should corrosive or lachrymous substances enter the eyes.

12. Sites potentially requiring Level C or B protection will require the removal of facial hair (except moustaches) to allow a proper facepiece fit.

13. Rigorous contingency planning and dissemination of plans to all personnel minimizes the impact of rapidly changing safety protocols in response to changing site conditions.

14. Withdrawal from a hazardous situation to reassess procedures is the preferred course of action.

15. Be aware that chemical contaminants may mimic or enhance symptoms of other illnesses or intoxication. Avoid excess use of alcohol and working with an illness during field investigation assignments.

16. The site leader, the HSO, and sampling personnel shall maintain records in a bound notebook recording daily activities, meetings, facts, incidents, data, etc., relating to the project. These record books will remain on the site during the full duration of the project so that replacement personnel may add information in the same record book, maintaining continuity. These notebooks and daily records will become part of the permanent project file.

6.2 SITE ENTRY PROCEDURES. In most cases, Jordan teams are not the first on-site investigators. Considerable knowledge of site history and current status allows the preparation of a HASP with reasonable assurance that personnel are adequately protected. In the event that sufficient site information is not available to perform a summary risk assessment and assign the appropriate level of personal protective equipment, the following procedures should be followed. It must be understood that verification of the level of contamination (even with background information) will always require some of the steps below.

- Recognize that Jordan's presence on-site implies a perceived contamination potential by the client.

- Assume that the site is contaminated and conduct a site safety reconnaissance.

- Establish a contamination reduction zone (decontamination area).

- At the highest level of protection practicable, survey the site beginning with a perimeter survey and gradually covering all areas of proposed activity with (as appropriate):

  - HNU photoionizer,
  - organic vapor analyzer,
  - radiation survey meter,
  - personal air sampling pumps,
  - chemically reactive indicating tubes,
  - oxygen deficiency meter, and
  - explosive mixture meter.

- Establish a "hot zone."

- Review data, assess risk, and select the appropriate level of protection.

- Prepare summary site HASP and document all data acquired.

7.0 SITE SAFETY EQUIPMENT

In addition to personal protective gear designated for the assigned level, various monitoring and safety equipment is maintained on-site. Minimum on-site equipment will generally include:

- photoionization meter,
- combustible gas indicator (explosimeter),
- oxygen meter or oxygen deficiency alarm,
- chemically reactive indicating tubes (specific to the site hazards),
- fire extinguishers,
- first aid kits,
- eye wash station,
- radiation survey meter or radiation alert,
- transportation suitable for emergency response, and
- organic vapor analyzer (optional).

Additional equipment may be specified and obtained as field conditions dictate.

8.0 EMERGENCY PLANNING

8.1 EMERGENCY MEDICAL SERVICES. Prior to site investigation or activity on hazardous sites, nearby health facilities will be evaluated to determine their capabilities in relation to the needs of on-site project staff. Criteria such as emergency department physician coverage, decontamination capabilities, and available medical specialists are evaluated.

8.1.1 Onsite First Aid. An industrial first-aid kit will be provided at the work site and contents of the kit will be checked weekly and restocked as necessary. Other equipment may include: oxygen, backboard and straps, splints, and a cervical collar.

At least one person qualified to perform first aid will be present on-site at all times during work activity. This person will have earned a certificate in first-aid training from the American Red Cross or will have received equivalent training. Designated first aides will receive regular review training from the American Red Cross or an equivalent session.

An emergency shower and eye-wash station will be provided at the work site, as well as flushing water for decontamination of boots, gloves, clothing, tools, etc.

8.1.2 Transportation to Emergency Treatment. A vehicle will be available at all times for use in transporting personnel to the hospital (in the event an ambulance is unnecessary or unavailable).

Personnel stretchers will be located at the work site for use in transporting personnel to the vehicle. Alternate transportation routes to area hospitals will be established prior to on-site activity.

8.2 CONTINGENCY PLANNING. Prior to commencement of onsite activities, field personnel will review safety considerations with the HSO. The HSO is responsible for adherence to the designated safety precautions and assumes the role of on-site coordinator in an emergency response situation.

All on-site personnel will be familiar with both the primary and secondary route to the nearest hospital (which may be shown on a Figure or local map) as well as the location of the nearest working telephone or radio communication device. Each will receive a list of emergency phone numbers as shown in Appendix F.

The local hospital and emergency response team will be advised in advance by the HSO of the work to be performed. The hospital will also be briefed on the availability of personnel health data and technical support through Executive Health Examiners.

Emergency communication will be required to ensure positive pre-planned notification of emergency authorities in the event of episodes requiring initiation of contingency plans.

- The communication will be coordinated with local agencies, fire department, police, ambulance, and hospital emergency room.

- Two-way radio communication may need to be established in the field, and a site alarm capable of warning site personnel and summoning assistance will be maintained (air horns).

- Emergency evacuation for residents of nearby homes is an unlikely event, but a person will be designated on-site to be responsible for implementing the contingency plan. The person will be made aware of the total number of households within a radius of 2,000 feet. Appendix A will provide the emergency contacts that will be required and an additional table will provide a list of residences and identifiable operations in the area in the event that evacuation is judged to be a possibility for a particular site.

- Prior to any activity, personnel will investigate possible routes of evacuation.

A copy of an accident report form is provided in Section 14.0 of the site plan report. It should be filled out by the HSO and filed with the individual's supervisor and a copy retained in the project records if an accident occurs.

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

8.3.1 Accidents. Accidents must be handled on a case by case basis. Minor cuts, bruises, muscle pulls, etc., will still allow the injured person to undergo reasonably normal decontamination procedures prior to receiving direct first aid. More serious injuries may not permit complete decontamination procedures to be undertaken, particularly if the nature of the injury is such that the victim should not be moved. The nature and degree of surface contamination at a site is generally low enough that emergency vehicles could reach the victim on-site without undue hazard. However, in the event that access on-site is limited, accident victims may be transported to a point accessible by an ambulance by Jordan personnel trained for this response.

8.3.2 Contact and/or Ingestion of Hazardous Materials. Properly prescribed and maintained protective clothing and adherence to established safety procedures are designed to minimize this hazard. However, it is still a possibility that contact or ingestion of materials may occur. One possibility for exposure is the puncture of a buried drum of liquid during drilling operations that might cause the drum contents to contact personnel. Standard first aid procedures should be followed. The drilling rig will have a tank of water which may be useful in some circumstances, particularly to flush contaminants off any exposed skin areas. Eye wash bottles will also be maintained at the site in case of emergencies. In cases of ingestion or other than minor contact with known substances, the local Poison Control Center and hospital should be contacted and the victim brought there immediately for further treatment and observation.

8.3.3 Explosion. The drilling crew should be keenly aware of combustible gas meter readings and withdraw at any indication of imminently hazardous conditions (greater than 20% Lower Explosive Limit [LEL]). The detection of such conditions shall be reported to local agencies for potential execution of the evacuation plan should the situation be assessed as warranting such response.

8.3.4 Fire. The combustible gas meter also warns of imminent fire hazards at borings. The greatest fire hazard at the site should be recognized as handling the fluids (e.g., methanol, acetone) used for certain decontamination procedures. No smoking or open flames are allowed on site. Carbon dioxide fire extinguishers will be kept at the drilling rig, and the decontamination area/field office. The Fire Department, previously informed of site activities, will be called as needed.

8.4 EVACUATION RESPONSE LEVELS. Evacuation responses will occur at three levels: (1) withdraw from immediate work area (100+ feet upwind), (2) site evacuation, and (3) evacuation of surrounding area. Anticipated conditions that might require these responses are described below.

Withdrawal Up-Wind (100 or more feet)

- Condition: sensing ambient air conditions as containing greater contaminant concentrations than guidelines allow for the type of respiratory protection being worn. The work party may return upon donning greater respiratory protection and/or assessing the situation as transient and past.

- Condition: breach in protective clothing or minor accident. The party may return when tear or other malfunction is repaired and first aid or decontamination has been administered.

- Condition: respirator malfunctions and must be replaced.

Site Evacuation

- Condition: sensing ambient air conditions as containing explosive and persistent levels of combustible gas or excessive levels of toxic gases.

- Condition: fire or major accident.

- Condition: imminent explosion or explosion.

Surrounding Area Evacuation

- Condition: persistent, unsuppressable release of toxic or explosive vapors from test pits or borings (possible pressure release from punctured drum). Air quality should be monitored at several distances downwind to assess danger to surrounding area before initiating this response.

8.5 EVACUATION PROCEDURES.

8.5.1 Withdrawal Upwind. The work party will continually note general wind directions while on-site. (A simple wind sock may be set up near the work site for visual determinations.) Upon noting the conditions warranting movement away from the work site, the crew will move upwind a distance of approximately 100 feet or farther as indicated by the site monitoring instruments. Donning SCBA and a safety harness and line, the HSO and a member of the crew may return to the work site to determine if the condition noted was transient or persistent. If persistent, then an alarm should be raised to notify on-site personnel of the situation and the need to leave the site or don SCBA. An attempt should be made to decrease emissions only if greater respiratory protection is donned. The Health and Safety Supervisor (HSS) and client will be notified of conditions. When access to the site is restricted and escape may thus be hindered, the crew may be instructed to evacuate the site rather than move upwind, especially if withdrawal upwind moves the crew away from escape routes.

8.5.2 Site Evacuation. Upon determination of conditions warranting site evacuation, the work party will proceed upwind of the work site and notify the security force, HSO, and the field office of site conditions. If the decontamination area is upwind and greater than 500 feet from the work site, the crew will pass quickly through decontamination to remove contaminated outer suits. If the hazard is toxic gas, respirators will be retained. The crew will proceed to the field office to assess the situation. There the respirators may be removed (if instrumentation indicates an acceptable condition). As more facts are determined from the field crew, these will be relayed to the appropriate agencies. The advisability and type of further response action will be coordinated and carried out by the HSO.

8.5.3 Evacuation of Surrounding Area. When the HSO determines that conditions warrant evacuation of downwind residences and commercial operations, the local agencies will be notified and assistance requested. Designated on-site personnel will initiate evacuation of the immediate off-site area without delay.

9.0 DECONTAMINATION

9.1 PERSONNEL DECONTAMINATION PROCEDURE. Decontamination procedures are carried out by all personnel leaving hazardous waste sites. Under no circumstances (except emergency evacuation) will personnel be allowed to leave the site prior to decontamination. Generalized procedures for removal of protective clothing are as follows.

1. Drop tools, monitors, samples, and trash at designated drop stations (i.e. plastic containers or drop sheets).

2. Step into the designated shuffle pit area and scuff feet to remove gross amounts of dirt from outer boots.

3. Scrub outer boots and outer gloves with decon solution or detergent and water. Rinse with water.

4. Remove tape from outer boots and remove boots; discard in disposal container.

5. Remove tape from outer gloves and remove gloves; discard in disposal container.

6. If the worker has left the exclusion zone to change the air tank on his/her SCBA, or the canister on his/her air purifying respirator, this is the last step in the decontamination procedure. The tank or cartridge should be exchanged, new outer gloves and boot covers donned, the joints taped, and the worker returns to duty.

7. Remove outer garments and discard in disposal container.

8. Remove respirator and place or hang in the designated area.

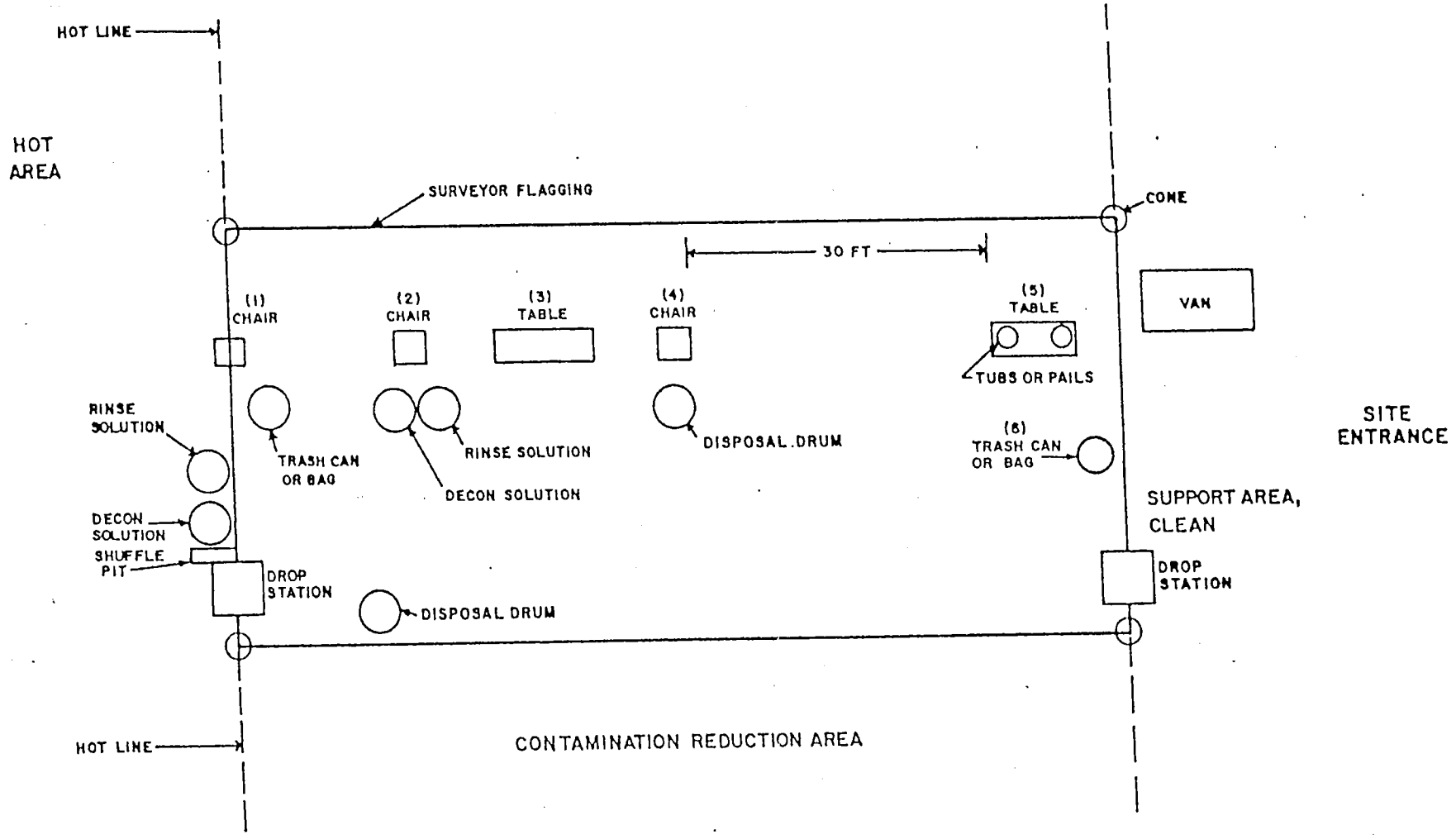
9. Remove inner gloves and discard in disposal container.

10. If the site requires use of a decontamination trailer, all personnel must shower before leaving the site at the end of the work day.

    Note: Disposable items (Tyvek coveralls, inner gloves, and latex overboots) will be changed on a daily basis unless there is reason for changing sooner. Dual respirator canisters will be changed daily unless more frequent changes are deemed appropriate by site surveillance data or personnel assessment.

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

A schematic of a typical decontamination area is shown in Figure 9-1.



