

CLEAN

Contract No. N62474-88-D-5086

Contract Task Order No. 0283

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**NAVAL WEAPONS STATION
CONCORD, CALIFORNIA**

**SOLID WASTE MANAGEMENT UNIT
SITE INVESTIGATION**

DRAFT FINAL HEALTH AND SAFETY PLAN

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REVIEWS AND APPROVALS

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**NAVAL WEAPONS STATION CONCORD, CALIFORNIA
SOLID WASTE MANAGEMENT UNIT**

We, the undersigned, have read and approve of the health and safety guidelines presented in this Health and Safety Plan (HSP) for on-site work activities at Naval Weapons Station Concord, California - Solid Waste Management Unit.

| | Signature | Date |
|---|-----------|-------|
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| Ksenija Mikulicic CLEAN Health and Safety Coordinator (HSC) | _____ | _____ |
| Santiago Lee PRC's Project Manager (PM) | _____ | _____ |
| Ken Bowen On-site Health and Safety Officer (OHSO) | _____ | _____ |
| Subcontractor Health and Safety Officer | _____ | _____ |

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ABBREVIATIONS AND ACRONYMS

| | |
|-------------------|--|
| ANSI | American National Standards Institute |
| BAAQMD | Bay Area Air Quality Management District |
| BTEX | Benzene, toluene, ethylbenzene, and xylenes |
| ° C | Degrees Celsius |
| Cal EPA | California Environmental Protection Agency |
| CCCEHD | Contra Costa County Environmental Health Division |
| CCCSD | Contra Costa County Sanitary District |
| CCR | California Code of Regulations |
| CERCLA Act | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | Code of Federal Regulations |
| CGI | Combustible gas indicator |
| CI | Cast Iron |
| CLEAN | Comprehensive Long-Term Environmental Action Navy |
| COPC | Chemicals of potential concern |
| CPR | Cardiopulmonary resuscitation |
| CPRM | CLEAN Program Manager |
| CRZ | Contamination reduction zone |
| CTO | Contract Task Order |
| DDT | Dichlorodiphenyltrichloroethane |
| DTSC | Cal EPA, Department of Toxic Substances Control |
| E&E | Ecology and Environment, Inc. |
| EPA | U. S. Environmental Protection Agency |
| EZ | Exclusion zone |
| ° F | Degrees Fahrenheit |
| FTL | PRC's Field Team Leader |
| FM | Fugro-McClelland |
| FSP | Field Sampling Plan |
| HEPA | High efficiency particulate air |
| HLA | Harding Lawson Associates |
| HSC | PRC's Health and Safety Coordinator |
| HSP | Site-specific Health and Safety Plan |
| HSPM | CLEAN Health and Safety Program Manager |
| IAS | Initial Assessment Study |
| IDLH | Immediately dangerous to life or health |
| IRP | Installation Restoration Program |
| IT | International Technology Corporation |
| LEL | Lower explosive limit |
| MSHA | U. S. Mine Safety and Health Administration |
| mg/m ³ | milligrams per cubic meter |
| mph | Miles per hour |
| msl | Mean sea level |
| MSDS | Material Safety Data Sheet |

ABBREVIATIONS AND ACRONYMS
(Continued)

| | |
|---------|--|
| NIOSH | National Institute for Occupational Safety and Health |
| OHSO | PRC's On-site Health and Safety Officer |
| OM | Oxygen meter |
| OSHA | U. S. Occupational Safety and Health Administration |
| PAH | Polycyclic aromatic hydrocarbons |
| PCB | Polychlorinated biphenyls |
| PDS | Personnel decontamination station |
| PEL | OSHA Permissible Exposure Limit |
| PETN | Pentaerythritol tetranitrate |
| pH | Relative acidity or alkalinity of an aqueous solution |
| PID | Photoionization detector |
| PM | PRC's Project Manager |
| ppb | Parts per billion |
| PPE | Personal protective equipment |
| ppm | Parts per million |
| PRC | PRC Environmental Management, Inc. |
| PWC | Public works center |
| QC | Quality control |
| RCRA | Resource Conservation and Recovery Act |
| RDX | Hexahydro-1,3,5-trinitro-sym-triazine |
| RES | Riedel Environmental Services |
| RFA | RCRA Facility Assessment |
| RHSC | Radiation Health and Safety Committee |
| ROPS | Rollover protective structures |
| SCBA | Self-contained breathing apparatus |
| SFRWQCB | San Francisco Bay Regional Water Quality Control Board |
| SI | Site investigation |
| SVOC | Semivolatile organic compounds |
| SWMU | Solid Waste Management Unit |
| SWP | Safe work practices |
| SZ | Support zone |
| TBT | Tributyltin |
| TOC | Total organic carbon |
| TOG | Total oil and grease |
| TPH | Total petroleum hydrocarbons |
| TPHd | Total petroleum hydrocarbons as diesel |
| TPHg | Total petroleum hydrocarbons as gasoline |
| TTLCS | Total threshold limit concentrations |
| UCP | Unglazed clay pipe |
| USCG | U. S. Coast Guard |
| UST | Underground storage tank |
| VCP | Vitrified clay pipe |
| VOC | Volatile organic compounds |
| WPNSTA | Naval Weapons Station |

ABBREVIATIONS AND ACRONYMS
(Continued)

WESTDIV Western Division, U. S. Navy Facilities Engineering Command

1.0 INTRODUCTION

PRC Environmental Management, Inc. (PRC) received Contract Task Order (CTO) No. 0283 from the Western Division, U. S. Naval Facilities Engineering Command (WESTDIV) under Contract No. 62474-88-D-5086 to conduct site investigations (SI) at 24 solid waste management units (SWMU) at Naval Weapons Station (WPNSTA) Concord, California. The health and safety provisions in this site-specific Health and Safety Plan (HSP) have been developed for use during SI activities to be performed at WPNSTA Concord in summer of 1994. Applicable regulations include:

- Federal Occupational Safety and Health Administration (OSHA) requirements for general industry under Title 29, Code of Federal Regulations, Part 1910 (29 CFR 1910), "Occupational Safety and Health Standards."
- 29 CFR 1910.120 (29 CFR 1910.120), "Hazardous Waste Operations and Emergency Response."
- 29 CFR 1910.146, "Permit-required Confined Spaces."
- 29 CFR 1910.1200, "Hazard Communication."
- 29 CFR 1910, Subpart Z, "Toxic and Hazardous Substances."
- 29 CFR 1926, "Safety and Health Regulations for Construction."
- Environmental Protection Agency (EPA), "Standard Operating Safety Guides, 1992."
- National Institute for Occupational Safety and Health, Occupational Safety and Health Administration, U.S. Coast Guard, and the Environmental Protection Agency, "Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities," 1985.
- Title 8, "Industrial Relations," California Code of Regulations, Chapter 3.2 (8 CCR 3.2), "California Occupational Safety and Health Regulations."
- 8 CCR Chapter 4, "Division of Industrial Safety," Subchapter 7, "General Industry Safety Orders," Article 109, "Hazardous Substances and Processes," § 5192, "Hazardous Waste Operations and Emergency Response."
- 8 CCR 4, Subchapter 7, Article 108, § 5156, "Confined Spaces."

This site-specific HSP also has been designed to meet the requirements of PRC's CLEAN Health and Safety Program, June 25, 1993. The site-specific HSP also will comply with Navy's environmental

health and safety requirements. This document will be provided to all on-site personnel who may be exposed to hazardous on-site conditions, including PRC and subcontractor personnel and site visitors participating in site investigations.

The purpose of this site-specific HSP is to define health and safety requirements and designate the protocols to be followed during SI activities for SWMU at WPNSTA Concord. All personnel on site, including PRC and subcontractor employees, and site visitors, must be informed of site emergency response procedures and any potential fire, explosion, health, or safety hazards of on-site activities. This site-specific HSP summarizes potential hazards and defines protective measures planned for the site activities.

This site-specific HSP was reviewed and approved by the CLEAN Health and Safety Program Manager (HSPM), Health and Safety Coordinator (HSC), PRC's responsible Project Manager (PM), site-specific On-site Health and Safety Officer (OHSO), and subcontractor Health and Safety Officer (see the Reviews and Approvals form before the Table of Contents in this document). The Health and Safety Plan Compliance Agreement Form shown as Attachment A must be signed by all personnel before they enter the site. Any revisions to this site-specific HSP must be approved by the HSPM.

2.0 HEALTH AND SAFETY PLAN ENFORCEMENT

This section describes the responsibilities of project personnel and summarizes requirements for subcontractors and visitors who wish to enter the WPNSTA Concord SWMU sites during field activities.

2.1 PROJECT PERSONNEL

PRC's responsible PM, PRC's Field Team Leader (FTL), HSPM, and site-specific OHSO will be responsible for implementation and enforcement of the health and safety provisions of PRC's CLEAN Health and Safety Program and this site-specific HSP. Their duties are described in the following sections. Other personnel responsible for implementation and enforcement of this site-specific HSP are identified in the "Health and Safety Plan Compliance Agreement Form" of this site-specific HSP, shown as Attachment A. Hazardous waste site workers who do not meet the training and medical

surveillance requirements stated above will not be allowed to conduct field work at a CLEAN project work site.

2.1.1 CLEAN Health and Safety Program Manager

Fred Stanley, Ph.D., Certified Industrial Hygienist (CIH), No. 791, Certified Hazardous Materials Manager (CHME) No. 093, and Certified Safety Executive (CSE), No. 169, in PRC's San Francisco office, is the HSPM for PRC's CLEAN program. Dr. Stanley reports directly to the CLEAN Program Manager (CPRM), Daniel Chow, and he is responsible for developing, establishing, and coordinating the implementation of health and safety policies and procedures for PRC's CLEAN Health and Safety Program.

The responsibilities of the HSPM include the following:

- Assist the CPRM in ensuring compliance with all federal, state, and local regulations and Navy requirements.
- Coordinate with PRC's responsible Project Managers (PM) the preparation of site-specific HSPs.
- Review all site-specific HSPs prepared by subcontractors for technical accuracy and make recommendations for corrective actions, when necessary, to comply with PRC's CLEAN Health and Safety Program, and federal, state, and local regulatory requirements.
- Review and approve all site-specific HSPs prepared by PRC's staff for technical accuracy, and make recommendations for corrective actions, when necessary, for compliance with PRC's CLEAN Health and Safety Program, and federal and state regulatory requirements.
- Designate PRC's site-specific OHSO for each specific CLEAN project work site, in coordination with PRC's responsible PM, where PRC's personnel will be working on or managing a CTO for the U.S. Navy.
- Determine the qualifications of PRC's project personnel to work on CLEAN project work sites based on a review of physician's written opinions associated work restrictions, if any, and training records.
- Maintain liaison with a consulting occupational medicine physician who is certified by the American Board of Occupational Medicine to assist the HSPM, by request, in medical matters. An example of consultation would be the assessment of potential

health hazards encountered for a particular CLEAN project work site while it is in the planning stages.

- Interface between PRC and regulatory agencies regarding health and safety issues.
- Interface with other contractors, subcontractors, and visitors concerning application of PRC's CLEAN Health and Safety Program.
- Participate in audits to evaluate compliance with PRC's CLEAN Health and Safety Program, and this site-specific HSP.
- Assist the CPRM in investigating and reporting accidents/incidents, preparing accident/incident reports, and implementing corrective actions taken to eliminate potential causes of future accidents/incidents.

2.1.2 CLEAN Health and Safety Coordinator

Ksenija Mikulicic, in PRC's San Francisco office, is the CLEAN Health and Safety Coordinator. With the assistance of the HSPM, she is responsible for coordinating the office functions to help ensure that all provisions of PRC's CLEAN Health and Safety Program are implemented. She serves as the alternate to the HSPM in his absence and also serves as the liaison between PRC's San Francisco office and PRC's Health and Safety Director in Chicago, Illinois.

She also is responsible for maintaining up-to-date records of site-specific HSP-related documentation and site-specific HSP participants. Site-specific HSP-related documentation will be maintained at PRC's San Francisco office. Her responsibilities include the following:

- Review site-specific HSPs prepared by PRC and subcontractor's staff for technical adequacy and compliance with PRC's Health and Safety Program before submittal to the HSPM.
- Coordinate with PRC's responsible PMs the use of the Health and Safety Tracking Form, shown as Attachment D in accordance with Chapter 4.3, "Health and Safety Plan Tracking Form."
- Documentation of a fit test for workers required to wear respiratory protection equipment [meeting the requirements of 29 CFR 1910.134 and American National Standards Institute (ANSI) Z88.2-1980]
- Ensure proper scheduling and coordinating of health and safety training programs and activities for PRC personnel.

- Ensure that proper records of PRC personnel training completion are maintained.
- Ensure proper scheduling and coordinating of required medical examinations for PRC personnel.
- Ensure that proper records of medical examinations for PRC personnel are maintained.
- Maintain a file of physicians written opinions on PRC personnel who work at CLEAN project work sites.

2.1.3 PRC's Project Manager

PRC's responsible PM, Santiago Lee, with the assistance of PRC's FTL, is responsible for the job-related health and safety of personnel under their supervision and for managing the risks associated with equipment and facilities under their control at the 24 SWMUs at WPNSTA Concord. PRC's PM is responsible for full implementation of PRC's CLEAN Health and Safety Program. His responsibilities include the following:

- Notify the HSPM of all upcoming projects under the jurisdiction of PRC's CLEAN Health and Safety Program.
- Notify the HSPM of any upcoming project that may involve potential exposure of personnel to hazardous chemicals.
- Furnish complete and approved project work plans for CLEAN project work sites to the HSPM that define work tasks and objectives and identify the methods to accomplish those tasks and objectives.
- Prepare site-specific HSPs for CLEAN project work sites in consultation with the HSPM, and PRC's site-specific OHSO, as appropriate.
- Provide for the safe operation of facilities, equipment, and vehicles under his control during work at WPNSTA Concord.
- Enforce site-specific rules and procedures at WPNSTA Concord sites in the site-specific HSP for the healthful and safe performance of the work done by PRC's CLEAN project field team members.
- Take prudent measures to reduce health and safety hazards or to correct unsafe conditions or actions when made aware of such unsafe or potentially unsafe work conditions.
- Participate in the completion of investigation and corrective action reports.

2.1.4 PRC's On-site Health and Safety Officer

PRC's site-specific OHSO, Ken Bowen, appointed by the PRC's responsible PM and approved by the HSPM, will be responsible for field implementation and enforcement of PRC's CLEAN Health and Safety Program and this site-specific HSP. The site-specific OHSO will have advanced field work experience and will be familiar with health and safety requirements specific to the project.