TASK

(1) WASH OUTER BOOTS - RINSE BOOTS - DISPOSE
(2) WASH OUTER GLOVES - RINSE GLOVES - DISPOSE
(3) SCBA TANK CHANGE OVER TABLE W/SPARE TANKS
(4) REMOVE OUTER GARMET - DISPOSE
(5) REMOVE SCBA, WASH MASK IN PAILS OR TUBS
(6) REMOVE INNER GLOVES - DISPOSE

NOT TO SCALE

FIGURE 9-1
TYPICAL PERSONNEL DECONTAMINATION AREA

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

All decontamination will be done by personnel in protective gear appropriate for the level of decontamination, determined by the Site Safety Officer. The decontamination work tasks will be split or rotated among support and work crews. Decontamination procedures within the trailer (if used) should take place only after other personnel have cleared the "hot area," moved to the clean area and the door between the two areas closed.

Miscellaneous tools and samplers will be dropped into a plastic pail, tub, or other container. They will be brushed off and rinsed (outside, if possible) and transferred into a second pail to be carried to further decontamination stations. They will be washed with a detergent solution, rinsed with methanol or acetone (if required), rinsed with a detergent solution, and finally rinsed with clean water.

9.2.1 Drilling Rig and Tools. It is anticipated that the drill rigs will be contaminated during test pit/borehole activities. They will be cleaned with high pressure water or portable high pressure steam followed by soap and water wash and rinse. Loose material will be removed by brush. The person performing this activity will usually be at the level of protection used during the personnel and monitoring equipment decontamination.

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

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

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

9.2.4 Respirators. Respirators will be decontaminated daily. Taken from the drop area, the masks will be disassembled, the cartridges set aside, and the rest placed in a cleansing solution. (Parts will be precoded, e.g., #1 on all parts of mask #1). After an appropriate time within the solution, the parts will be removed and rinsed off with tap water. The old cartridges will be discarded into the contaminated trash container for disposal. In the morning the masks will be re-assembled and new cartridges installed if appropriate. Personnel will inspect their own masks to be sure of proper readjustment of straps for proper fit (see also Appendix B).

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

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

10.0 DOCUMENTATION AND RECORDKEEPING

Minimum documentation consists of:

- daily field records kept by the site technical leader or designee,
- site surveillance record kept by the Site Safety Officer,
- sampling-related records kept by sample collection team,
- chain-of-custody records for each sample collected, and
- daily exposure record for each person on-site.

11.0 UPDATING OF HEALTH AND SAFETY PLAN

The HSO is responsible for maintaining proper documentation regarding the daily safety log. If any deficiency is encountered in the health and safety plan, a report will be prepared and forwarded to the HSS at Jordan and copies sent to the project manager and technical director. The HSO will immediately initiate necessary changes to improve protection of field staff.

During the remedial investigation process or after initial field investigation, any new chemical hazard encountered will be evaluted and safety plans modified to reflect the effect of that chemical hazard. Similarly, any physical hazards that are discovered will be addressed by the HSO and reported.

12.0 HEALTH AND SAFETY AUDIT PROCEDURES

Regular health and safety audits shall be conducted to assure compliance with health and safety policy and procedures. Auditing may be performed on any Jordan site by the HSS or the Corporate Health and Safety Manager (HSM), and will include health and safety evaluations of all work activities. The audits will be an unannounced evaluation of sites selected at the discretion of the HSS or HSM with a goal of 10 percent of active sites being subject to audits each quarter.

The results of each site health and safety audit will be summarized into an audit report that is provided to the site HSO, the Project Manager, and the Operational Group Manager charged with responsibility for the project. Where the audit report identifies deficiencies, it will be the Project Manager's responsibility to promptly implement corrective action. The corrective action undertaken will be outlined in a written report submitted to the HSS and the HSM. The HSM or the HSS shall retain the original audit report that has been signed by the Project Manager and the HSO to acknowledge their receipt of the audit's findings. Any mitigating comments submitted to the HSM or the HSS shall be appended to the original report.

13.0 REFERENCE GUIDES FOR HAZARDOUS MATERIALS

Reference guides for material classification determinations are:

1) CHRIS Hazardous Chemical Data, Manual II, U.S. Department of Transportation and U.S. Coast Guard, 1985.

2) Dangerous Properties of Industrial Materials, Sax, N.I., 6th edition, Van Nostrand Reinhold Co., 1984.

3) Documentation of TLV's and BEI's, 5th Edition, American Conference of Governmental Hygienists, 1986.

4) Guidelines for the Selection of Chemical Protective Clothing, 3rd Edition, American Conference of Governmental Industrial Hygienists, Inc., 1987.

5) Guide to Portable Instrumentation for Assessing Airborne Pollutants Arising from Hazardous Wastes, Draft International Document, in International Organization of Legal Metrology.

6) Handbook of Chemistry & Physics, 64th Edition, CRC Press, 1984.

7) Hazardous Waste Operations and Emergency Response, Occupational Safety and Health Administration, 29 CFR 1910.120, 1986.

8) The Merck Index, 9th Edition, Merck, Sharp & Dohme Ltd., 1980.

9) NIOSH/OSHA/OSCG/EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, U.S. Department of Health and Human Services, Public Health Services, Centers for Disease Control, National Institute for Occupational Safety and Health, 1985.

10) Pocket Guide to Chemical Hazards, 1980 Edition, NIOSH/OSHA, DHEW (NIOSH) Publication No. 78-120.

11) Registry of Toxic Effects of Chemical Substances, 8th edition, NIOSH, 1978.

12) Threshold Limit Values and Biological Exposure Indicies for 1987-1988, American Conference of Governmental Industrial Hygienists, 1987.

APPENDIX B

RESPIRATORY PROTECTION PROGRAM

1. INTRODUCTION

This program has been developed to govern the selection and use of respiratory protective devices by E.C. Jordan Co. (Jordan) personnel. The program is intended to comply with Occupational Safety and Health Administration (OSHA) requirements as set forth in 29 CFR 1910.134(b). The scope of this program is limited to activities related to field investigations of potentially hazardous waste disposal sites.

2. PERSONNEL REQUIREMENTS

All personnel assigned to field activities at hazardous or potentially hazardous locations are currently required by Jordan's Health and Safety policies to be enrolled in the corporate Health Monitoring Program. A portion of this program involves spirometry, a measure of the respiratory system status. No personnel may be assigned to the use of, or withdraw from stock, any respira-tory protective device without physician certification that use of such a device will not be injurious to health. Psychological limitations, e.g. claustrophobia, are also considered in personnel assignments. Training in the use of the selected device and fit testing, as described herein, are also required.

No personnel will be assigned duties that require a respirator when facial hair, skullcaps or eye glasses will interfere with a proper fit. No contact lenses may be worn with any respiratory protective device. Eyeglass frames that fit inside the respirator facepiece are provided as necessary.

3. APPLICABLE EQUIPMENT

Jordan maintains the following respiratory protective equipment:

- full-face chemical/mechanical air purifying respirators,
- self-contained breathing apparatus,
- full-face air line-supplied breathing apparatus, and
- 5-minute escape air supply.

This equipment is intended for use on an as needed basis, to be determined by an evaluation of on-site conditions. Respiratory protective equipment should not be used arbitrarily by any Jordan personnel.

Selection criteria are presented separately; training is required in the use of each type of equipment prior to drawing from stock.

4. PERSONNEL TRAINING

Training of personnel in the proper use and care of respiratory protective equipment is considered essential to the success of the program. Training encompasses:

- respiratory protection principles,
- selection of appropriate equipment,
- use of equipment,

- maintenance of equipment, and
- fit testing.

Information regarding each topic is presented as standard respiratory protection procedures.

5. STANDARD RESPIRATORY PROTECTION PROCEDURES

The following information has been organized and presented by topic as Standard Respiratory Protection Procedures, to be used both in training and as reference material for field operations.

Standard Respiratory Protection Procedure No.	Topic
1	Respiratory Protection Principles
2	Selection of Respirators
3	Fit Testing
4	Inspection/Maintenance/Storage

These procedures are discussed later in this appendix.

6. PROGRAM ADMINISTRATION AND DOCUMENTATION

The administration of Jordan's Respiratory Protection Program is the responsibility of the Health and Safety Supervisor. Administration includes:

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

Written HASPs for each site, and site hazard assessments result in respirator selection in accordance with the decision logic set forth in Standard Respiratory Protection Procedure No. 2.

Fit testing and respirator maintenance is performed by the equipment manager of Jordan's Sample Control and Staging Center under the administration of the HSS. Major maintenance is performed by manufacturer certified technicians only. Personnel training in respiratory protection is one aspect of the HSS's ongoing personnel training programs.

Program evaluation is a dynamic process, occurring each time a Project HASP is prepared.

Medical supervision of personnel occurs as part of Jordan's Health Monitoring Program, also administered by the HSS. Medical surveillance is required for all personnel assigned to hazardous or potentially hazardous site activities.

Documentation of the various elements of Jordan's Respiratory Protection Program is achieved through several media.

- Documentation of respirator selection is included in the hazard assessment of each site's HASP.

- Documentation of personnel training is maintained in both hard-copy and computerized files.

- Documentation of medical surveillance is achieved indirectly by maintaining a list of enrolled employees in the Health Monitoring Program and directly through physician certification of personnel allowed to be assigned respiratory protective devices.

- Documentation of fit-testing is maintained on file with the equipment manager of the Sample Control and Staging Center, using the appropriate form (Exhibit 1) .

- Documentation of site surveillance is required both by this program and by the HASP for each site. Records of site surveillance are created by the HSO and maintained in project files.

- Respirator inspection and maintenance records are created and maintained for each respirator, SCBA, and escape respirator by the equipment manager (Exhibit 2).

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

EXHIBIT 1

RESPIRATOR FIT TEST WORKSHEET

RESPIRATOR FIT TEST WORKSHEET

Applicant Name _____

Organization _____

Date of Test _____

Employee Number _____

Equipment Type _____

Manufacturer _____

Model/Size _____

Test Conducted by _____

TEST RESULTS

(1)	Negative Pressure Test	Pass ( )	Fail ( ) _____
(2)	Positive Pressure Test	Pass ( )	Fail ( ) _____
(3)	Isoamyl Acetate Vapor Test		
	Initial Odor Recognition	Yes ( )	No ( ) _____
	Odor Detected w/ Respirator On	Yes ( )	No ( ) _____
(4)	Irritant Smoke Test		
	Irritant Detected	Yes ( )	No ( ) _____

Employee briefed on fundamental principals of respiratory protection, use, inspection, cleaning, maintenance and storage of equipment

Yes ( ) No ( )

ADDITIONAL INFORMATION

Last Employee Physical Exam Conducted on _____
Stress Test Included Yes ( ) No ( )

At Medical Facility _____

Corrective Lenses Required for Normal Work Tasks Yes ( ) No ( )

Facial Characteristics: Clean Shaven ( ) Beard ( ) Other ( ) _____
Specify

Follow-up Physical Due _____

I hereby certify the subject employee has been fit tested according to procedures specified in RESPIRATORY PROTECTION PROCEDURE NO. 3.

_____ _____
Tester Name Date

EXHIBIT 2

RESPIRATOR USE & MAINTENANCE RECORD

RESPIRATOR USE AND MAINTENANCE RECORD

Respirator

ID Number

Respirator Type _____

Manufacturer _____

Model Number _____ Date Placed In Service _____

Date	Assigned to Whom or Location of Storage	Inspection/Maintenance and Charging (SCBAs) Information	Serviced By

7. STANDARD RESPIRATORY PROTECTION PROCEDURE NO. 1
RESPIRATORY PROTECTION PRINCIPLES

Because the lungs are not completely effective in protecting the body against respirable chemical hazards, they must be artificially protected from toxic gases, vapors, and particulates. In addition, the body must be supplied with enough oxygen to maintain a normal capacity to perform tasks.

7.1 ROUTES OF EXPOSURE. The volume of air inhaled during "normal" activities is approximately 6 l/min. The volume of air inhaled during brisk activity or during periods of stress can go up to 75 l/min (a 12-fold increase).

Air is inhaled through the nose and mouth and travels an extremely turbulent path to the lungs. This turbulence results in the air impinging on many sites, thus allowing the insoluble particulates to become impacted and soluble particulates, vapors, and gases to become absorbed.

The inhaled air passes through the pharynx, the common passageway for both food and air, and enters the trachea at the larynx. The trachea (or windpipe) divides into two bronchi, which lead to the two lungs. All of these organs are collectively called the conducting tubes, since they lead the air to the alveoli, the site of gaseous exchange with the pulmonary capillaries (i.e., the blood).

Toxic substances may be absorbed at any point in the respiratory tract. The conducting tubes are lined with mucus and cilia. Insoluble contaminants caught in the mucus are swept up to the esophagus by the cilia and swallowed, thus causing an ingestion problem.

7.2 OXYGEN DEFICIENCY.

7.2.1 Oxygen and the Respiratory Process. The chemical composition of normal air is presented below as Table 1.

Table B7-1
Atmospheric composition

Health Monitoring and Safety Training Plan
Appendix B, Respiratory Procedures No. 1
Naval Air Station Cecil Field
Jacksonville, Florida

Gas	Volume (percent)	Partial pressure (mm Hg at sea level)
Nitrogen	78.9	594
Oxygen	20.95	159
Argon	0.93	7
Carbon dioxide	0.04	0.03

It is not the percentage of oxygen in the air, but rather its partial pressure, that is important in respiration. With increases in altitude, the percentage of oxygen stays constant, but its partial pressure drops. Additionally, as the percentage of oxygen in the air drops, so does its partial pressure.

The "anatomic dead space volume" of the respiratory tract is about 150 ml. The average breath draws in about 500 ml of air. This air is mixed with the air remaining in the dead space from the previous exhalation, which has been depleted in oxygen due to the normal respiratory process. The overall effect is a lower partial pressure of oxygen in the respiratory tract as compared with the ambient air. The average respirator adds about 100 ml of dead space to the respiratory system, which further lowers the partial pressure of oxygen in the respiratory system, causing a slight oxygen deficiency.

7.2.2 Oxygen Levels/Physiological Effect. The currently accepted National Institute for Occupational Safety and Health (NIOSH) standards specify that if an atmosphere contains less than 19.5 percent by volume oxygen at sea level, then an atmosphere-supplying device must be used.

Note that as altitude increases, the percentage of oxygen stays constant, but the partial pressure drops. There is currently no standard that accounts for the drop in partial pressure with altitude; the problem is currently under study by NIOSH.

The physiological effects of oxygen deficiency are indicated in Table 2.

Table B7-2
Physiological Effects of oxygen deficiency

Health Monitoring and Safety Training Plan
Appendix B, Respiratory Procedures No. 1
Naval Air Station Cecil Field
Jacksonville, Florida

Oxygen volume, percentage at sea level	Physiological effect	
16-12	Increased breathing volume. Impaired attention and thinking.	Accelerated heartbeat. Impaired coordination.
14-10	Very faulty judgment. Very poor muscular coordination. Muscular exertion causes rapid fatigue that may cause permanent heart damage.	Intermittent respiration.
10-6	Nausea. Inability to perform vigorous movement or loss of all movement. Unconsciousness, followed by death.	Vomiting.
Less than 6	Spasmatic breathing. Death in minutes.	Convulsive movements.

7.3 PARTICULATE CONTAMINANTS, AEROSOLS. Aerosol is a term used to describe particulates in air without regard to their origin. Particulates are collected on the walls of the respiratory tract depending upon their size as follows:

1. Pharynx - 10-30 μm
2. Trachea - 10 μm
3. Bronchus - 5-10 μm
4. Alveoli - 0.1-1 μm

Particulates less than 0.5 μm may never be deposited in the respiratory tract and may simply be exhaled.