PRC's site-specific OHSO's responsibilities include the following:

- Serve as the initial contact for all site-specific health and safety activities at WPNSTA Concord sites.
- Coordinate the preparation of an adequate site-specific HSP at WPNSTA Concord sites with PRC's responsible PM and the HSPM, as appropriate, addressing the specific project tasks and activities.
- Coordinate implementation of PRC's CLEAN Health and Safety Program with the HSPM, as appropriate.
- Seek guidance from the HSPM and PRC's responsible PM, as appropriate, when unanticipated conditions develop, and obtain approved site-specific HSP amendments at WPNSTA Concord sites before any planned deviation from the site-specific HSP.
- Assist PRC's responsible PM in documenting compliance with PRC's CLEAN Health and Safety Program and the site-specific HSP at WPNSTA Concord sites.
- Obtain documentation from all field personnel that they have received the required medical and training certification.
- Enforce written medical restrictions concerning PRC's employees working at WPNSTA Concord sites, when necessary.
- Conduct briefing sessions and provide documentation for all personnel attending the briefing sessions concerning the site-specific health and safety hazards, emergency procedures, and symptoms associated with exposures discussed at each briefing session at WPNSTA Concord sites.
- Document health and safety protection briefings, meetings, and training that were completed in the field.
- Determine the required personal level of protection based on guidance given in the site-specific HSP and on actual on-site operations at WPNSTA Concord sites.

- Assure the proper selection, use, care, inspection, and maintenance of all site-specific personal protective equipment (PPE) prior to and during any use at WPNSTA Concord sites.
- Assure that only respirators approved by National Institute for Occupational Safety and Health (NIOSH) or the Mining Safety and Health Administration (MSHA) are provided and used.
- Conduct respirator fit-testing of employees, if needed.
- Conduct air monitoring operations to determine the appropriate selection of PPE based on the required personal level of protection; evaluate changes in on-site operations at WPNSTA Concord sites; necessary changes in the personal level of protection required; and document the air monitoring operations and results.
- Ensure proper operation, calibration, and storage of required site-specific health and safety monitoring equipment at WPNSTA Concord sites.
- Provide appropriate health and safety supervision in regard to this site-specific HSP.
- Assist in decontamination of equipment and personnel, if applicable.
- Enforce the "buddy system" in accordance with 29 CFR 1910.120(a)(3), "Definitions" (organizing employees into work groups such that each employee is designated to be observed by at least one other employee in the work group) for all on-site work at WPNSTA Concord.
- Set up, enforce, and document decontamination operations for personnel and sampling equipment, sample containers, and heavy equipment.
- Suspend any operation that threatens the health or safety of PRC's CLEAN project field team members or the surrounding population, and immediately notify PRC's responsible PM.
- Determine and post locations and routes to medical facilities, arrange for emergency transportation to medical facilities, and post emergency service telephone numbers.
- Inspect and maintain the first aid kit and other emergency equipment.
- Notify the appropriate local public emergency offices, such as police and fire departments, of the nature of PRC's CLEAN project field team's operations.
- Assume the lead role during medical emergencies.
- Provide cardiopulmonary resuscitation (CPR) and first aid as necessary at all CLEAN project work sites.
- Observe work party members for symptoms of heat or cold overexposure or stress, and take prudent measures to evaluate and reduce, or treat these symptoms.

- Coordinate with PRC's responsible PM in preparing accident/incident reports.

The site-specific OHSO will ensure that the Health and Safety Plan Compliance Agreement Form shown as Attachment A, and the Health and Safety Meeting Sign-off Sheet (included as Attachment B) is signed by all personnel who are to perform field work at WPNSTA Concord. The site-specific OHSO also must ensure that each field worker completes a Daily Site Log (included as Attachment C) before leaving the site.

2.1.5 PRC's Field Team Leader

Ken Bowen is designated by PRC's responsible PM as PRC's field team leader (FTL). He has the delegated authority to direct all field activities. He will support PRC's responsible PM in ensuring compliance with PRC's CLEAN Health and Safety Program, and this site-specific HSP. He also will ensure that the necessary preparation and coordination for all operations, including occupational health and safety, is complete prior to initiating all field activities.

2.1.6 Field Technical Staff

Health and safety precautions are of paramount importance during on-site activities at all CLEAN project work sites. Despite thorough preparation, an employee may not have complete knowledge of site conditions, and it is impossible to anticipate every occupational health, safety, and ionizing radiation hazard that might arise. Therefore, the employee will use common sense, experience, and his or her best professional judgment at all times. The employee also will consult with PRC's site-specific OHSO for a pre-entry briefing before beginning on-site work, to review potential health, safety, and ionizing radiation hazards and safety precautions.

Whenever field personnel work at a CLEAN project work site, the field technical staff is required to be fully trained and medically certified. Each individual is responsible for demonstrating his or her familiarity with PRC's CLEAN Health and Safety Program. Flagrant or willful disregard for health and safety and radiation protection rules, regulations, or practices will result in disciplinary action.

All PRC field technical staff personnel will comply with the following:

- Reading and complying with PRC's CLEAN Health and Safety Program.
- Reading and complying with this HSP at WPNSTA Concord sites, including all of its attachments and amendments.
- Practicing reasonable health maintenance procedures. All employees of PRC and its subcontractors should realize that some personal habits, such as alcohol consumption, smoking, or controlled substance abuse, heighten the risks and deleterious effects resulting from exposure to contaminants and may create a hazard to the health and safety of fellow workers. Therefore, working at a CLEAN project work site while under the influence of alcohol or controlled substances is strictly forbidden.
- Knowing and observing all medical restrictions placed on their own activities at WPNSTA Concord sites (such as corrective lenses or lifting limitations) and informing PRC's site-specific OHSO of those restrictions.
- Adhering to all health and safety, guidance and work practices.
- Reading and complying with this HSP at WPNSTA Concord sites, including wearing the appropriate level of protection, without exception.
- Having a working knowledge of the health, safety and ionizing radiation protection rules and regulations that have been instituted for protection of their health and safety. This will be done through a combination of training and periodic refresher training.
- Knowing the specifics of the task that he or she performs. This will be accomplished through the use of procedure manuals, and clear instructions from their supervisors. Unfamiliarity with the task can result in an increased or unsuspected health, safety hazard.
- Being prepared to carry out the task prior to entering an area. This will be done by studying procedures and/or technical manuals in advance. This should help to ensure availability of the proper tools, equipment, drawings, procedures, etc., prior to starting a task, and should reduce needless exposure associated with repeated trips to the work area.
- Understanding and following health, safety requirements. This is accomplished by checking the posted entry requirements prior to each entry into a controlled area.
- Following decontamination procedures, as specified in the applicable site-specific HSP at CLEAN project work sites.
- Observing procedures for eating, drinking, and smoking.
- Reporting potential hazards, injuries, or possible exposures to PRC's site-specific OHSO.

- Properly storing and labelling samples and waste materials, if applicable to the field work assignment.
- Using safety equipment in accordance with training received and written instructions.
- Inspecting health and safety equipment before each work shift to determine whether it is in good condition and proper working order.
- Looking for health and safety hazards and report them to PRC's site-specific OHSO and PRC's responsible PM for corrective action.
- Maintaining a high level of safety awareness - when in doubt, follow the safest course of action.
- Using the "buddy system."
- Meeting all training and refresher training requirements and medical surveillance requirements.
- Refraining from activities that would create additional hazards during field work including smoking, eating, chewing tobacco or gum, drinking, or using cosmetics.
- Notifying PRC's CLEAN HSC of known or suspected pregnancy and then refrain from participation in CLEAN project work site field activities.
- Reporting all injuries, suspected chemical, physical, exposures, and exposure symptoms to PRC's site-specific OHSO as appropriate, as soon as possible.

2.2 SUBCONTRACTORS

Subcontractor personnel participating in SI will be required to read and comply with all section of this site-specific HSP. All subcontractor personnel entering the site must sign the site-specific HSP acceptance form. Subcontractor personnel must comply with all applicable 29 CFR 1910.120 training, fit testing, and medical surveillance requirements.

Subcontractors are responsible for providing PPE required by this site-specific HSP for their personnel (see Section 6.2, Protective Equipment and Clothing), and are directly responsible for the health and safety of their employees.

2.3 VISITORS

Site visitors will be handled in accordance with Chapter 3.2.13, "Visitors," PRC's CLEAN Health and Safety Program. All site visitors will be required to read this site-specific HSP and sign the site-specific HSP acceptance form. Visitors will be expected to comply with relevant Occupational Safety and Health Administration (OSHA) requirements.

Visitors will also be expected to provide their own PPE required by this site-specific HSP. Any visitors who do not adhere to the provisions of this site-specific HSP will be requested to leave the work area. Visitors who have not meet OSHA training and medical surveillance requirements are not permitted to enter areas where exposure to hazardous materials is possible.

Exceptions will be strongly discouraged, but they can be made on a case-by-case basis under the following conditions: (1) respirators are not required, (2) visitors' time on site is limited, (3) visitors are given a pre-entry briefing, (4) visitors are accompanied by trained personnel at all times, and (5) site-specific OHSO approval is obtained after consultation with the HSPM.

3.0 SITE BACKGROUND

The objective of the SI is to identify potential on-site sources of chemicals of potential concern (COPC). Specific objectives include:

- Characterize the geology and hydrogeology underlying the SWMUs.
- Identify potential chemical sources.
- Determine the nature of chemicals present in groundwater, soil, and sediment.
- Determine which SWMUs will require further investigation.

To meet these objectives, surface and subsurface samples will be collected at each of the 24 SWMUs to be investigated. Shallow soil boring (hand augered to 5.0 feet) will be advanced in areas where the source for COPC is suspected of being at the surface or shallow depth. Deep soil borings (advanced with a truck mounted rig or Geoprobe) will be utilized to determine if COPC have migrated vertically and/or collect groundwater samples utilizing HydroPunch, Geoprobe, or monitoring wells.

Soil samples will also be collected from trenches at SWMU 2. Monitoring wells will be installed in areas where groundwater will be collected from soil borings by using either HydroPunch or Geoprobe sampling methods. Water and sludge from septic tanks will be sampled in order to confirm the results of previous sampling.

Reconnaissance activities will be conducted prior to any field sampling activities. A utility clearance reconnaissance will be conducted at each site prior to of field activities. A summary of soil and water sampling is presented in Table 1.

The following sections describe WPNSTA Concord SWMU sites and its history.

3.1 SITE DESCRIPTION AND HISTORY

WPNSTA Concord is the major naval munitions transshipment facility on the West Coast and is located in the north-central portion of Contra Costa County, California, approximately 30 miles northeast of San Francisco (Refer to Figure 1). The facility, which encompasses approximately 13,000 acres, is bounded by Suisun Bay to the north and by the city of Concord to the south and west. Currently, the facility contains three main separate land holdings: the Tidal Area, the Inland Area, and a radiography facility in Pittsburg, California.

The Tidal Area, located north of Los Medanos Hills, includes 6,077 acres of mainland and six islands in Suisun Bay that total 1,571 acres: Freeman, Roe, Ryer, Snag, and the two unnamed Seal Islands. Two county-owned public roads, Waterfront Road and Port Chicago Highway, traverse the Tidal Area in the vicinity of the former town of Port Chicago. The area is crossed by three railroads and the Contra Costa Canal.

The majority of the facilities located in the greater Tidal Area are dedicated to ordnance operations and are located on the original property of the Naval Magazine, Port Chicago, acquired by the Navy in 1942. Within the 17,000 linear feet of waterfront are three explosives-handling piers, a barge pier, lighter moorings, and a tug basin. Barricaded rail car sidings, rail car classification yards, and a large unbarricaded holding lot for trucks are inland from the waterfront area and approximately 1,000 feet east of the Tidal Area Landfill site. There are several open inert storage and parking aprons associated with the piers and support activities.

The Inland Area encompasses approximately 5,100 acres between the Los Medanos Hills and the city of Concord. Three public roads cross the Inland Area: State Route 4, Willow Pass Road, and Bailey Road. The northwest section of the base is also crossed by the Contra Costa Canal.

The majority of WPNSTA Concord operations take place in the Inland Area. Ammunition storage, which constitutes the largest single land use at WPNSTA Concord, is maintained in five magazine groups and two groups of barricaded railroad sidings. Various production facilities for the inspection and maintenance of ordnance are located throughout the Inland Area.

The Los Medanos Hills separate the Tidal and Inland Areas and is the site of the Los Medanos underground gas storage field. This land is privately owned and is leased to the Pacific Gas and Electric Company for deep well gas injection. The land is also used for cattle grazing. Fifteen miles to the southeast of the station is the Mount Diablo State Park and State Game Refuge. This 7,004-acre preserve contains picnic facilities, campsites, and hiking trails.

WPNSTA Concord is bordered on the south by residential sections of the city of Concord. These neighborhoods are made up of single-family, medium-density housing. Most of the housing dates from the mid-1950s. In addition, seven public schools and several parks parallel the Navy property line. The Concord Pavilion, a public entertainment facility, is constructed on Kirker Pass Road near the station's south boundary.

Contra Costa County normally experiences dry, warm summers and moderately rainy winters. The wind blows from southwest to west-northwest at a mean wind speed of 12 miles per hour (mph) 65 percent of the time. The average local temperature varies from 45 °F in January to 75 °F in August.

The mean annual precipitation for WPNSTA Concord is 14 inches (E&E 1983). As in most of northern California, about 84 percent of the rainfall occurs from November through March. Regionally, rainfall may vary from 13 inches in the eastern portion of Contra Costa County to over 30 inches on the upper slopes of Mt. Diablo.

The California Environmental Protection Agency, Department of Toxic Substances Control (DTSC) previously conducted the Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) investigation into past disposal practices at 49 sites of interest at WPNSTA Concord (DTSC 1992). The RFA was developed through preliminary review and evaluation of information provided by WPNSTA Concord in response to a questionnaire, as well as other information found in inspection reports and permit applications. The RFA investigation also included sites where non-RCRA regulated wastes (i.e. asbestos and waste oil) are managed. The RFA, however, does not evaluate sites which are being handled under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). These sites have been identified as potentially contaminated and investigations are being conducted in coordination with the DTSC, San Francisco Bay Regional Water Quality Control Board (SFRWQCB), and U.S. Environmental Protection Agency (EPA).