Particulates affect the human body as follows.

1. Nuisances: inert substances that cause no lung damage but inhibit proper functioning of the lungs.

2. Inert pulmonary reaction causing substances: substances that produce nonspecific pulmonary effects.

3. Pulmonary fibrosis causing substances: substances that produce effects ranging from nodule production to serious diseases such as asbestosis.

4. Irritants: substances that irritate, inflame, or ulcerate lung tissues.

5. Systemic poisons: substances that cause injury to specific organs and body systems.

6. Allergens: substances that produce hypersensitivity.

7.4 GASEOUS CONTAMINANTS. Gaseous contaminants are "filtered" to a small degree by the respiratory tract before they reach the alveolar spaces. However, if the contaminants are soluble they can be directly absorbed through the walls of the respiratory tract.

Gaseous contaminants affect the human body as follows.

1. Irritants: corrosive compounds that injure and inflame tissue.

2. Asphyxiants: substances that displace oxygen or prevent the use of oxygen by the body.

3. Anesthetics: substances that depress the central nervous system and cause intoxication or loss of sensation.

4. Systemic poisons: substances that cause diseases.

7.5 EXPRESSING AIR CONTAMINANT CONCENTRATIONS. Any substances that are not normal components of breathing air (oxygen, nitrogen, etc.) are considered to be

contaminants. The respiratory threat posed by contaminants is a function of the actual contaminant and its concentration in the air. The concentration is expressed in a variety of ways, as listed below.

1. Particulates

   a. mppcf - millions of particulates per cubic foot.
   b. ppcc - particles per cubic centimeter.
   c. mg/m^3 - milligrams per cubic meter.

2. Gases and Vapors

   a. ppm - volumes per million volumes of air (parts per million).
   b. ppb - volumes per billion volumes of air (parts per billion).
   c. mg/m^3 - milligrams of gas per cubic meter.
   d. Conversion of units - The following equation converts mg/m^3 to ppm, at 24 °C and 760 mm Hg.

$$ppm = \frac{24.45}{molecular\ weight}\ mg/m^3$$

   This equation is extremely useful for determining respiratory protection requirements.

7.6 MEASURES OF RESPIRATORY HAZARDS. Every contaminant contained in breathing air has a limit, above which it becomes a threat to human health. These limits are determined either from animal studies or from epidemiological data. Unfortunately, animal studies can only approximate human response and may vary widely for individual chemicals. Epidemiological studies, although capable of providing a more precise forecast of human response, are limited by a lack of accurate records and a lack of controlled studies. Therefore, the "safe" limits of various chemicals must be viewed only as guidelines. Furthermore, these guidelines are primarily designed for the industrial situation where an individual is being exposed to one or two well-defined substances. These guidelines do not address the problems of synergism, potentiation, or allergic response.

The guidelines used in measuring respiratory hazards are listed below.

1. Threshold Limit Value. The threshold limit value (TLV) is recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) and is derived from consensus review. It is a time-weighted average concentration set for a particular substance and represents a level that almost all workers can be exposed to for an 8-hour day (40-hour week) without suffering adverse health effects. It is assumed that following each 8-hour exposure there will be a 16-hour recovery period and that after 5 days there will be a 48-hour recovery period. The TLV lists are revised on a yearly basis.

2. Permissible Exposure Limits. The permissible exposure limits (PELs) are set forth in the Occupational Safety and Health Administration (OSHA) Standards 29 CFR 1910.1000, Tables Z-1, Z-2, and Z-3. These

levels were promulgated initially from the ACGIH TLV lists (1968). As part of the law, they represent the legal maximum concentrations for personnel exposure. They are not updated on a yearly basis, as is the TLV list. Therefore, the most current ACGIH TLV is used in determining respiratory protection, rather than the PEL listing.

3. Immediately Dangerous to Life and Health. 30 CFR 11.3 defines conditions that are immediately dangerous to life and health (IDLH) as "conditions that pose an immediate threat to life or health or conditions that pose an immediate threat of severe exposure to contaminants such as radioactive materials, which are likely to have an adverse cumulative or delayed effect on health."

   OSHA adds the following criteria.

   a. The worker must be able to escape without losing his life or suffering permanent health damage within 30 minutes.

   b. The worker must be able to escape without severe eye or respiratory irritation or other reactions.

4. Lower Flammable Limit. The lower flammable limit (LFL) is the lowest concentration by volume of a gas or vapor in air that will explode when there is an ignition source.

7.7 RESPIRATORY PROTECTION. When it has been determined that the ambient atmosphere is hazardous, it becomes necessary to protect the individual by:

1. avoiding and/or minimizing exposure,
2. applying engineering controls such as ventilation, and
3. using a respirator to either filter the air or supply air.

The legal requirements for respiratory protection are summarized below.

1. Williams and Steiger Occupational Safety and Health Act of 1970 established standards that state that "approved or accepted respirators shall be used when they are available."

2. 29 CFR 1910.134 gives legal requirements for the selection and use of respiratory equipment as promulgated by OSHA and based on American National Standards Institute (ANSI) Standard Z88.2, "American National Standards Practices for Respiratory Protection." Standard Z88.2 was originally a consensus standard, but now has been cited as a Federal regulation.

3. 30 CFR Part 11 describes tests for permissibility of respiratory protective apparatus and updates or deletes approvals. 30 CFR Part 11 also cites ANSI Z88.2 as the basis for respiratory protection.

8. STANDARD RESPIRATORY PROTECTION PROCEDURE NO. 2 SELECTION OF RESPIRATORS

8.1 INTRODUCTION. This text is based on "Joint NIOSH/OSHA Standards Completion Program - Respirator Decision Logic." The text is excerpted for the purpose of covering the major points of the respirator decision logic. For the complete text, see John S. Pritchard's, "A Guide to Industrial Respiratory Protection" (U.S. Department of Health, Education, and Welfare, U.S. Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, Cincinnati, Ohio, June 1976). It is not intended to be all-inclusive in content.

The purpose of the respirator decision logic is to provide technical accuracy and uniformity in the selection of respirators and to provide necessary criteria to support this selection. The decision logic is a step-by-step elimination of inappropriate respirators until only those that are acceptable remain. Judgment by persons knowledgeable of inhalation hazards and respiratory protection equipment is essential to ensure appropriate selection of respirators.

The primary technical criteria for what constitutes a permissible respirator are based on the technical requirements of 30 CFR 11. The health standards will allow only respirators approved under 30 CFR 11. Classes of respirators are only included when at least one device has been approved.

Protection factors are criteria used in determining what limiting concentrations are to be permitted for each respirator type that will afford adequate protection to the wearer. The referenced Subparts of 30 CFR 11 give technical descriptions concerning each type or class of respirators referenced in the decision logic; 30 CFR 11 should be used with the decision logic in order to properly understand the criteria for the specification of allowable respirators.

Throughout this text, reference is made to PELs. Prudent, accepted practice dictates the use of current ACGIH TLVs, which are updated each year, in the place of the PEL, which is only periodically updated.

8.2 GENERAL DECISION LOGIC FLOWCHART. The following material used in concert with the decision logic chart (Figure 1) provides a formalized selection guide for respiratory protection.

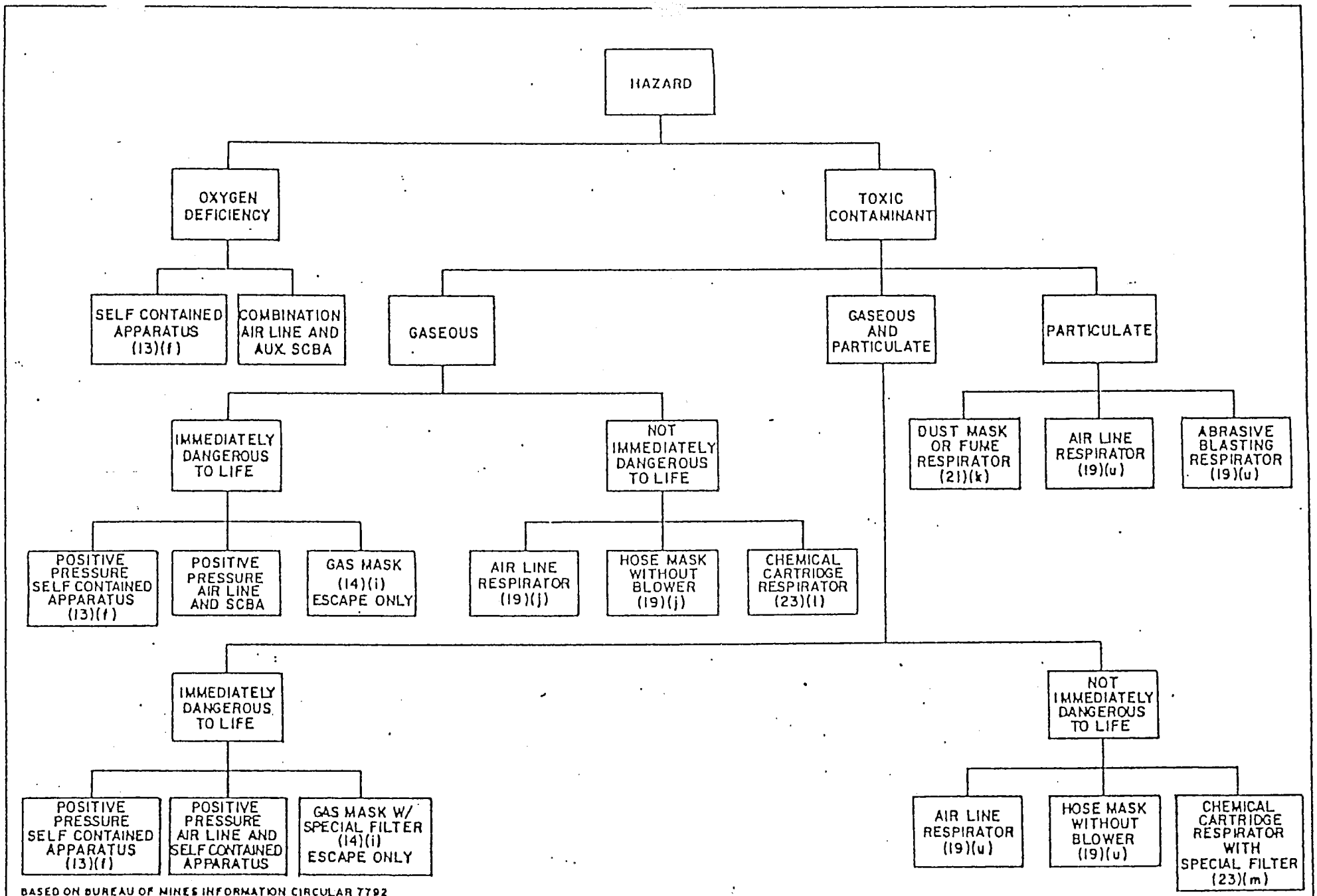
1. Step 1 - Assemble Information on Substance. Assemble necessary toxicological, safety, and research information for the particular contaminant. The following are required:

   a. permissible exposure limits specified in 29 CFR 1910.1000 (Tables Z-1, Z-2, and Z-3),

   b. warning properties if the substance is a gas or a vapor.

   c. eye irritation potential of the substance,

   d. LFL for the substance,



BASED ON BUREAU OF MINES INFORMATION CIRCULAR 7792
NUMBERS IN PARENTHESIS REFER TO BUREAU OF MINES SCHEDULES
LETTERS IN PARENTHESIS REFER TO SUBPART OF NIOSH/MESA 30 CFR PART 11

FIGURE 1
SELECTION OF RESPIRATORY EQUIPMENT (LUNDIN, A., 1979)

e. IDLH concentration for the substance,

f. any possibility of poor sorbent efficiency at IDLH concentration and below,

g. any possibility of systemic injury or death resulting from absorbance of the substance (as a gas or vapor) through the skin,

h. any possibility of severe skin irritation resulting from contact of the skin with corrosive gases, vapors, or particulates,

i. the vapor pressure of the substance (and equivalent ppm), and

j. any possibility of high heat of reaction with sorbent material in cartridge or canister.

2. Step 2 - Determine Physical State of Substance. Determine the physical state(s) of the substance as it is likely to be encountered in the occupational environment. It will be either (1) gas or vapor, (2) particulate (dust, fume, or mist), or (3) combination of (1) and (2).

3. Step 3 - Assemble a Table of Permissible Respiratory Protection for Substance. This is done using the material from Step 1 and the appropriate specific decision logic chart from Section 2.3 below and respirator protection factors. Classes of respirators are only included where at least one device has been approved.

4. IF STEPS 1 THROUGH 3 CANNOT BE COMPLETED, THE ATMOSPHERE IS UNKNOWN AND MUST BE CLASSIFIED IDLH. ONLY POSITIVE PRESSURE SCBA MAY BE SELECTED.

8.3 SPECIFIC DECISION LOGIC CHARTS. A decision logic chart for respiratory protection against gases or vapors and against particulates is shown as Figure 1.

8.4 DECISION LOGIC CRITERIA

8.4.1 Skin Absorption and Irritation. Respirator selection criteria are based primarily on the inhalation hazard of the substance. A supplied-air suit may protect the skin from extremely toxic substances that may be absorbed through the skin or from substances that may cause severe skin irritation or injury.

Supplied-air suits are not covered in 30 CFR 11. Adequate data are not available to make recommendations for supplied-air suits for all types of exposures.

Where information is available indicating systemic injury or death resulting from absorbance of gas or vapor through the skin or where severe skin irritation or injury may occur from exposure to a gas, corrosive vapor, or particulate, the following statement is included as a footnote to the respirator tables, and both the employee and employer are cautioned in the appendices concerning their use.

> Use of supplied-air suit may be necessary to prevent skin contact and respiratory exposure from airborne concentrations of (specific substance). Supplied-air suits should be selected, used, and maintained under the immediate supervision of persons knowledgeable in the limitations and potential life-endangering characteristics of supplied-air suits. Where supplied-air suits are used above a concentration that may be IDLH (concentration), an auxiliary positive-pressure self-contained breathing apparatus must also be worn.

As a guideline for inclusion of the supplied air-suit statement for substances that are sorbed through the skin, a single skin penetration LD_{50} of 2 g/kg for any species is used.

8.4.2 Poor Warning Properties (Refer to Table B8-1). It is important to realize that 30 CFR 11 approvals for air-purifying (organic vapor) devices prohibit use against organic vapors with poor warning properties.

Warning properties include odor, eye irritation, and respiratory irritation. Warning properties relying upon human senses are not foolproof. However, they provide some indication to the wearer of possible sorbent exhaustion, of poor facepiece fit, or other respirator malfunction.

Adequate warning properties can be assumed when the substance odor, taste, or irritation effects are detectable and persistent at concentrations at or below the permissible exposure limit.

If the odor or irritation threshold of a substance is more than three times greater than the permissible exposure limit, this substance should be considered to have poor warning properties. If the substance odor or irritation threshold is somewhat above the permissible exposure limit (not in excess of three times the limit) and there is no ceiling limit, consideration is given to whether undetected exposure in this concentration range could cause serious or irreversible health effects. If not, the substance is considered to have adequate warning properties. Some substances have extremely low thresholds of odor and irritation in relation to the permissible exposure limit. Because of this, these substances cannot be detected by a worker within the facepiece of the respirator even when the respirator is functioning properly. These substances are, therefore, considered to have poor warning properties.

Though 30 CFR 11 does not specifically eliminate air-purifying respirators for pesticides with poor warning properties, prudent practice dictates that a respirator should not be used to protect against any substance with poor warning properties.