The 49 sites the RFA investigated included 33 Inland Area sites, 15 Tidal Area sites, and a site located at the Radiographic Facility in Pittsburg, California. Of the 49 SWMUs, 25 were recommended for no further action and 24 were recommended for further action. WPNSTA Concord is required under the Hazardous Waste Facility Permit (effective July 31, 1993), Section V.A. 2, to further investigate these 24 SWMUs. WPNSTA Concord is also required under the Hazardous Facility Permit (Section V.F.) to notify the DTSC of any newly identified SWMUs. One SWMU, designated SWMU 50, was added during March 1994 after petroleum hydrocarbons were detected in soils during a construction project. Four additional SWMUs were identified in April 1994 after it was noted that they contained septic tanks that were not addressed in the RFA. Because the possibility exists that hazardous waste was dumped into the sanitary sewer, these SWMUs were included in the SI and designated as SWMUs 51, 52, 53, and 54.

Five of the 29 SWMUs recommended for further actions are being investigated under separate programs. A discussion of each of these five SWMUs and their current status is presented in the FSP. A description of the 24 SWMUs addressed under this HSP is presented in Section 3.3.

3.3 SITE SPECIFIC DESCRIPTION

The following sections provide site descriptions, operational histories, and summaries of previous investigations for the 24 SWMUs to be investigated under the SI.

3.3.1 SWMU 1 - Building IA-6

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 1. Figure 3 shows the location of the building IA-6.

Building IA-6, constructed in the 1940s, is approximately 3/4 mile east of the main entrance and on the south side of Kinne Boulevard. The building is a boiler house which supplies heat to several structures in the Inland Area. It houses three gas-fired steam boilers. The three boilers used diesel fuel supplied from a 10,000-gallon capacity UST. The UST, about 15 feet south of building IA-6, was removed in 1989. The natural gas boilers were the normal operation boilers.

The boilers are constructed of red brick with either an asbestos or steel interior lining. Piping leading to and from the boilers is insulated with asbestos containing material. Chemicals frequently added to boiler water were sodium hydroxide, sodium carbonate, sodium sulfite, sodium phosphate, and sodium nitrate.

The ground surface in the vicinity of building IA-6 generally slopes to the southwest, and has an elevation of approximately 48 feet msl. Seal Creek, an intermittent stream, runs southwest of the site. The area south and west of building IA-6 is generally surrounded by unpaved open space with the exception of building IA-4 and the electric substation. The area to the east is a paved driveway and parking area. A gravel driveway intersecting Kinne Boulevard is along the south and west sides of building IA-6.

Groundwater flow is in a northwest direction approximately paralleling Kinne Boulevard. This is based on water levels collected during investigations conducted in 1993.

Along the west side of the building, a grease and sand trap prevents oil and debris from entering the sanitary sewer system. This trap is inspected and cleaned every 3 months as required by the wastewater discharge permit from the Contra Costa County Sanitary District (CCCSD).

A 6-inch-diameter pipe was noted at the bottom of a 1-foot deep hole in the ground located about 4 feet north of the grease and sand trap. An area approximately 10-feet by 20-feet was saturated, and ponded water was noted adjacent to the gravel road that crosses the west side of building IA-6. A visit to the SWMU on April 13, 1994, revealed that grass was distressed in the area which had been saturated. The source of the water is believed to be boiler purge water which leaked from a broken line leading to the purge water holding tank. While being operated, the boilers were purged after each shift. The boilers were taken out of service during 1994.

In September 1987, water entered the underground storage tank (UST) through an open manway access while the lid was being removed for repairs, causing the UST to overflow. An estimated 1,900 gallons of diesel fuel was reportedly released from the UST. Following the fuel release, Riedel Environmental Services (RES) conducted an environmental assessment. Trenches were excavated in December 1987. In April 1988, RES installed monitoring well MW-1.

RES removed the UST in June 1989. About 80 cubic yards of contaminated soil was excavated. At the time of UST removal, a soil sample collected from the west side of the UST excavation pit indicated the presence of total petroleum hydrocarbons as diesel (TPHd). TPHd was not detected from the east side of the UST excavation pit (Fugro-McClelland [FM] 1993). Diesel fuel was detected in groundwater.

Following removal of the UST, monitoring wells MW-2 and MW-3 were installed by RES in July 1989. In September 1990, PRC installed monitoring well MW-4. On September 16, 1990, PRC collected groundwater samples from monitoring wells MW-1, MW-2, MW-3, and MW-4. Results indicated 1.5 inches of floating product in MW-1. TPHd was detected in monitoring wells MW-2 and MW-4. PRC sampled the four wells again on November 15, 1990, to confirm the contaminants present. TPHd was detected in MW-1, and no petroleum hydrocarbons were detected in MW-2, MW-3, or MW-4.

FM sampled the monitoring wells on August 12, 1992. Floating product was observed in MW-1. No TPHd or total petroleum hydrocarbons as gasoline (TPHg) were detected in any of the other three monitoring wells. FM sampled the monitoring wells again on April 4, 1993. MW-1 was not accessible; and groundwater samples from MW-2, MW-3, and MW-4 indicated no presence of TPHd or benzene, toluene, ethylbenzene, and xylenes (BTEX). Analytical results confirmed the presence of purgeable halocarbons in each of the groundwater samples.

On September 2 and 3, 1993, FM drilled soil borings MW-5 and MW-6 to depths of 30, 25, 25, and 30 feet, respectively. Soil borings MW-5 and MW-6 were completed as monitoring wells. Groundwater samples were collected from monitoring wells MW-2, MW-3, MW-4, and MW-5 and MW-6. Groundwater in monitoring well MW-1 was not sampled because a thin film of floating product was observed. No TPHd or BTEX was detected in any of the monitoring wells that were sampled. Tetrachloroethene was detected in all monitoring wells. At monitoring well MW-5, chloroform, 1,1-dichloroethene, and trichloroethene were detected. TPHd was detected in soil samples from DH-1 at 10 feet and MW-5 at 10 feet.

3.3.2 SWMU 2 - Building IA-7

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 2. Figure 3 shows the location of the building IA-7.

Building IA-7, constructed in the 1940s, is about 1/2 mile south of the main entrance, on the west side of Kinne Boulevard, and is a fire station for the Inland Area. Between 1969 and 1973, fire-fighting training activities were conducted twice a year in a shallow pit located south of the fire station. Fuel oil and napalm were used in the practice burns. Extinguisher chemicals used included potassium chloride, sodium chloride, ammonium phosphate, and potassium carbonate. Between 1969 and 1973, residues of these chemicals were scraped off the ground and disposed of in the Seal Creek bed (usually dry) which runs just south of the fire station. Since 1973, practice burns were conducted in shallow metal pans. Chemical residues contained in the pans were disposed of at approved sites.

Two storage facilities, building 114 and building 416, are located to the south. The area south of building 114 slopes gradually toward Seal Creek which is about 200 feet to the south. This area is overgrown with grass and trees.

The area east of building IA-7 is paved and used for parking vehicles. The parking area extends 300 feet east and approximately 200 feet to the south. Aerial photographs show that during the period from 1976 to 1986 the parking area was being expanded to the south. The 1976 aerial photograph shows the parking lot boundary to extend from the hazardous waste accumulation building east to building IA-8. The area to the south of the parking lot appears in the photograph to have been partially backfilled. The present parking lot extends 100 feet south of the hazardous waste accumulation building.

A storm drain is 50 feet east of building IA-7 and drains into the drainage ditch about 100 feet south. The drainage ditch flows to the south into Seal Creek. This drainage was not present in the 1957 aerial photograph and the storm drain may not have been in place then. Aerial photographs from 1969 show that the storm drain may have been installed during the period from 1957 to 1969. The aerial photograph from 1986 shows that the drainage from the storm drain outfall shifted slightly to the west when the parking lot was expanded to the south. Adjacent to the storm drain outfall is one of the satellite accumulation points for hazardous waste. The hazardous waste is held in drums near a yellow metal shed until delivery to the hazardous waste storage facility at building 433.