8.4.3 Sorbents. There are certain limitations involved with the use of sorbents in cartridge/canister sorbents. When the following conditions occur, a sorbent cartridge is not recommended.

Table B8-1
Comparison of odor thresholds and threshold limit values (TLV) for selected chemical compounds

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Compound	Odor threshold (ppm)	Threshold limit value (ppm)
Group 1		
Odor Threshold Below or Approximately the Same as the TLV		
Acrolein	0.2	0.1
Carbon tetrachloride	10	5
Carbon disulfide	0.21	10
Cyclohexane	300	300
Cyclohexanol	100	50
Epichlorhydrin	10	2
Ethyl benzene	140	100
Ethylene diamine	11	10
Hydrogen chloride	10	5
Methyl acetate	200	200
Methylamine	10	10
Methyl chloride	25	50
Methyl chloroform	300	350
Nitrogen dioxide	5	3
Propyl alcohol	200	200
Turpentine	200	100
Group 2		
Odor Threshold from 2 to 10 Times the TLV		
Allyl alcohol	7	2
Arsine	0.21	0.05
Crotonaldehyde	7	2
1,2-Dichloroethylene	500	200
Dichloroethyl ether	35	5
Dimethyl acetamide	46	10
Dimethyl formamide	100	10
Hydrogen selenide	0.3	0.05
Isopropyl glycidyl ether (IGE)	300	50
Styrene monomer	200	50

Table B8-1
Comparison of odor thresholds and threshold limit values (TLV) for selected chemical compounds--Continued

Compound	Odor threshold (ppm)	Threshold limit value (ppm)
Group 3 Odor Threshold Equal to or Greater Than 10 Times TLV		
Acrylonitrile	21	2
Bromoform	530	0.5
Camphor (synthetic)	1.6 to 200	2
Chloroacetophenone	1	0.05
Chloroform	200	10
Chloropicrin	1	0.1
Diglycidyl ether (DGE)	5	0.1
Ethylene oxide		500 1
Mercury vapor	([1])	0.05[2]
Methyl bromide	([1])	5
Methyl formate	2,000	100
Methanol	2,000	200
Methyl cyclohexanol	500	50
Phosgene	1.0	0.1
Phosphine	([1])	0.3
Radioactive gases and vapors	([1])	
Toluene 2,4-diisocyanate (TDI)	2	0.005

[1]Information not available.
[2]Value is in milligrams per cubic meter.

1. Where supporting evidence exists of immediate (less than 3 min.) breakthrough time at the IDLH concentration and below for a cartridge or canister sorbent, air-purifying devices shall not be allowed for any use, escape or otherwise. See Table 2.

2. Where there is reason to suspect that commonly used sorbents (e.g., activated charcoal) do not provide adequate sorption efficiency against a specific contaminant, use of such sorbents shall not be allowed. However, where another sorbent material has been demonstrated to be effective against a specific contaminant, approved respirators using the effective sorbent material shall be allowed.

3. Where there is reason to suspect that a sorbent has a high heat of reaction with a substance, use of that sorbent is not allowed.

4. Where there is reason to suspect that a substance sorbed on a sorbent of a cartridge or canister is shock sensitive, use of air-purifying respirators is disallowed.

8.4.4 Eye Irritation. In addition to respiratory protection, it is important to consider a chemical's potential for producing eye irritation or damage. The following guidelines deal with eye protection.

1. For routine work operations, any perceptible eye irritation is considered unacceptable. Therefore, only full facepiece respirators are permissible in contaminant concentrations that produce eye irritation. Protection may be required in certain concentrations of gases and vapors. For escape, some eye irritation is permissible if it is determined that such irritation would not inhibit escape and such irritation is reversible.

2. Where quantitative eye irritation data cannot be found in literature references, and theoretical considerations indicate that substance should not be an eye irritant, half-facepiece respirators are allowed.

3. Where a review of the literature indicates a substance causes eye irritation but no eye irritation threshold is specified, the data will be evaluated to determine whether quarter- or half-facepiece respirators can be used.

Table B8-2
Effect of solvent vapor on respirator cartridge efficiency[a]

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Solvent	Time to reach 1 percent breakthrough (10 ppm) (Min)
Aromatics	
Benzene	73
Toluene	94
Ethyl benzene	84
m-Xylene	99
Cumene	81
Mesitylene	86
Alcohols	
Methanol	0.2
Ethanol	28
Isopropanol	54
Allyl alcohol	66
n-Propanol	70
Sec-Butanol	96
Butanol	115
2-Methoxyethanol	116
Isoamyl alcohol	97
4-Methyl-2-pentanol	75
2-Ethoxyethanol	77
Amyl alcohol	102
2-Ethyl-1-butanol	76.5
Monochlorides	
Methyl chloride	0.05
Vinyl chloride	3.8
Ethyl chloride	5.6
Allyl chloride	31
1-Chloropropane	25
1-Chlorobutane	72
Chlorocyclopentane	78
Chlorobenzene	107
1-Chlorohexane	77
o-Chlorotoluene	102
1-Chloroheptane	82
3-Chloromethyl heptane	63

Table B8-2
Effect of solvent vapor on respirator cartridge efficiency[a]--Continued

Solvent	Time to reach 1 percent breakthrough (10 ppm) (Min)
Dichlorides	
Dichloromethane	10
Trans-1,2-dichloroethylene	33
1,1-Dichloroethane	23
cis-1,2-Dichloroethylene	30
1,2-Dichloroethane	54
1,2-Dichloropropane	65
1,4-Dichlorobutane	108
o-Dichlorobenzene	109
Trichlorides	
Chloroform	33
Methyl chloroform	40
Trichloroethylene	55
1,1,2-Trichloroethane	72
1,2,3-Trichloropropane	111
Tetra- and Pentachlorides	
Carbon tetrachloride	77
Perchloroethylene	107
1,1,2,2-Tetrachloroethane	104
Pentachloroethane	93
Acetates	
Methyl acetate	33
Vinyl acetate	55
Ethyl acetate	67
Isopropyl acetate	65
Isopropenyl acetate	83
Propyl acetate	79
Allyl acetate	76
sec-Butyl acetate	83
Butyl acetate	77
Isopentyl acetate	71

Table B8-2
Effect of solvent vapor on respirator cartridge efficiency[a]--Continued

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Solvent	Time to reach 1 percent breakthrough (10 ppm) (Min)
Acetates--Continued	
2-Methoxyethyl acetate	93
1,3-Dimethylbutyl acetate	61
Amyl acetate	73
2-Ethoxylethyl acetate	80
Hexyl acetate	67
Ketones	
Acetone	37
2-Butanone	82
2-Pentanone	104
3-Pentanone	94
4-Methyl-2-pentanone	96
Mesityl oxide	122
Cyclopentanone	141
3-Heptanone	91
2-Heptanone	101
Cyclohexanone	126
5-Methyl-3-heptanone	86
3-Methylcyclohexanone	101
Diisobutyl ketone	71
4-Methylcyclohexanone	111
Alkanes	
Pentane	61
Hexane	52
Methylcyclopentane	62
Cyclohexane	69
Cyclohexene	86
2,2,4-Trimethylpentane	68
Heptane	78
Methylcyclohexane	69
5-Ethylidene-2-norbornene	87
Nonane	76
Decane	71

Table B8-2
Effect of solvent vapor on respirator cartridge efficiency[a]--Continued

Solvent	Time to reach 1 percent breakthrough (10 ppm) (Min)
Amines	
Methyl amine	12
Ethyl amine	40
Isopropyl amine	66
Propyl amine	90
Diethyl amine	88
Butyl amine	110
Triethyl amine	81
Dipropyl amine	93
Diisopropyl amine	77
Cyclohexyl amine	112
Dibutyl amine	76
Miscellaneous Materials	
Acrylonitrile	49
Pyridine	119
1-Nitropropane	143
Methyl iodide	12
Dibromomethane	82
1,2-Dibromoethane	141
Acetic anhydride	124
Bromobenzene	142

[a]The above cartridge pairs were tested at 1000 ppm, 50 percent relative humidity, 22 °C, and 53.3 1/min. (equivalent to a moderately heavy work rate). The time to achieve a 1 percent breakthrough is noted for each cartridge pair. Cartridges were preconditioned at room temperature and 50 percent relative humidity for at least 24 hours prior to testing.

8.4.5 IDLH. The definition of IDLH provided in 30 CFR 11.3(t) is as follows.

> "Immediately dangerous to life or health" means conditions that pose an immediate threat to life or health or conditions that pose an immediate threat of severe exposure to contaminants, such as radioactive materials, which are likely to have adverse cumulative or delayed effects on health."

The purpose of establishing an IDLH exposure concentration is to ensure that the worker can escape without injury or irreversible health effects from an IDLH concentration in the event of failure of the respiratory protective equipment. The IDLH is considered a maximum concentration above which only highly reliable breathing apparatus providing maximum worker protection is permitted. Since IDLH values are conservatively set, any approved respirator may be used up to its maximum use concentration below the IDLH.

In establishing the IDLH concentration the following factors are considered:

1. escape without loss of life or irreversible health effects; 30 minutes is considered the maximum permissible exposure time for escape; and

2. severe eye or respiratory irritation or other reactions that would prevent escape without injury.

IDLH should be determined from the following sources:

1. specific IDLH provided in the literature, such as the AIHA Hygienic Guides,

2. human exposure data, and

3. acute animal exposure data.

Where such data are lacking, acute toxicological data from analogous substances may be considered.

The following guidelines should be used to interpret toxicological data reported in the literature for animal species.

1. Where acute animal exposure data are available (30 min. to 4-hour exposures), the lowest exposure concentration causing death or irreversible health effects in any species is determined to be the IDLH concentration.

2. Chronic exposure data may have no relevance to the acute effects and should be used in determining the IDLH concentration only upon competent toxicologic judgment.

3. Where there is no toxicologic evidence of an IDLH concentration, 500 times the permissible exposure limit shall determine the upper limit above which only highly reliable breathing apparatus providing maximum worker protection is used.

8.4.6 Lower Flammable Limit. In addition to toxic chemicals and irritants, it is necessary to consider flammable substances. In any atmosphere where there is a likelihood of a chemical fire, there is the risk of creating toxic vapors in the fire or of asphyxiation caused by reduction of the oxygen content by the products of combustion.

Contaminant concentrations in excess of the LFL are considered to be IDLH. At or above the LFL, the use of respirators is limited to those devices that provide the maximum protection (i.e., positive pressure self-contained breathing apparatus (SCBA) and the combination positive pressure supplied-air respirators with auxiliary positive pressure SCBA).

8.4.7 Protection Factors. The protection factors of respiratory protection devices are a useful numerical tool to assist in the choice of a protective system. Protection factors are a measure of the overall effectiveness of a respirator. Filtering efficiency is a part of the protection factor and becomes a significant consideration for less efficient air-purifying respirators.

The protection factor of a given respirator for a specific user times the PEL (or TLV) for a given substance is the maximum allowable concentration for that substance for which the respirator may be used. For example, the protection factor for a full-face mask respirator will provide protection up to 1,000 ppm. Note that there is a difference between "quantitative" protection factors and "qualitative" protection factors. The correct protection factor must be used in determining the maximum allowable concentration.

8.4.8 Escape. Jordan provides and requires employees to carry an escape respirator where exposure to extremely toxic substances may occur. This escape respirator provides a 5-minute self-contained air supply. (An extremely toxic substance is defined as a gas or vapor having an LC_{50} of less than 10 ppm.)

9. STANDARD RESPIRATORY PROTECTION PROCEDURE NO. 3
RESPIRATOR QUALITATIVE FITTING METHODS

Despite the care that goes into respirator design and manufacture to give maximum protection, efficiency will be lost if there is an improper match between the facepiece and the user, or other improper wearing practices. The problem is twofold. Because more than one brand or particular type of facepiece is available, the first problem is to determine which fits best. The second problem is whether the user knows when the respirator fits properly. Both problems can be solved by the use of a fitting test, which is in fact an OSHA requirement. A number of tests and fitting procedures can be performed easily, as outlined below.

Note: During any fitting test, the respirator head straps must be as comfortable as possible. Tightening the straps will sometimes reduce the facepiece leakage, but the user may be unable to tolerate the respirator for any length of time.

9.1 TEST 1, NEGATIVE PRESSURE TEST. The user will perform this test alone in the field. It consists of merely closing off the inlets of the canister, cartridge(s), or filter(s) by covering with the palm(s) or replacing the seals over the canister or cartridge inlets, or by squeezing breathing tubes so that air cannot pass; inhaling gently so the facepiece collapses slightly; and holding the breath for 10 seconds. If the facepiece remains slightly collapsed and no inward leakage is detected, the respirator is probably tight enough.

Although this test is simple, it has several major drawbacks, primarily that the user must handle the respirator after it has supposedly been positioned on the face. Handling can modify the facepiece-to-face seal. When the respirator is to be used in a relatively toxic atmosphere, this test should be used only as a very gross determination of fit. The user will perform this test just before entering any toxic atmosphere.

9.2 TEST 2, POSITIVE PRESSURE TEST. This test is very much like the negative pressure test; it has the same advantages and limitations. It is conducted by closing off the exhalation valve and exhaling gently into the facepiece. The fit is considered satisfactory if slight positive pressure can be built up inside the facepiece without any evidence of outward leakage. For some respirators, this method requires the user to remove the exhalation valve cover and then carefully replace it after the test, often a most difficult task that can disturb the respirator fit even more than does the negative pressure test. If removing and replacing the valve cover is required, this test should be used sparingly. For respirators whose valve covers have a single small port that can be covered by the palm or finger, this test is easy. Where applicable, this test will be performed just before entering any hazardous atmosphere.

9.3 TEST 3, ISOAMYL ACETATE VAPOR (BANANA OIL) TEST. The chemical isoamyl acetate has a pleasant, easily detectable odor, therefore it is used widely in checking respirator fit.

The test gives the user the required opportunity to wear the respirator in a test atmosphere. Generally, it consists of creating an atmosphere containing banana

oil around the user of an atmosphere-supplying or air-purifying respirator with an organic vapor removing cartridge(s) or canister. If the hazard is particulate matter or a non-organic vapor or gas, the organic vapor cartridge(s) or canister must be replaced with a particulate filter(s) or proper cartridge(s) or canister after this test. Thus, this test can be used for any facepiece that has the capability of accepting chemical cartridges and particulate filters. It must be emphasized, however, that the correct cartridge, canister, or filter must be replaced on the facepiece before the user enters the specific exposure area.

The isoamyl acetate test is performed with single use capsules, or may be performed by saturating a piece of cotton or cloth with the liquid and passing it close to the respirator near the sealing surface, taking care to avoid skin contact.

In general, the isoamyl acetate fitting test will be performed as follows.

1. The user puts on the respirator in a normal manner in an area where he/she cannot smell banana oil and thus not be influenced by the odor while performing the fitting test. If it is an air-purifying device, it must be equipped with a cartridge(s) or canister specifically designed for protection against organic vapors.

2. The capsule or saturated cloth is passed close to the respirator sealing surfaces.

3. If the user smells banana oil, he readjusts the facepiece and/or adjusts the head straps without unduly tightening them.

4. The user repeats step 2. If banana oil is not smelled, there is assumed to be a satisfactory seal. If the wearer smells the vapor, an attempt should be made to find the leakage point. If the leak cannot be located, another respirator of the same type and brand should be tried. If this leaks, another brand of respirator with a facepiece of the same type but slightly different shape or size should be tried.

5. After a fit is obtained, if the respirator is an air-purifying device, it must be equipped with the correct filter(s), cartridge(s), or canister for the anticipated hazard.

During the test, the subject must make movements that approximate a normal working situation. These will include, but not necessarily be limited to, the following:

1. normal breathing;

2. deep breathing like during a heavy exertion period; this should not be done long enough to cause hyper ventilation;

3. slowly performing side-to-side and up-and-down head movements: these movements should be exaggerated, but should approximate those that take place on the job;

4. talking; this is most easily accomplished by reading prepared text loudly enough to be understood by someone standing nearby; and

5. other exercises may be added depending upon the situation; for example, if users are going to spend a significant part of their time bent over at some task, it will include an exercise approximating this bending.

When the test is used in training workers and selecting the respirators that fit best, they will perform the complete set of exercises. However, the number of exercises may be reduced when the test is used as a quick field check before routine entry into a contaminated atmosphere.

9.4 TEST 4, IRRITANT SMOKE TEST. This test is similar to the isoamyl acetate test in concept. It involves exposing the respirator wearer to an irritating aerosol produced by stannic chloride or titanium tetrachloride smoke tubes normally used to check the quality of ventilation systems. (Note: ther types of smoke tubes such as acetic acid are available, but should not be used for respirator fitting.) When the tube ends are broken and air is passed through it, the material inside reacts with the moisture in the air to produce a dense, highly irritating smoke, consisting of hydrochloric acid absorbed in small solid particles. As a qualitative means of determining respirator fit, this test has a distinct advantage in that the user usually reacts involuntarily to leakage by coughing or sneezing. The likelihood of this giving a false indication of proper fit is reduced. On the other hand, the aerosol is very irritating and must be used carefully to avoid injury.

This test can be used for both air-purifying and atmosphere-supplying respirators, but air-purifying respirators must have a high-efficiency filter(s). After the test, it may be necessary to replace the high-efficiency filter(s) on the air-purifying respirator with another type of air-purifying element(s) depending upon the hazard to which the respirator user is to be exposed. This test can be used for worker training or respirator selection.

The irritant smoke test must be performed with proper safeguards because the aerosol is highly irritating. The procedure is as follows.

1. The user puts on the respirator normally, taking care not to tighten the headstrap uncomfortably and stands with his/her back to a source of exhaust ventilation.

2. The tester tells the user to close his/her eyes, even if wearing a full facepiece respirator, and to keep them closed until told to open them.

3. The tester lightly puffs smoke over the respirator, holding the smoke tube at least 2 feet from it. At this time, the tester should keep the amount of smoke minimal and pause between puffs to note the user's reaction.

4. If the user detects no leakage, the tester will increase the smoke density and move the smoke tube progressively closer to the subject, still remaining alert to any reactions.

5. When the smoke tube has been brought to within about 6 inches of the respirator with no leakage detected, the tester will start to direct smoke specifically at potential sources of leakage, around the sealing surfaces and exhalation valve, while the subject's head is still.

6. At this point, if no leakage has been detected, the user may cautiously begin the head movements described in the isoamyl acetate test. The tester should remain especially alert and be prepared to stop producing smoke immediately.

7. If leakage is detected at any time, the tester should stop the smoke and let the user readjust the facepiece or head strap tension. The tester should then restart the test at step 2.

10. STANDARD RESPIRATORY PROTECTION PROCEDURE NO. 4 INSPECTION/MAINTENANCE/STORAGE

10.1 INTRODUCTION. Respirator maintenance is an integral part of the overall respirator program. Wearing a poorly maintained or malfunctioning respirator is, in one sense, more dangerous than not wearing a respirator at all. Personnel wearing defective devices think they are protected when, in reality, they are not. Emergency escape and rescue devices are particularly vulnerable to poor maintenance as they generally are used infrequently, and then in the most hazardous and demanding circumstances. Serious injury or death can result from wearing a defective device during emergency escape or rescue.

This program includes:

1. inspection for defects (including a leak check),
2. cleaning and disinfecting,
3. repair as required, and
4. proper and sanitary storage of equipment.

10.2 INSPECTION FOR DEFECTS. The most important part of a respirator maintenance program is continual inspection of the devices. If properly performed, inspections will identify damaged or malfunctioning respirators before they can be used. Inspections will be performed at two times:

1. while the respirator is in use, and
2. while it is being cleaned.

Because the use and cleaning will, to a large extent, be performed by the same personnel, these inspections may become concurrent.

10.3 FREQUENCY OF INSPECTION. OSHA requires that "all respirators be inspected before and after each use" and that those not used routinely, i.e., emergency escape and rescue devices, "shall be inspected after each use and at least montly...." Obviously, emergency escape and rescue devices do not require inspection before each use. Records of inspections are kept on forms presented in Section VI-Program Administration and Documentation.

10.4 INSPECTION PROCEDURES. Respirator inspection shall include checking of:

1. tightness of the connections,
2. facepiece,
3. valves,
4. connecting tubes, and
5. canisters, filters, or cartridges.

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

10.5 FIELD INSPECTION OF AIR-PURIFYING RESPIRATORS. Routinely used air-purifying respirators will be checked as follows before and after each use.

1. Examine the facepiece for:

   a. excessive dirt,

   b. cracks, tears, holes or physical distortion of shape from improper storage,

   c. inflexibility of rubber facepiece (stretch and knead to restore flexibility),

   d. cracked or badly scratched lenses in full facepieces,

   e. incorrectly mounted full facepiece lenses, or broken or missing mounting clips, and

   f. cracked or broken air-purifying element holder(s), badly worn threads, or missing gasket(s).

2. Examine the head straps or head harness for:

   a. breaks,

   b. loss of elasticity,

   c. broken or malfunctioning buckles and attachments, and

   d. excessively worn serrations on head harness, which might permit slippage (full facepieces only).

3. Examine the exhalation valve for the following after removing its cover:

   a. foreign material, such as detergent residue, dust particles or human hair under valve seat,

   b. cracks, tears, or distortion in the valve material,

   c. improper insertion of the valve body in the facepiece,

   d. cracks, breaks, or chips in the valve body, particularly the sealing surface,

   e. missing or defective valve cover, and

   f. improper installation of the valve in the valve body.

4. Examine the air-purifying element(s) for:

   a. incorrect cartridge, canister or filter for the hazard,;

b. incorrect installation, loose connections, missing or worn gasket, or cross threading in the holder;

c. expired shelf-life date on the cartridge or canister;

d. cracks or dents in the outside case of the filter, cartridge, or canister, indicated by the absence of sealing material, tape, foil, etc., over the inlet; and

e. identical cartridges if more than one are used.

10.6 CARE AND CLEANING OF SELF-CONTAINED BREATHING APPARATUS (SCBA). The proper care of SCBAs involves:

1. inspection for defects,
2. cleaning and disinfecting,
3. repair, and
4. storage.

The following checklist is to be used by personnel whenever they have to check an SCBA. (Note: any discrepancy found should be cause to set the unit aside until it can be repaired by a certified repair-person.)

1. Preliminary inspection. Check to ensure that:

   a. high-pressure hose connector is tight on cylinder fitting,
   b. hypass valve is closed,
   c. mainline valve is closed,
   d. there is no cover or obstruction on regulator outlet, and
   e. pressure in the tank is at least 1,800 psi.

2. Backpack and harness assembly.

   a. Straps

      (1) Visually inspect for complete set.

      (2) Visually inspect for frayed or damaged straps that may break during use.

   b. Buckles

      (1) Visually inspect for mating ends.
      (2) Check locking function.

   c. Backplate and cylinder lock

      (1) Visually inspect backplate for cracks and for missing rivets or screws.

(2) Visually inspect cylinder hold-down strap and physically check strap tightener and lock to ensure that it is fully engaged.

3. Cylinder and cylinder valve assembly

a. Cylinder

(1) Physically check cylinder to ensure that it is tightly fastened to backplate.

(2) Check hydrostatic test date to ensure that it is current[1].

(3) Visually inspect cylinder for large dents or gouges in metal.

b. Head and valve assembly

(1) Visually inspect cylinder valve lock for presence.

(2) Visually inspect cylinder gauge for condition of face, needle, and lens.

(3) Open cylinder valve and listen or feel for leakage around packing. (If leakage is noted, do not use until repaired.) Note function of valve lock.

4. Regulator and high-pressure hose

a. High-pressure hose and connector

Listen or feel for leakage in hose or at hose-to-cylinder connector. (Bubble in outer hose covering may be caused by seepage of air through hose when stored under pressure. This does not necessarily mean a faulty hose.)

b. Regulator and low-pressure alarm

(1) Cover outlet of regulator with palm of hand. Open mainline valve and read regulator gauge (must read at least 1,800 psi and not more than rated cylinder pressure).

(2) Close cylinder valve and slowly move hand from regulator outlet to allow slow flow of air. Gauge should begin to show immediate loss of pressure as air flows. Low-pressure alarm should sound between 650 and 550 psi. Remove hand completely from outlet and close mainline valve.

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[1]Monthly inspection only.

(3) Place mouth onto or over regulator outlet and blow. A positive pressure should be created and maintained for 5 to 10 seconds without any loss of air. Next, establish a slight negative pressure in regulator and hold for 5 to 10 seconds. Vacuum should remain constant. This tests the integrity of the diaphragm. Any loss of pressure or vacuum during this test indicates a leak in the apparatus.

(4) Open cylinder valve.

(5) Place hand over regulator outlet and open mainline valve. Remove hand from outlet and replace in rapid movement. Repeat twice. Air should escape when hand is removed each time, indicating a positive pressure in chamber. Close mainline valve and remove hand from outlet.

(6) Ascertain that no obstruction is in or over the regulator outlet. Open and close the bypass valve momentarily to ensure flow of air through bypass system.

5. Facepiece and corrugated breathing tube.

a. Facepiece

(1) Visually inspect head harness for damaged serrations and deteriorated rubber. Visually inspect rubber facepiece body for signs of deterioration or extreme distortion.

(2) Visually inspect lens for proper seal in rubber facepiece, retaining clamp properly in place, and cracks or large scratches.

(3) Visually inspect exhalation valve for visible deterioration or foreign materials buildup.

b. Breathing tube and connector

(1) Stretch breathing tube and visually inspect for deterioration and holes.

(2) Visually inspect connector to ensure good condition of threads and for presence and proper condition of "O" ring or rubber gasket seal.

(3) Negative pressure test on facepiece[2]

(a) Don backpack and facepiece.

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[2]For regular monthly inspection, only steps (b) and (c) of procedure are necessary.

(b) With facepiece held tightly to face or facepiece properly donned, stretch breathing tube to open corrugations and place thumb or hand over end of connector.

(c) Inhale. Negative pressure should be created inside mask, causing it to pull tightly to face. This negative pressure should be maintained for 5 to 10 sec. If negative pressure leaks down, the facepiece assembly is not adequate and should not be worn.

6. Storage of units. Check that:

a. cylinder is refilled as necessary and unit is cleaned and inspected,

b. cylinder valve is closed,

c. high-pressure hose connector is tight on cylinder,

d. pressure is bled off high-pressure hose and regulator,

e. bypass valve is closed,

f. mainline valve is closed,

g. all straps are completely loosened and laid straight, and

h. facepiece is properly stored to protect against dust, sunlight, heat, extreme cold, excess moisture, and damaging chemicals.

10.7 CLEANING AND SANITIZING. Any good detergent may be used followed by a disinfecting rinse or a combination disinfectant-detergent for a one step operation. Reliable, effective disinfectants may be made from readily available household solutions, including the following.

1. A Hypochlorite solution (50 ppm of chlorine) can be made by adding approximately two milliliters of bleach (such as Clorox) to one liter of water, or two tablespoons of bleach per gallon of water. A 2-minute immersion disinfects the respirators.

2. An aqueous solution of iodine (50 ppm of iodine) can be made by adding approximately 0.8 milliliters of tincture of iodine per liter of water, or 1 teaspoon of tincture of iodine per gallon of water. Again, a 2-minute immersion is sufficient.

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

10.8 RINSING. The cleaned and disinfected respirators should be rinsed thoroughly in water (140 °F maximum) to remove all traces of detergent and disinfectant. This is very important for preventing dermatitis.

10.9 DRYING. The respirators may be allowed to dry in room air on a clean surface. They may also be hung from a horizontal wire, like drying clothes, but care must be taken not to damage or distort the facepieces.

10.10 REASSEMBLY AND INSPECTION. The clean, dry respirator facepieces should be reassembled and inspected in an area separate from the disassembly area to avoid contamination. The inspection procedures have been discussed; special emphasis should be given to inspecting the respirators for detergent or soap residue left by inadequate rinsing. This appears most often under the seat of the exhalation valve, and can cause valve leakage or sticking.

The respirator should be thoroughly inspected and all defects corrected. New or retested cartridges and canisters should be installed, and the completely reassembled respirator should be tested for leaks.

For SCBA devices, the facepiece should be combined with the tested regulator and the fully charged cylinder, and an operational check performed.

10.11 MAINTENANCE AND REPAIR. Replacement or repair shall be done only by trained, experienced persons with parts designed for the respirator. Besides being contrary to OSHA requirements, substitution of parts from a different brand or type of respirator invalidates approval of the device.

This restriction applies particularly to maintenance of the more complicated devices, especially SCBA, and more specifically, regulator valves and low pressure warning devices. These devices should be returned to the manufacturer or to a trained technician for adjustment or repair.

No problems are anticipated in repairing and maintaining most simple respirators, particularly the commonly used air-purifying type.

10.12 RESPIRATOR STORAGE. Respirators must be stored to protect against:

1. dust,
2. sunlight,
3. heat,
4. extreme cold,
5. excessive moisture,
6. damaging chemicals, and
7. mechanical damage.

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

Freshly cleaned respirators should be placed in reusable plastic bags until reissue. They should be stored in a clean, dry location away from direct

sunlight. They should be placed in a single layer with the facepiece and exhalation valve in an undistorted position to prevent rubber or plastic from taking a permanent distorted "set".

APPENDIX C

CONFINED SPACE PROVISIONS

1. CONFINED SPACE CLASSIFICATION

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

2. ENTRY PROCEDURES

2.1 TEAM SIZE. A minimum of three workers is required for each confined space activity (two entry and one standby; or one entry, one rescue, and one standby). If the former is used, all three must be E.C. Jordan Co. (Jordan) employees. If the latter is used, the standby could be a non-Jordan team member, assuming he/she has comparable training, is proficient in the assigned duties, and is capable of using all safety equipment.

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

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

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

2.2 GENERAL ENTRY PROCEDURES. The following steps must be taken when entering a confined space.

1. Inspect all pieces of equipment to ensure they are in good working order. DO NOT ENTER CONFINED SPACE WITH DEFECTIVE EQUIPMENT.

2. Conduct a background check to identify all potential hazards that may be encountered in the confined space. Determine if there is a potential for fire/explosion hazards, as well as a potential for a toxic or oxygen-deficient atmosphere.

3. Before entry, the atmosphere inside the confined space must be tested. An attempt should be made to test the atmosphere without opening the entryway (i.e., through a vent line or a small opening). If the entryway must be opened to test and only low levels are expected in the confined space, crack open entryway, test breathing zone first, and then test the confined space. If potentially high levels are expected in the breathing zone, respiratory protection should be worn prior to opening the entryway cover.

4. If explosive, toxic, or oxygen-deficient atmosphere is detected, purge or ventilate the confined space prior to entry. Retest the atmosphere three times at 5-minute intervals. A person can enter the confined space without respiratory protection only if all three test results are below the Permissible Exposure Limit/Threshold Limit Value (PEL/TLV), 10 percent of the LEL, and above 19.5-percent oxygen (all three conditions must be met).