3.3.3 SWMU 5 - Building IA-12

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 5. Figure 3 shows the location of the building IA-12.

Building IA-12, constructed in the early 1940s, is in the main industrial complex of WPNSTA Concord, approximately 1 mile east of the main entrance and north of Kinne Boulevard. The building houses the locomotive repair shop where the maintenance of approximately 1,100 pieces of railway, automotive, construction, and weight-handling equipment was conducted.

Battery maintenance and recharging was done at the northeast corner of building IA-12. Water was added to batteries that were low in liquid. This procedure was discontinued in early 1992. Batteries are recycled and are stored on the north side of building IA-12. This area serves as a satellite accumulation point for these batteries. Approximately 49 automotive batteries are disposed of or recycled annually. Approximately 24 locomotive batteries have also been disposed of from this facility in the past 5 years. Battery acids from automotive and locomotive batteries are drained into a

5-gallon carboy, which is then delivered to Mare Island Naval Shipyard for recycling. The outside of the battery casings are rinsed and neutralized prior to recycling.

Hazardous waste is generated and accumulated at various locations around building IA-12. A locomotive and rail car steam cleaning pad is approximately 59 feet west of building IA-12. Wash water from the washdown pad is collected from the north and west side of the pad. Records show that the pad was installed in 1976 to collect oily wastes into an oil/water separator through a 6-inch-diameter vitrified clay pipe (VCP) drain line. The oil/water separator, about 5 feet west of the washdown pad, is a single-walled, 6-inch-thick concrete sump with a 200-gallon capacity. It is about 4 feet wide, 9 feet long, and 7 feet deep. The oil/water separator is also known as Sump Container No. IA-12B. It is periodically cleaned by a contractor who pump the oil to a vacuum truck. The water from the oil separator is drained into a manhole through 6-inch-diameter VCP about 190 feet west of the oil separator. The water is then discharged to the sewer system with the approval of the CCCSD.

A diesel fuel transfer pump is at the northwest corner of building IA-12. The dispenser is connected to a 10,000-gallon UST located about 50 feet north of the dispenser. The UST was built in 1944 and is about 50 feet north of building IA-12.

A 500-gallon capacity waste oil UST was located along the south side of building IA-12. It was used to store waste oil generated from locomotives. A sink on the outside platform delivered the waste oil to the UST. The UST was removed during 1993 as part of a Resource Conservation and Recovery Act (RCRA) closure.

During the site visits, it was noted that the asphalt was stained along the northeast wall. An area approximately 3 by 10 feet along the southeast wall was noted to be stained with petroleum hydrocarbons. Staining was observed around the diesel fuel transfer pump. Drums filled with motor oil were next to a platform at the southeast corner.

3.3.4 SWMU 7 - Building IA-16

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 7. Figure 3 shows the location of the building IA-16.

Building IA-16, constructed in the 1940s, is in the main industrial complex of WPNSTA Concord, approximately 1 mile east of the main entrance and north of Kinne Boulevard. About 20 painters worked out of building IA-16 in the years before 1960. They were responsible for interior and exterior painting of base buildings. Much of the paint was oil based and much of the exterior paint was lead based. Prior to the 1970's, all waste paint, thinners, cans, and the like were disposed of in the Tidal Area Landfill. Paint usage was estimated at 700 gallons per year, generating approximately three drums of solid waste per year. By the early 1960s, the paint shop crew was reduced to three painters responsible for touch-up and repair work and minor interior finishing. Major finishing jobs are now performed by contractors who are responsible for cleanup and disposal of their materials.

Four USTs are located beneath the paved area between buildings IA-12 and IA-16 (two 10,000-gallon gasoline USTs and two 10,000-gallon diesel fuel USTs). Three of the USTs are located adjacent to the southeast corner of building IA-16 and supply fuel to a gas station 60 feet southeast of building IA-6. The fourth UST supplies diesel fuel to the fuel dispenser at the northwest corner of building IA-12. Leak tests of USTs were done annually and reported to Contra Costa County Environmental Health Division (CCCEHD). Routine level and volume checks of the USTs are made by station personnel. No leaks have ever been detected in the USTs. Small spills (1 to 2 gallons) have occasionally occurred. These spills were confined to the immediate area of the asphalt pad where they were contained and cleaned up.

Inside building IA-16 is a paint shop with a paint locker. A satellite accumulation area for waste paints and thinners is near the storage shed at the back of the building. Leftover paint from 1- and 5-gallon cans is drained into a 55-gallon drum. Empty paint cans are allowed to dry and then are disposed of as nonhazardous waste at a municipal trash bin.

During the site visit, asphalt in a 10-foot by 40-foot area along the northeast wall was observed to be cracked and stained with paint. Some paint staining was observed around the paint locker.

3.3.5 SWMU 12 - Building IA-24

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 12. Figure 3 shows the location of the building IA-24.

Building IA-24, constructed in the 1940s, is 60 feet north of Kinne Boulevard, approximately 3 miles from the front gate. Maintenance of forklift equipment is done at building IA-24. Some of the hazardous wastes generated are used oil, absorbent materials soaked with oil, used paint spray cans from touch-up painting jobs, and batteries which are recycled. The building has a satellite accumulation area for these wastes.

Building IA-24 and the adjacent storage area building IA-24A house minor forklift maintenance operations and include recharge facilities for expended forklift batteries. All solid wastes generated in building IA-24 were probably disposed of in the Tidal Area Landfill until 1978. These wastes included oily wastes, oil sludge from the collection sump, battery casings, rags, old parts and tools, and cans containing small amounts of paints and solvents. In 1971, it was reported that steam cleaning wastes of grease and oil from forklifts and batteries were discharged into an improperly operating catch basin. This reportedly resulted in oil contamination of an adjacent drainage ditch.

As part of forklift maintenance, the forklifts and batteries are steam cleaned to remove oil and grease. The steam cleaner discharges through a line from the southwest side of building IA-24 and drains into Seal Creek, but the steam cleaning pad has not been used since 1988. In addition, the WPNSTA Concord personnel park 3-ton trucks on the unpaved areas between buildings IA-24 and IA-55.

A 2,000-gallon diesel UST is located along the southeast wall of building IA-24. The integrity of the UST was checked by precision testing in January 1988 and annually thereafter. The UST failed the tests twice due to piping leaks. The leaks were repaired and the UST and piping retested. The UST again failed additional testing and was then taken out of service. Adjacent to the UST is a shallow vadose-zone well (installed to monitor the vapors in the vadose zone in the vicinity of the UST). During drilling of the vadose-zone well in December 1987 (ERM-West 1989), a petroleum odor was reported starting at a depth of 4 feet down to 8 feet below ground surface (bgs).

Building IA-24 has a sink and sanitary sewer system that drains into two septic tanks through a 6-inch VCP. The septic tanks are about 200 feet south of building IA-24 and are 20 feet from each other. Sewage from building IA-55 drains through a 6-inch cast iron (CI) sanitary sewer pipe and connects with the 6-inch VCP which connects to the two septic tanks. Railroad tracks are located 40 feet to the north of the septic tanks and parallel to Kinne Boulevard.