   NOTE: <u>any</u> downward deflection of the readings on the oxygen meter from background (i.e., 20.9 percent) should be viewed as a potential for an IDLH atmosphere. Unless contaminants are known to be nontoxic, do not enter the confined space without respiratory protection if the oxygen level is below background.

5. Blank, block, or otherwise isolate, lockout, and tag all chemical, physical, and/or electrical hazards wherever possible.

6. If using an air-purifying respirator or if an IDLH and/or explosive atmosphere exists, air monitoring must be on a continuous basis. If respiratory protection is not used and there is potential for atmospheric conditions to change due to work practices or conditions, air monitoring should be done periodically. In all these cases, a 5-minute escape pack must be used.

7. Record all results of the tests for hazardous conditions including the location, time, date, weather (if applicable), and readings on the PID, combustible gas meter, oxygen deficiency meter, Draeger tubes, and any other equipment used on the "Confined Space Entry Checklist-General Entry" form. Send a copy of the completed form to the Health and Safety Supervisor (HSS).

8. Wear appropriate clothing for site conditions, as determined by the Health and Safety Officer (HSO).

9. A safety belt or harness with lifeline <u>must</u> be worn if hazardous conditions exist, although good safety precautions dictate their use regardless of "existing" conditions. If the diameter of the entryway is less than 18 inches, the wrist-type harness must be used and special provisions made if a supplied air respirator is necessary.

10. One person (standby) must remain at the entryway at all times and must keep continuous contact with the person entering the confined space.

Contact can be maintained by line of sight, listening for sounds, the safety line, and/or radio. The standby person must not enter the confined space unless another trained person is available to act as standby, and he/she is equipped with adequate respiratory and dermal protection. (In most cases, respiratory protection would be an airline respirator or SCBA.)

11. Do not smoke when working in or near confined spaces and do not take flash-lighted photographs when explosive gases are known or suspected to be present.

12. Do not rely on permanent ladders because they are often in poor condition. If they must be used, be sure of footing. Inspect permanent ladders for deterioration before entering and while descending. Try each step with one foot, while standing on the step above. When in doubt, use a portable ladder of adequate height to reach 3 feet above opening or a rope ladder, or lower the entry person using the tripod. If a portable ladder is used, it should be tied off, if possible; otherwise, it should be held in place by the standby person.

13. Do not work without adequate lighting. Use only "explosion-proof" lights or hand lamps.

14. The entry person must not remain in the confined space if he/she becomes even slightly drowsy, faint, dizzy, or otherwise uncomfortable. Many of the gases that cause the most problems are odorless, tasteless, and invisible.

2.3 MANHOLE/SEWER ENTRY. When preparing to enter a manhole/sewer, the following safety measures must be taken.

1. Inspect all pieces of equipment to ensure they are all in good working order. DO NOT ENTER CONFINED SPACE WITH DEFECTIVE EQUIPMENT.

2. Park the vehicle near the manhole (do NOT leave the vehicle running). If the manhole is in the street, it is best to park so as to detour oncoming traffic around the manhole. The vehicle's emergency flashers and portable yellow warning beacon must be ON. The vehicle serves as protection from oncoming traffic, can be used to store emergency equipment (e.g., SCBA and first aid kit), and can be used in an extreme emergency to slowly pull an injured person from the confined space if a tripod with hoist attachment is unavailable or inoperative.

3. Erect portable barricades or cones around the manhole and in front of the vehicle to ensure traffic is adequately diverted and to prevent pedestrians from falling in. Reflective vests should be worn so that workers are visible to approaching traffic.

4. If there are openings large enough to admit sampling tubes, test for the presence of explosive and toxic gases before removing each manhole

cover. Otherwise, raise one side of the cover using the cover hook or pick, prop it slightly open, and conduct the tests.

5. If toxic or explosive gases are detected in the sewer, report this immediately to the local Fire Department and/or Department of Public Works.

6. Record the results of tests for hazardous conditions, including location, manhole number (if applicable), time and date, weather (if applicable), and the readings on the PID, combustible gas meter, oxygen deficiency meter, and Draeger tube on the Manhole/Sewer Entry Log Form. Send a completed copy of the form to the HSS.

7. Remove manhole covers with a cover hook or pick; do not improvise. Be careful of fingers and toes; the cover is usually heavy and difficult to handle. Unless the cover is extremely heavy, it is safer for only one worker to handle it.

8. Test the atmosphere; if a toxic, flammable, or oxygen-deficient atmosphere exists, ventilate the sewer. Depending on the hazard, ventilation can be accomplished in a variety of ways. For example, (1) remove and vent the adjoining upstream and downstream manhole covers, as soon as possible, and well in advance of entering the manhole (high hazard); and (2) vent the manhole in which entry will occur (very low hazard). If a blower is used, it is desirable to establish a flow of air in the sewer, <u>in</u> one manhole and <u>out</u> another. Ensure that the air intake is well away from automobile exhaust, and combustible and/or toxic atmospheres. Appropriate traffic control measures must be taken by barricading or otherwise marking the open manholes.

9. After ventilating, test for explosive and toxic gases and oxygen deficiency in the manhole at ground level and at the bottom; record results. If entering the sewer itself, make the same tests at the manholes at either end. If ventilation is necessary, monitor the atmosphere in the manhole while work progresses, or continue operation of the blower. Continuous monitoring (i.e., equipment ON during entire entry) is imperative because conditions within the sewer may change rapidly. Do not enter a manhole while there is an oxygen deficiency without a pressure-demand, air-supplied breathing apparatus. If the oxygen level is lower than 20.9 percent of background, caution must be taken because an IDLH atmosphere may exist.

10. When entering manholes or tanks, wear hardhats, protective clothing, and unless inappropriate, respiratory protection and safety belt or harness with lifeline. If the manhole is less than 18 inches in diameter, a wrist-type harness must be used and special provisions made if air-supplied respirators are necessary. When working in manholes greater than 12 feet deep, in the sewer itself, of where potential exists for gases to appear unexpectedly, a 5-minute emergency egress air supply is required (unless the time required to

don the emergency respirator is greater than what would be needed to exit the manhole).

11. At least one person (i.e., standby) must remain at the manhole at all times and must keep continuous contact with the person entering the sewer. Contact can be maintained by line of sight, listening for sounds, and the safety line and/or radio. The standby person must not enter the manhole unless another trained person is available to act as standby and has adequate respiratory and dermal protection available. (In most cases, respiratory protection will be an airline respirator or SCBA.) The standby/rescue person should be suited up (but not yet on air) before the work crew enters the confined space.

12. Do not smoke when working in or near manholes. Do not take flash-lighted photographs when explosive gases are known or suspected to be present.

13. Do not rely on the manhole ladders because they are often in poor condition. If they must be used, be sure of footing. Inspect manhole ladders for deterioration before entering and while descending. Try each step with one foot, while standing on the step above. When in doubt, use a portable or rope ladder of adequate height to reach 3 feet above the manhole opening, or lower the entry person using the tripod. If a portable ladder is used, it should be tied off if possible; otherwise, it should be held in place by the standby person.

14. Do not work without adequate lighting. Use only "explosion-proof" lights or hand lamps in the manhole or sewer.

15. The entry person must not remain in the manhole or sewer if he/she becomes even slightly drowsy, faint, dizzy, or otherwise uncomfortable. Remember that carbon monoxide, carbon dioxide, methane, and hydrogen sulfide, which cause the most trouble, are odorless (hydrogen sulfide has a distinct odor only during initial exposure), tasteless, and invisible.

APPENDIX D

VAPOR EMISSION RESPONSE PLAN

APPENDIX D
VAPOR EMISSION RESPONSE PLAN

The vapor emission response plan is divided into two sections: the minor and major emission responses.

Minor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 5 ppm above background in the breathing zone at the work zone perimeter (i.e., approximately 3 to 5 feet from and above borehole), the drilling activities will be halted and monitoring continued. If the organic level decreases below 5 ppm, then drilling activities can resume with increased monitoring.

Drilling activities can also resume (with appropriate personnel protection) if the organic level is above 5 ppm and below 50 ppm at the work zone perimeter, other parameters permitting (e.g., the LEL at the wellhead is below 20%, and the H_2S level is below 10 ppm). However, the organic level 200 feet downwind of the work zone must not exceed 5 ppm above background.

If the organic level is above 50 ppm, or the H_2S level is above 10 ppm at the work zone perimeter, then the Site Safety Officer must be notified and well drilling activities stopped.

If the LEL level exceeds 20% all drilling activities shall be stopped immediately and all engines (ignition sources) will be turned off. Drilling personnel will leave the area and notify the Site Safety Officer.

Major Emission Response Plan

If any of the following levels are identified approximately 200 feet downwind from the work zone perimeter, all drilling activities must stop:

1) organic levels greater than 5 ppm above background,

2) LEL greater than 20%, or

3) H_2S levels greater than 10 ppm.

If any of the above levels persist after cessation of drilling activities, then the following contingency plan shall be placed into effect.

1. The perimeter of the closest downwind residential or commercial property will be monitored. If organic vapor levels approach 5 ppm, or if H_2S levels approach 10 ppm above background, then the local police authorities will be immediately contacted by the Site Safety Officer.

2. The appropriate personnel listed on the Master Phone List are to be notified by the Site Safety Officer.

In the event of a significant gas release (sudden visual and/or audible release) or excessive volatile emissions (organic level greater than 5 ppm above background located 200 feet downwind) during the well drilling program, the response action described below will be carried out.

Response Action

The well drillers will immediately proceed as follows:

1) Break the drill rods at the nearest joint unless the rods can be removed from the hole in one lift.

2) As soon as possible, leave the site and notify the Site Safety Officer. The well drillers shall not proceed with remedial efforts until instructed to do so by the Site Safety Officer.

The Site Safety Officer will determine if a Minor or Major Vapor Emission condition (as defined in the previous Section) exists and will activate the appropriate Vapor Emission Response Plan.

If a major emission response action is warranted, the drillers, wearing the proper level of protection, will then seal off the borehole using a bentonite slurry grout and abandon the hole.

APPENDIX E

OSHA JOB SAFETY AND HEALTH PROTECTION POSTER

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm or employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides the employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discrimination.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory penalties against employers of up to $1,000 for each serious violation and for optional penalties of up to $1,000 for each nonserious violation. Penalties of up to $1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to $10,000 for each such violation.

Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of up to $250,000 (or $500,000 if the employer is a corporation), or by imprisonment for up to six months, or by both. Conviction of an employer after a first conviction doubles these maximum penalties.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control emplyee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can proivde considerable help and advice on solving safety and health problems or can refer you to other sources for health such as training.

Consultation

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

POSTING INSTRUCTIONS

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

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, Georgia	(404) 347-3573
Boston, Massachusetts	(617) 565-7164
Chicago, Illinois	(312) 353-2220
Dallas, Texas	(214) 767-4731
Denver, Colorado	(303) 844-3061
Kansas City, Missouri	(816) 426-5861
New York, New York	(212) 337-2325
Philadelphia, Pennsylvania	(215) 596-1201
San Francisco, California	(415) 995-5672
Settle, Washington	(206) 442-5930

Washington, D.C.
1989 (Revised)
OSHA 2203

Elizabeth Dole, Secretary of Labor

U.S. Department of Labor

Occupational Safety and Health Adminstration

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

APPENDIX F

EMERGENCY INFORMATION

(This Appendix must always be the last one. This is to allow for easy removal in order to post the information in the trailer. If the site does not have a trailer, it also allows the information to be found quickly in an emergency situation).

ROUTES TO EMERGENCY MEDICAL FACILITIES

NAS CECIL FIELD

Primary source of medical assistance:

Facility Name: Saint Vincent's Hospital

Address: 1800 Barrs, Jacksonville, Florida

Telephone Number: (904) 387-7395

Directions to primary source of medical assistance: (attach map)

Travel 12.5 miles northeast from the base on Highway 228 to Barrs Road, turn right, travel 0.05 mile; the hospital will be on the right side of the road.

Alternate Source of Medical Assistance:

Facility Name: Riverside Hospital

Address: 2033 Riverside Avenue, Jacksonville, Florida

Telephone Number: (904) 387-7070

Directions to alternate source of medical assistance: (attach map)

Travel 13 miles northeast from the base on Highway 228 to Margaret Street, turn right on Margaret Street then travel 0.03 mile; the hospital will be on the right side of the road.

EMERGENCY SIGNALS

In most cases, field personnel will carry portable radios for communications. If this is the case, a transmission that indicates it is of an emergency nature will take priority over all other transmissions. All other site radios will yield the frequency to the emergency transmissions.

Where radio communication is not available, the following air-horn signals will be used:

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

(Enter any other site-specific emergency signals deemed necessary.)

EMERGENCY TELEPHONE NUMBERS

NAS Cecil Field

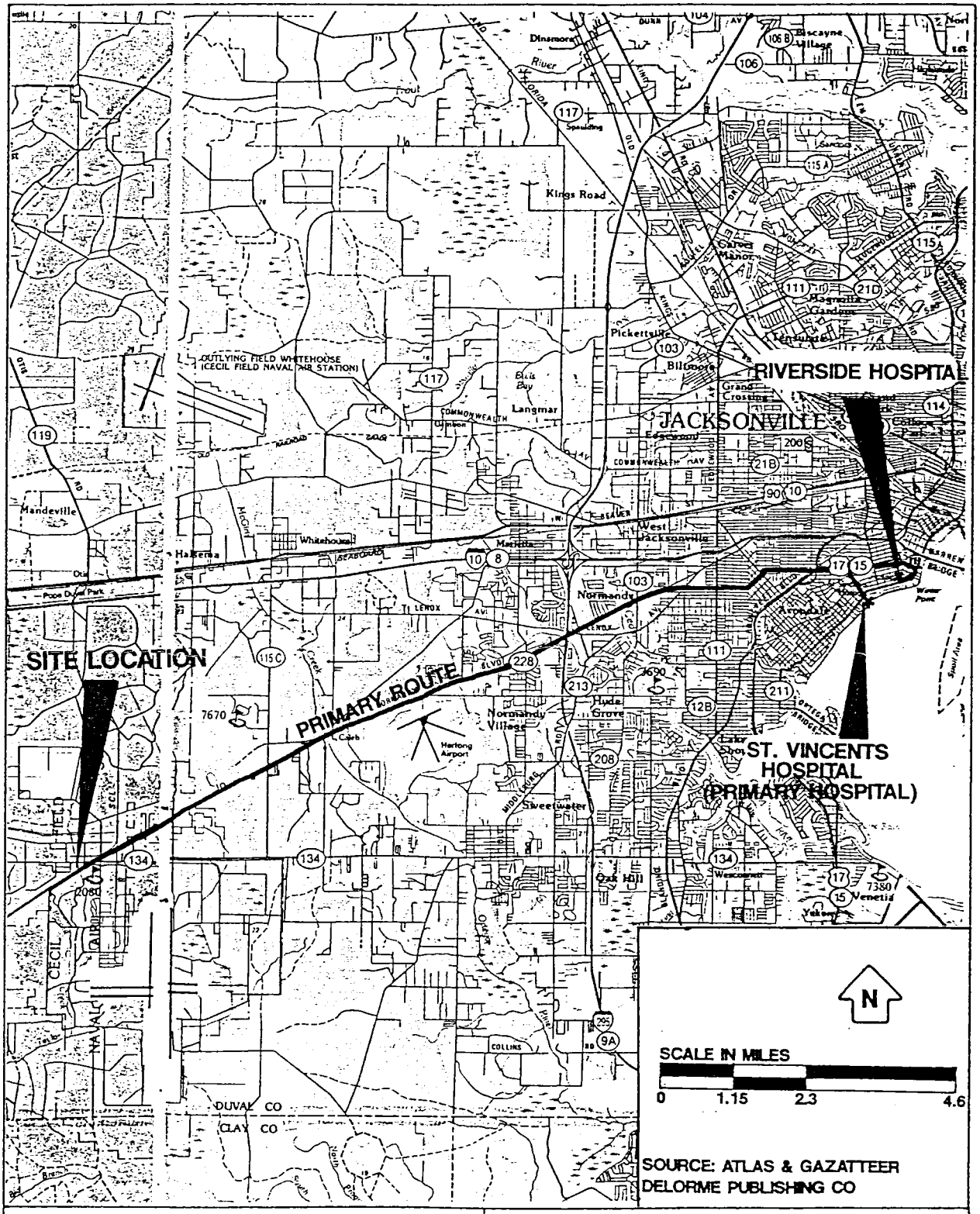
(On base) Police Department	(904) 778-5381
(On base) Fire Department	(904) 778-5333
(On base) Rescue	(904) 778-5212
St. Vincents Hospital	(904) 387-7395
Riverside Hospital	(904) 387-7070