The septic tanks are partially covered with dirt. The outlet of each septic tank splits into two 4-inch open-joint unglazed clay pipe (UCP) which run parallel to the drain field. The two UCP drains are about 10 feet apart. Each distribution field is about 2 feet wide and 2.5 feet deep. The drain field has a slope of 0.004 along the 300-foot length.

The dumping of battery acid, reported in the Initial Assessment Study (IAS) (E&E 1983), may have caused a low pH and possible lead contamination in the groundwater. The IAS also concluded that the acid would probably be neutralized from contact with the soil and that lead would bind to the soil, reducing its migration into groundwater. Given the absence of groundwater usage in the area, the IAS recommended no further investigation at this site (E&E 1983).

During the SI field work, performed by PRC and Montgomery Watson in 1992, soil and groundwater sampling were conducted southeast of the forklift parking lot in an attempt to verify the location of an acid disposal sump identified by IT (IT 1990). Three 4-foot-wide shallow trenches, 3 to 5 feet deep, were excavated with a backhoe in an area of stained soil identified by IT from historical aerial photographs as being the acid sump. A total of 16 soil samples were collected from 12 locations (ACS-1 through ACS-5 and ACS-7 through ACS-13) within the trenches, at 2 to 5 feet bgs. Two of these samples were collected from areas where surface soil staining was visually identified, and the remaining samples were evenly spaced throughout the trenches. The only sample that had TPHd above the detection limit was soil sample ACS-13-SB-02.0.

A 43-foot-deep soil boring (ACS-06-SB) was drilled adjacent to ACS-10, and soil samples were collected at 5-foot intervals until groundwater was encountered at 34 feet. The soil logged from the deep boring identified interbedded silt and sand from the surface to about 22 feet bgs. Sandy gravel was found from approximately 22 to 40 feet bgs, underlain by clay to a total depth of 43 feet bgs. TPHd was detected in three samples. TPHg was detected in four samples. The TPHg was detected in the samples from 0 to 20 feet, while TPHd was detected in the samples from 20 to 30 feet.

A temporary well was set within the deep soil boring (ACS-06-SB) and screened from 33 to 43 feet bgs. Groundwater was first encountered at 33.9 feet bgs, and after waiting 20 minutes, the groundwater level was measured at 34 feet bgs. Because the groundwater did not rise in the borehole, the aquifer is assumed to be at unconfined conditions. If the groundwater gradient mimics

the topographic gradient, then the potentiometric surface would dip to the northwest. TPHd, methylene chloride, and trichloroethene were detected in a sample from this temporary well.

Additionally, surface soil samples were collected at the termini of two runoff locations. The first sample, ACS-01-SFC, was collected near the culvert that drains storm water from the suspected acid sump area. Storm water from this area flows into a drainage ditch that discharges into a field. TPHd and sulfate were detected in the soil sample. The second surface sample, ACS-02-SFC, was collected at the end of the steam cleaning discharge line where it discharges into Seal Creek. TPHd, TPHg, and sulfate were detected in this soil sample.

The septic tank was sampled on August 17, 1993. TRPH and total oil and grease (TOG) were detected in the sludge sample.

As part of the ongoing effort to replace or remove old USTs, an investigation was conducted by Harding Lawson Associates (HLA) on September 9, 1993. One soil boring (No. 5) was drilled adjacent to the UST to a depth of 10.5 feet bgs and sampled at 7.5 bgs feet and 10.5 feet bgs. The results indicated no petroleum hydrocarbons, specifically TPHd, were present in the soil above the detection limits.

3.3.6 SWMU 13 - Building IA-25

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 13. Figure 3 shows the location of the building IA-25.

Building IA-25 is 110 feet west of the end of L Street, which intersects Kinne Boulevard approximately 2.5 miles from the main entrance and was used exclusively for pilot-scale development and manufacture of munitions. During the 1940s, when the building was put into service, hexahydro-1,3,5-trinitro-sym-triazine (RDX), pentaerythritol tetranitrate (PETN), lead styphnate, and lead azide were developed as military explosives. A paint booth used for repainting components was located in the southwest corner of the building. In addition to the nitrogen-based compounds, metals associated with casings, solvents, and pesticides are known to have been used in or around the facility. Pipes are wrapped in asbestos, and wall materials may also contain asbestos fibers. Building IA-25 has been renovated as a production facility for the rework of explosives. Work includes repair of (1)

structural damage to walls and floor, (2) lighting systems, (3) ventilation and heating systems, and (4) removal of asbestos insulation on pipes and asbestos wallboard materials.

Building IA-25 was constructed by cutting into an existing hillside creating a berm around three sides. On the north side an engineered berm was constructed. Access is through breaks in the berm at the northeast and northwest corners. Building IA-19 (boiler house) is east of building IA-25. The topography around building IA-25 slopes gradually to the northwest.

Building IA-25 has a sink and sanitary sewer system that drains into a septic tank through a 6-inch VCP. The septic tank is about 120 feet north of building IA-25 and is partially buried. The outlet of the septic tank splits into two 4-inch open-joint tile drains which run parallel to the drain field. The tile drains are about 10 feet apart. Each distribution field is about 2 feet wide and 2 feet deep. The drain field has a slope of 0.003 to 0.004 along the 100-foot length of the drain field.

A 6-inch pit drain is also connected from building IA-25 to the north side of L Street. The end of the pit drain is filled with 0.5 cubic yard of 1.5- to 2-inch-diameter base rock, providing a minimum of 6 inches of earth cover for the pit drain.

In 1983, the IAS investigation team was told that a burn pit and solvent disposal area existed behind building IA-25 at one time. Visual examination of the area revealed no environmental damage. The IAS indicated that up to 1,000 gallons of paints and solvents may have been disposed of.

Previous investigations included sampling in the crawl space beneath the building, asbestos survey of a 50-foot-square area below the building, and an investigation of shallow soils beneath and behind the building.

A contractor was hired in 1987 to perform an asbestos survey under building IA-25 (Pacific Environmental Services, Inc. 1988). The survey reported an area of approximately 50 square feet beneath the building where pieces of pipe insulation containing asbestos fibers were found. The report stated that the general public would not be subject to any health hazards under normal conditions, but the report indicated that the asbestos area would be a hazard to maintenance workers or others who might disturb the soil beneath the building.

On November 10, 1988, Navy personnel collected eight soil samples from beneath building IA-25. Elevated levels above North Bay area background soil concentrations of nitrates, potassium, and phosphorous were detected at all locations (U.S. Geological Survey, 1984). Volatile organic compounds (VOC) were detected in samples IA25-7 and IA25-1. Semivolatile organic compounds (SVOC) were detected in samples IA25-2 and IA25-7. Pesticides were detected in sample IA25-4. Lead, zinc, and trivalent chromium were detected in sample IA25-1 at levels above the State of California Total Threshold Limit Concentrations (TTLC). Samples IA25-4 and IA25-5 had a soluble lead concentration that exceeded the Soluble Threshold Limit Concentrations (STLC).

The area beneath building IA-25 was sampled again on June 28, 1989. Soil samples were collected at depths of 0 to 6 inches, 6 to 12 inches, and 12 to 18 inches bgs from 10 locations. The upper two samples were sent to a laboratory for analyses and the third was archived. A description of the methodology and rationale are discussed in a report prepared by International Technology Corporation ((IT) IT 1990). Trace amounts of the pesticide 4,4,-DDT were detected in soil samples SS-01, SS-03, SS-04, SS-06, and SS-07. Herbicides were detected in soil samples from SS-04, SS-06, SS-07, and SS-08. VOCs were detected in soil samples from SS-02 and SS-07. SVOCs were detected in soil samples SS-02 and SS-07. Lead, zinc, and chromium were detected in all samples.