Other Contacts

National Poison Control Center	(800) 492-2414
Maine Poison Control Center	(207) 871-2950
National Response Center	(800) 424-8802
Regional USEPA Emergency Response	(800) 414-8802
Chemical Manufacturers Association	
Chemical Referral Center	(800) 262-8200
Site HSO: Kevin Warner	(800) 476-1293
Site Manager: Ken Busen	(800) 476-1293
Regional HSS: Jack Davis	(800) 476-1293
ABB Environmental HSM: Cindy Sundquist	(800) 341-0460 ext 2101

EMERGENCY CONTACTS

Dr. Frank Lawrence	(207) 871-2617
Bruce Campbell, RPh	(207) 871-2449
Florida Poison Control Center	(800) 282-3171
E.C. Jordan (Maine)	(800) 341-0460
E.C. Jordan (Florida)	(800) 476-1293
USEPA Emergency Response	(800) 414-8802



HEALTH AND SAFETY PLAN
ROUTE TO ST. VINCENTS HOSPITAL
AND RIVERSIDE HOSPITAL

CONTAMINATION ASSESSMENT
INVESTIGATIONS

NAVAL AIR STATION
CECIL FIELD
JACKSONVILLE, FLORIDA

Project: Contamination Assessments at NAS Cecil Field

Name: Mark Diblin

Home Address: 121 Ferndale Drive

Tallahassee, Florida 32301

Home Phone: Area Code (904) 656-3162

DOB: 06-27-61 Height: 5'8" Weight: 150 lb

In case of emergency, contact: Melissa Diblin (wife)

Address: Same

Telephone (home): Area Code (904) 656-3162 (work): (904) 656-1293

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: None

Telephone: Area Code ( )

Project: Contamination Assessments at NAS Cecil Field

Name: Kevin Warner

Home Address: 285 Whetherbine Way Tallahassee, Florida 32301

Home Phone: Area Code (904) 878-5651

DOB: 11-05-62 Height: 6'0" Weight: 200 lb

In case of emergency, contact: Mary Warner (wife)

Address: Same

Telephone: Same

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: None

Telephone: Area Code ( )

Project: Contamination Assessments at NAS Cecil Field

Name: Jack Davis

Home Address: 513 Martin Street Tallahassee, Florida 32308

Home Phone: Area Code (904) 222-7073

DOB: 03-28-52 Height: 5'10" Weight: 165 lb

In case of emergency, contact: Cheryl S. Davis (wife)

Address: Same

Telephone: Same

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: Capital Health Plan

Telephone: Area Code (904) 386-3121

Project: Contamination Assessments at NAS Cecil Field

Name: Eric A. Blomberg

Home Address: 1414-C Shallow Brook Tallahassee, Florida 32301

Home Phone: Area Code (904) 656-7915

DOB: 05-22-63 Height: 6'02" Weight: 180 lb

In case of emergency, contact: John Blomberg (father)

Address: 2900 Brookside Cr., Parkersburg, West Virginia 26104

Telephone: Area Code (304) 428-2074

Do you wear contacts? (X) Yes ( ) No

Allergies: Bee stings

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: None

Telephone:

Project: Contamination Assessments at NAS Cecil Field

Name: Kenneth L. Busen

Home Address: Route 35, Box 2920, Tallahassee, Florida 32310

Home Phone: Area Code (904) 926-6037

DOB: 01-26-50 Height: 6'0" Weight: 172 lb

In case of emergency, contact: Karen Busen (wife)

Address: Same

Telephone: Same

Do you wear contacts? ( ) Yes (X) No

Allergies: Benedryl

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: None

Telephone:

Project: Contamination Assessments NAS Cecil Field

Name: Harry B. Hooper II

Home Address: 4425 Widgeon Way, Tallahassee, Florida 32303

Home Phone: Area Code (904) 562-5261

DOB: 04-25-48 Height: 5'11" Weight: 225 lb

In case of emergency, contact: Elena M. Hooper (wife)

Address: Same

Telephone: Same

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: lime eg. wet concrete

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: William T. Kepper, M.D.

Telephone: Area Code (904) 877-5143

Project: Contamination Assessments at NAS Cecil Field

Name: J. Michael Wilson

Home Address: 290 Teal Lane

Tallahassee, Florida 32308

Home Phone: Area Code (904) 942-4852

DOB: 07-28-59 Height: 6' Weight: 250 lb

In case of emergency, contact: Mary Wilson (wife)

Address: Same

Telephone (home): Area Code (904) 942-4852 (work): (904) 656-1293

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: None

Telephone: Area Code ( )

Project: Contamination Assessments at NAS Cecil Field

Name: Frances Hartnett

Home Address: 1207 Semalachee Drive

Tallahassee, Florida 32308

Home Phone: Area Code (904) 942-1652

DOB: 08-20-59 Height: 5'3" Weight: 128 lb

In case of emergency, contact: Rao Angara (spouse)

Address: Same

Telephone (home): Area Code (904) 942-4852 (work): (904) 656-1293

Do you wear contacts? ( ) Yes (X) No

Allergies: Pollens

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: Dr. Leslie Wilson, TMRMC Family Practice

Telephone: Area Code (904) 681-5431

Project: Contamination Assessments at NAS Cecil Field

Name: Andrew J. DeSandro

Home Address: 1984 Midyette Road

Tallahassee, Florida 32301

Home Phone: Area Code (904) 942-4756

DOB: 04-14-62 Height: 6' Weight: 165 lb

In case of emergency, contact: E.J. DeSandro

Address: Rte 1, Box 227, Grand Ridge, Florida 32442

Telephone (home): Area Code (904) 595-5148

Do you wear contacts? ( ) Yes (X) No

Allergies: None

List medication taken regularly: None

Particular sensitivities: None

Previous/recent illnesses or exposures to hazardous chemicals: None

Name of Personal Physician: None

Telephone: Area Code ( )

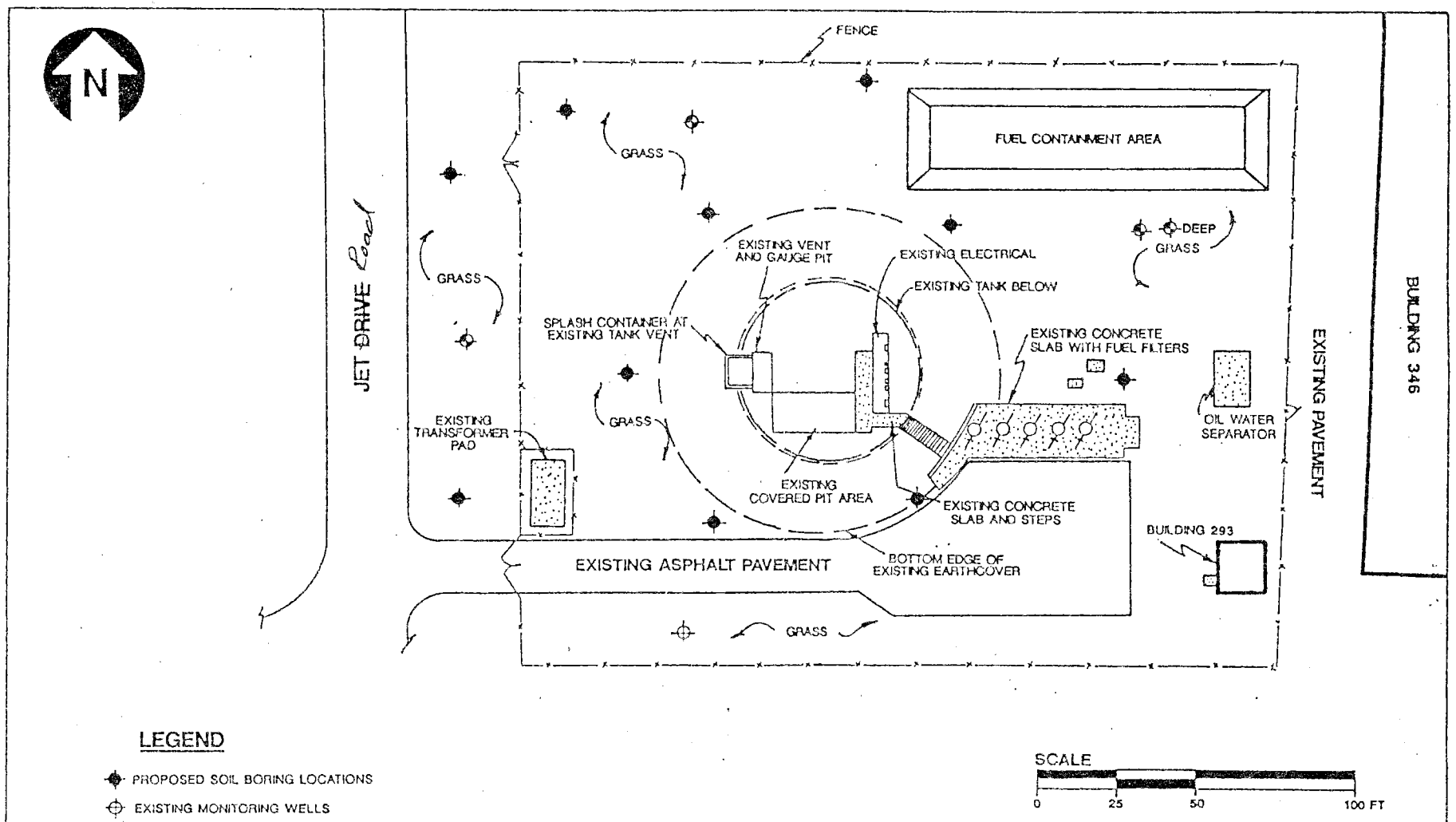


FIGURE 6

DAY TANK
FACILITY 293
SITE MAP

CONTAMINATION ASSESSMENT INVESTIGATIONS

NAVAL AIR STATION
CECIL FIELD
JACKSONVILLE, FLORIDA

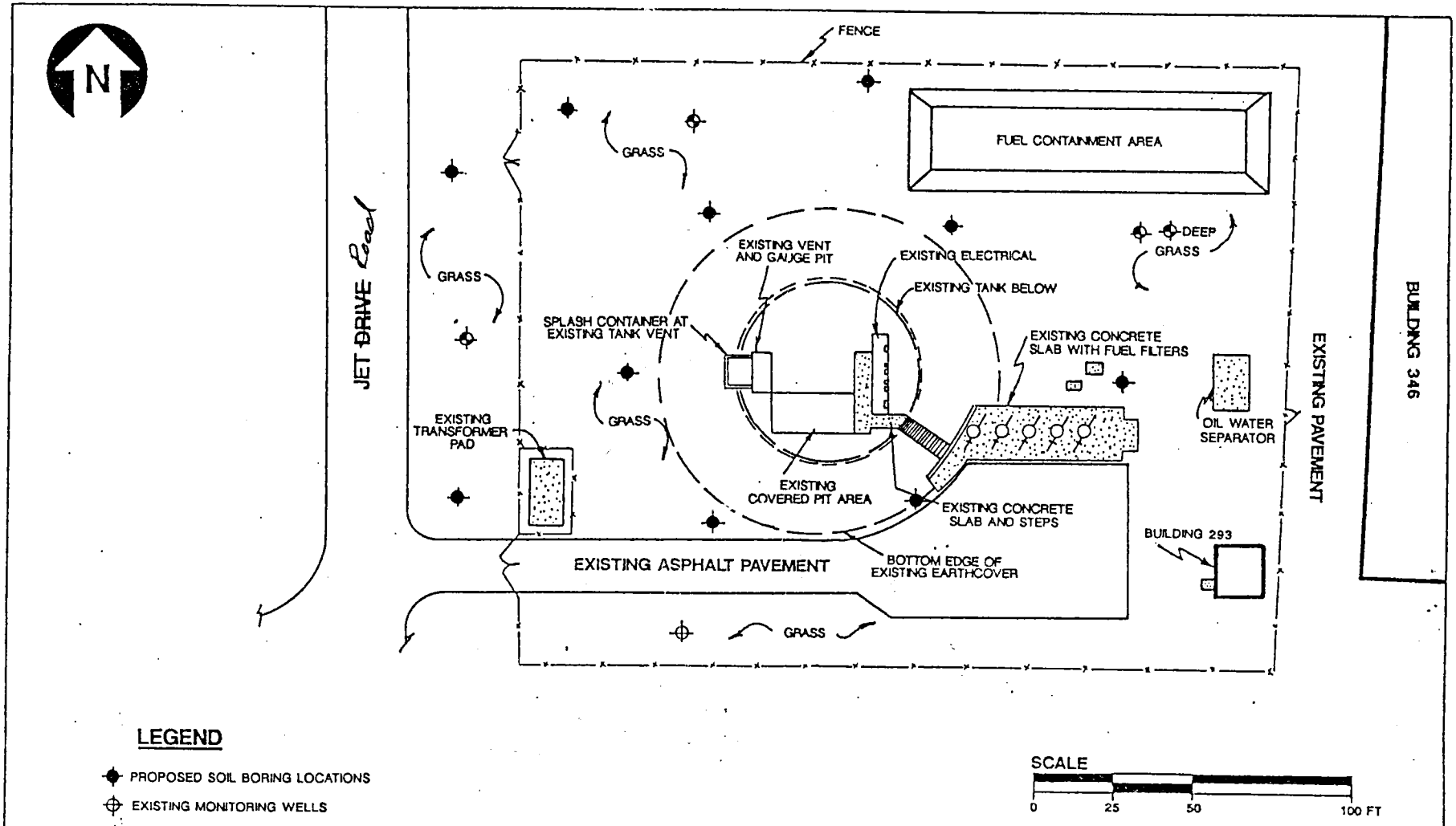


FIGURE 6

DAY TANK
FACILITY 293
SITE MAP

CONTAMINATION ASSESSMENT INVESTIGATIONS

NAVAL AIR STATION
CECIL FIELD
JACKSONVILLE, FLORIDA

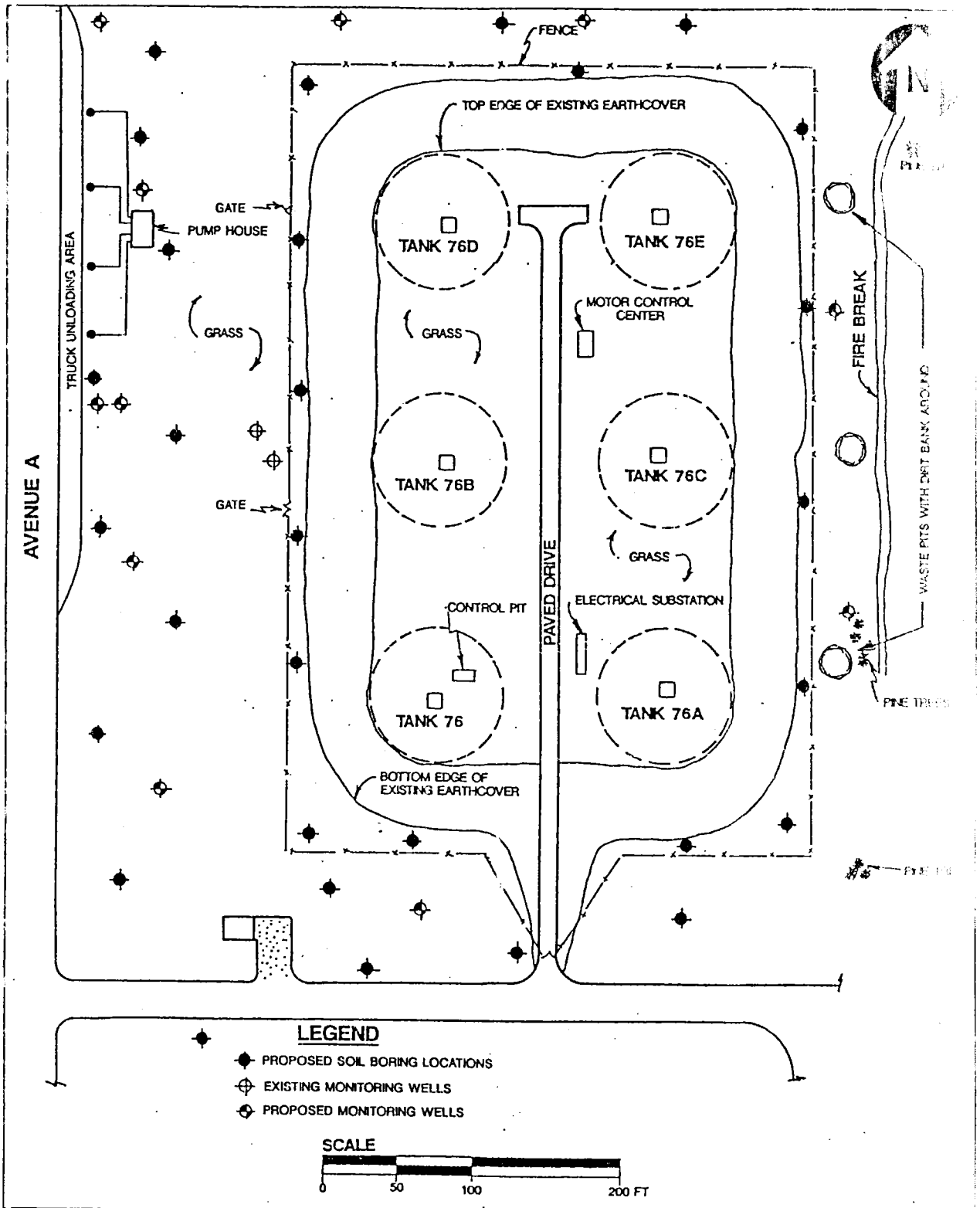


FIGURE 5

NORTH FUEL FARM
FACILITY 76
SITE MAP

CONTAMINATION ASSESSMENT
INVESTIGATIONS

NAVAL AIR STATION
CECIL FIELD
JACKSONVILLE, FLORIDA

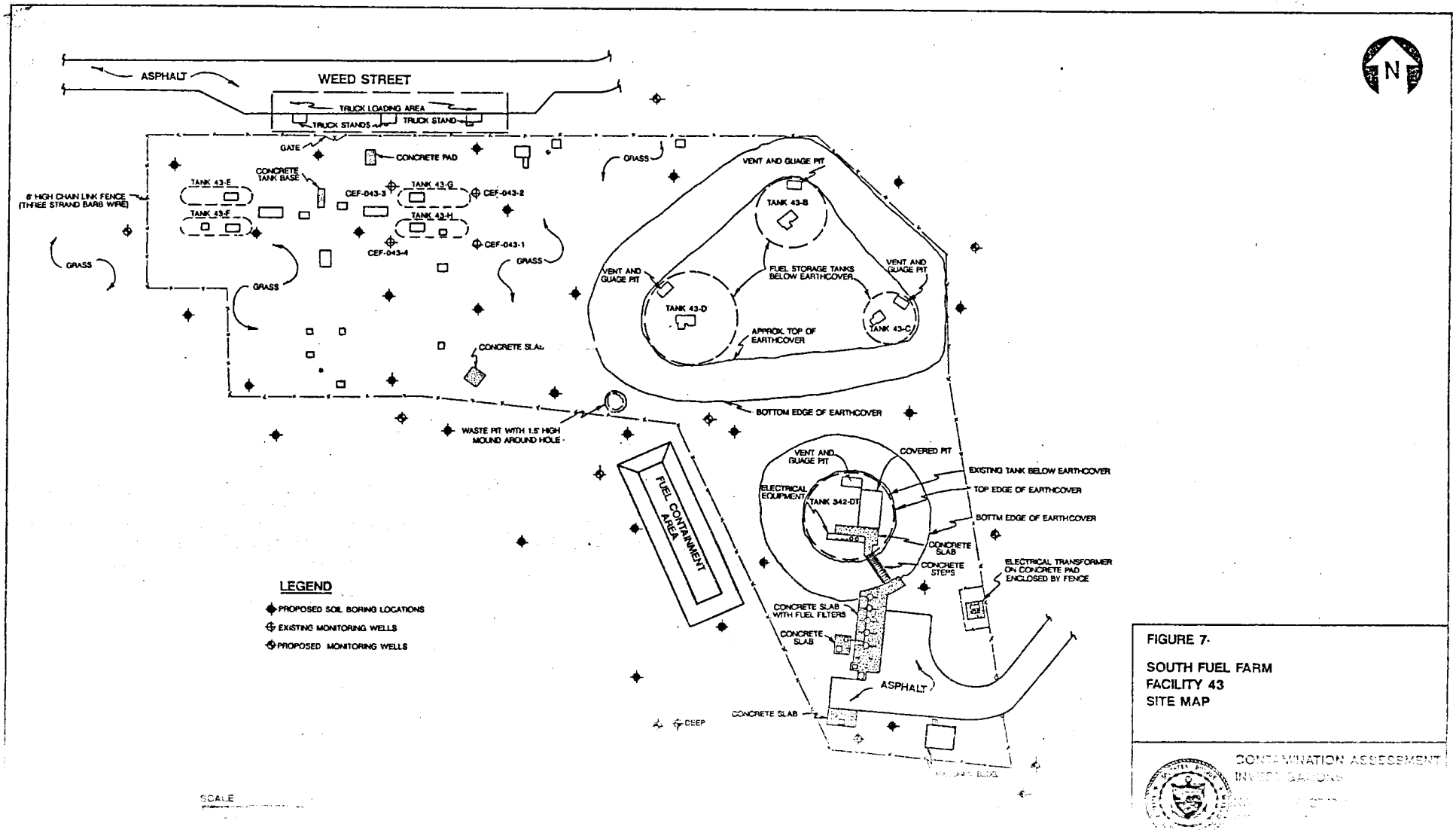


FIGURE 7-

SOUTH FUEL FARM
FACILITY 43
SITE MAP

CONTAMINATION ASSESSMENT
INVESTIGATION

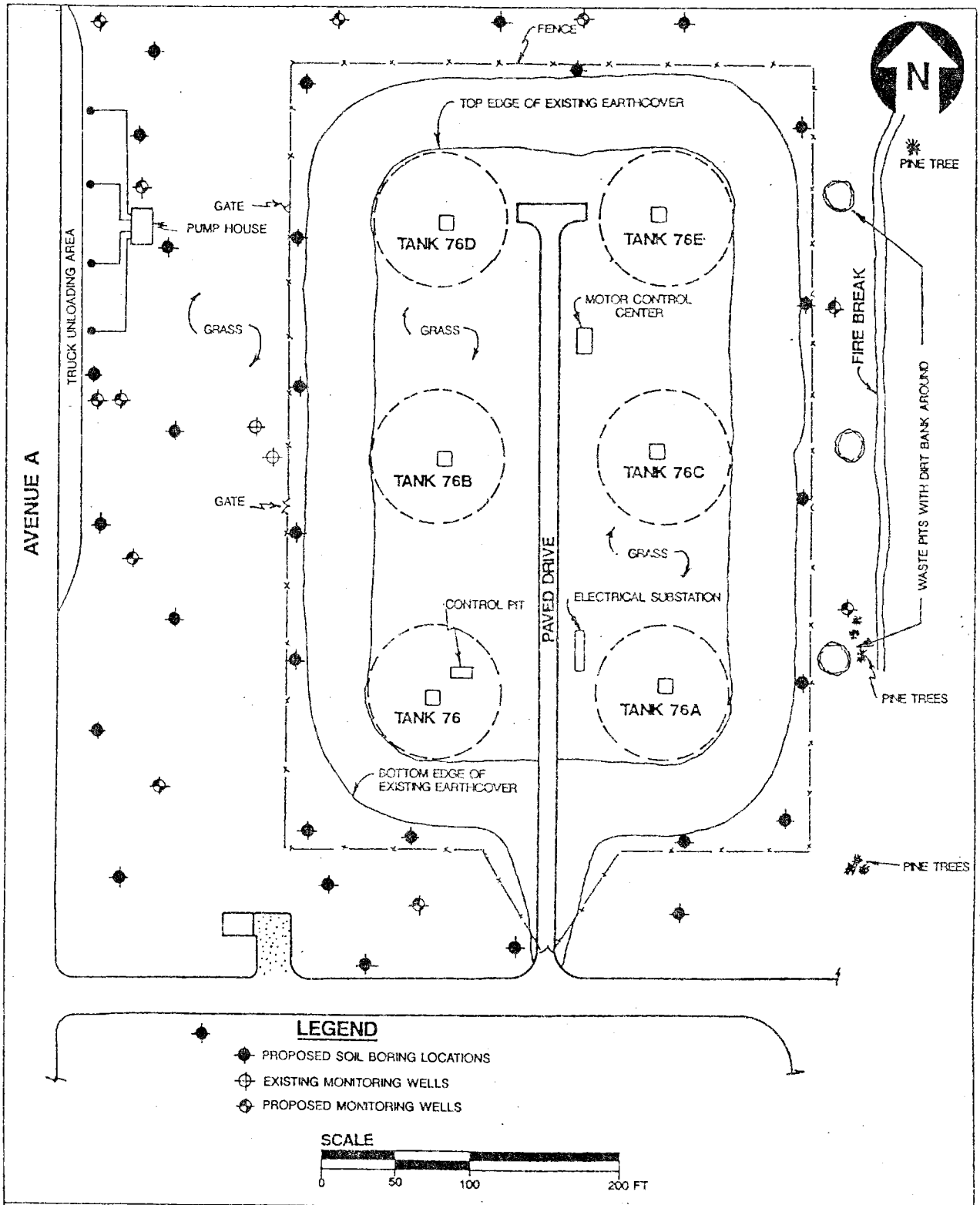


FIGURE 5

NORTH FUEL FARM
FACILITY 76
SITE MAP

CONTAMINATION ASSESSMENT INVESTIGATIONS

NAVAL AIR STATION
CECIL FIELD
JACKSONVILLE, FLORIDA

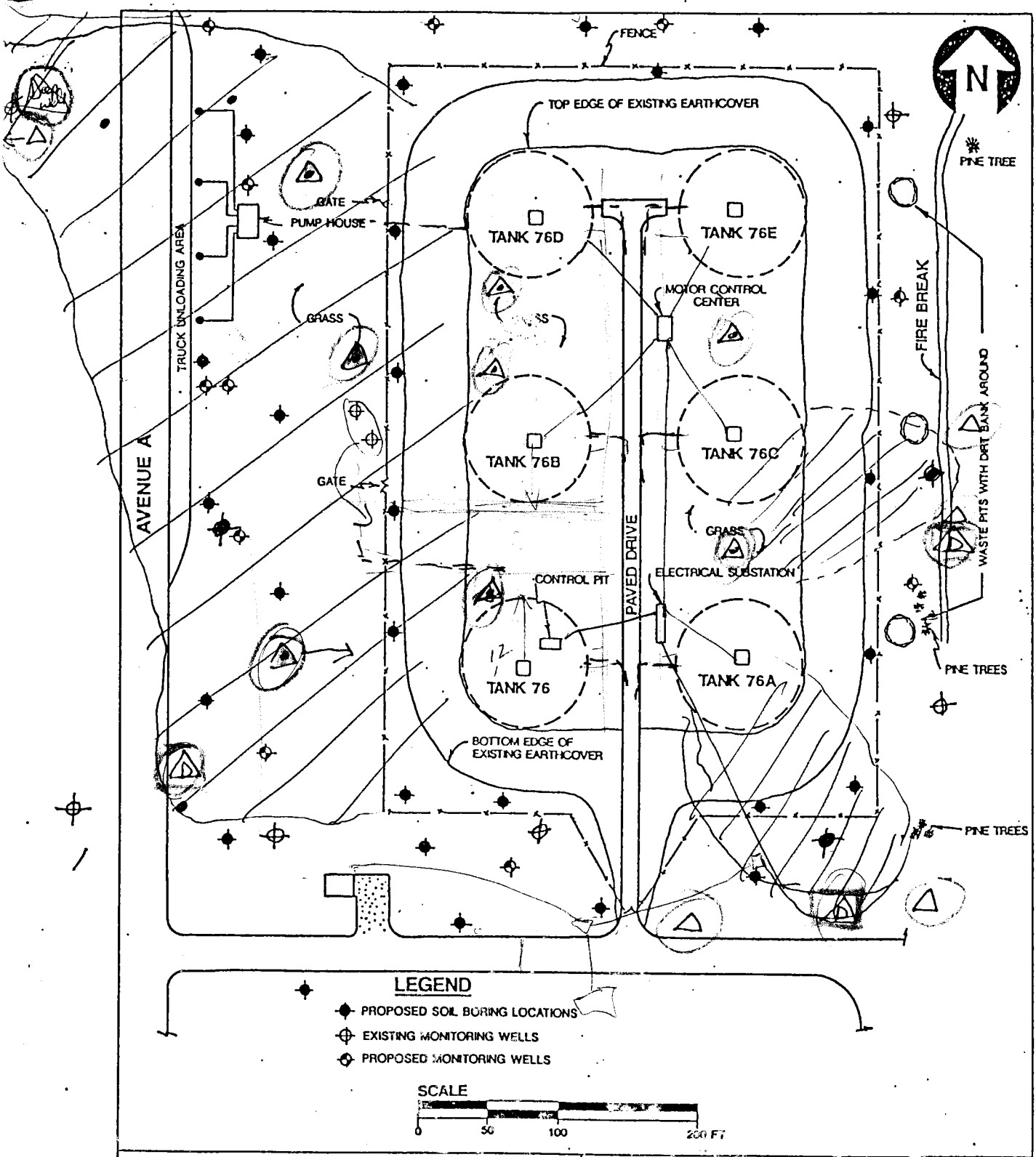


FIGURE 5

NORTH FUEL FARM
FACILITY 76
SITE MAP

CONTAMINATION ASSESSMENT
INVESTIGATIONS

NAVAL AIR STATION
CECIL FIELD
JACKSONVILLE, FLORIDA