The septic tank was sampled on October 9, 1990, and on August 17, 1993. TRPH and TOG were detected in the liquid sample from October 9, 1990. TOG was detected in the sludge sample from August 17, 1993. VOCs and SVOCs were detected only in the October 9, 1990 liquid sample. VOCs detected were 1,1-dichlorobenzene, 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethene, total 1,2-dichloroethene, toluene, and trichloroethene. SVOCs detected were 4-methylphenol, di-n-octylphthalate, and 1,4-dichlorobenzene.

3.3.7 SWMU 14 - Building IA-27

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 14. Figure 3 shows the location of the building IA-27.

Building IA-27, constructed in the mid 1940s, is 100 feet south of Kinne Boulevard, approximately 2.5 miles from the main entrance. It was used to house the carpenter shop, and carpentry personnel

often used paints and thinners. Building IA-27 is now a storage facility for the furniture of Marines housed on base.

The building is surrounded by a 16-foot high berm on the north and south sides. A paved parking area is between building IA-27 and the south berm. Railroad tracks are adjacent to the north side of building IA-27 and run parallel to the south side of the north berm. A large parking area is between the north berm and Kinne Boulevard. West of L Street is a paved, fenced area used to store equipment and supplies.

Building IA-35 (boiler house) is about 100 feet south of building IA-27 and building IA-44 is about 120 feet to the south. A UST was removed from the south side of building IA-35 in 1992. No petroleum hydrocarbons were detected in excavated soil.

Building IA-27 has a sink and sanitary sewer system that drains into a manhole connecting to a septic tank through a 6-inch VCP. The septic tank is about 200 feet south of building IA-27, adjacent to the southwest corner of building IA-44. The reinforced concrete septic tank is about 11 feet long, 4 feet wide, and 7.5 feet deep. It is accessible through a 2-foot by 3-foot opening at the top of the tank at the ground surface. The outlet of the septic tank splits into two 4-inch open-joint tile drains which run parallel to the drain field. The two tile drains are about 10 feet apart. Each distribution field is about 2 feet wide and 2.5 feet deep. The drain field has a slope of 0.004 along the 100-foot length. The drain field is about 40 feet from Seal Creek. During previous septic tank sampling events, the septic tank was dry and not sampled.

3.3.8 SWMU 15 - Building IA-41

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 15. Figure 3 shows the location of the building IA-41.

Building IA-41, about 800 feet south of the old airport and 1,800 feet east of building IA-56, was used as a paint storage shop. According to the RCRA Facility Assessment (RFA), this building has a sink and sanitary sewer system that drains into a septic tank. However, the septic tank was not located during the septic tank sampling event performed for all septic tanks in August of 1993.

Review of available engineering drawings by WPNSTA Concord did not reveal the presence of a septic tank.

The building is covered with fill material on three sides. A transmission line which belongs to the Bureau of Reclamation runs directly above building IA-41. The area around building IA-41 is flat and used for grazing. Housing is located a quarter mile south, just outside the base boundary.

3.3.9 SWMU 16 - Building IA-46

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 16. Figure 3 shows the location of the building IA-46.

Building IA-46, constructed in the 1940s, is in the main industrial complex of WPNSTA Concord, approximately 1 mile east of the main entrance and north of Kinne Boulevard, off D Street. The building is fenced on all sides, with the entrance on the west side. Building IA-49 is 80 feet to the west, and building 433 is 60 feet to the east. South of building IA-46 are several buildings for storage of paint, oxygen, and acetylene. Along the south fence is a storage area for construction supplies. During the site visit, no asbestos piping or residue was noted. Suspected releases of asbestos from packing operation in drums were noted in the RFA.

A fluorescent light tube crusher, located at the east end of building IA-46, is used to reduce the bulk of used fluorescent light bulbs generated at WPNSTA Concord. Approximately 10 to 20 fluorescent light tubes are crushed bi-monthly. The crusher operates by feeding the fluorescent light tubes through a cylindrical metal tube attached to a 55-gallon drum. Any particulates from the operation are entrained by a bag attached to the tube crusher's pump. Suspected releases of mercury from fluorescent light tube crushing operations was noted in the RFA. However, no mercury residues were observed on the walls, floor, or ceiling of the room where the fluorescent light tube crusher is located. Once the drum is filled, it is transferred to building 433, which is one of the five permitted hazardous waste management units at WPNSTA Concord. It is included in the Hazardous Waste Facility Permit effective July 31, 1993.

A storage shed for accumulation of asbestos waste was located at the west end of building IA-46. Friable asbestos was stored in drums. These drums were disposed of at a permitted Class II disposal

facility. Nonfriable asbestos pipe, used for minor repairs, was also stored near the shed. This shed was also used to mix pesticides. Mixing was performed according to instructions on container labels. Empty cans were triple-rinsed and the rinsed water deposited in the spray tanks. The cans were then suitable for disposal as solid waste. A sink in the shed was used to provide water for pesticide mixing. Occasional spills were reported. The IAS stated that in 1966 an agricultural lessee complained of poisonous chemicals being spilled into a drain which flowed into his cattle grazing area which is south of the intersection of Kinne Boulevard and D Street. The drain goes underneath Kinne Boulevard 200 feet east of the intersection of Kinne Boulevard and D Street. Public works center (PWC) acknowledged that chemical wastes from the pesticide storage and mixing area may have been dumped into an adjacent gutter on D Street which flowed toward the area in question. A drain was then installed from the storage shed into the sewer system.

3.3.10 SWMU 17 - Building IA-50

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 17. Figure 3 shows the location of the building IA-50.

Building IA-50, constructed in the early 1950s, is about 100 feet south of Kinne Boulevard, 2.7 miles from the main entrance. Six years ago, building IA-50 was used as a transfer station for ordnance materials. Often, packages of ordnance materials had to be broken down and repackaged inside the building. Ordnance was labeled using stencil and paint spray cans. The used spray cans were the hazardous wastes generated at that time.

The rail/truck transfer depot at building IA-50 is similar to an end of a railway station. Both sides of the building have a platform leading to a spur railroad track. The platforms and the spur railroad tracks were used to transfer ordnance from rail to truck and vice versa.

Building IA-50 has a sink and sanitary sewer system that drains into a septic tank through a 6-inch VCP. The septic tank is about 80 feet south of building IA-50. The outlet of the septic tank splits into two 4-inch open-joint tile drains which run parallel to each other. The two tile drains are about 10 feet apart. Each distribution field is about 2 feet wide and 2 feet deep. The drain field has a slope of 0.003 to 0.004 along the 100-foot length.

The septic tank was sampled on October 9, 1990, and August 17, 1993. TRPH and total oil and grease (TOG) were detected in the October 9, 1990, liquid sample and TOG in the August 17, 1993, liquid sample. The only SVOC detected in the October 9, 1990, liquid sample was 1,4-dichlorobenzene and the VOCs detected were benzene and chlorobenzene.

3.3.11 SWMU 18 - Building IA-51

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 18. Figure 3 shows the location of the building IA-51.

Building IA-51, constructed in the 1940s, is in the main industrial complex and was used as a steam cleaning facility for locomotives, trucks, and other vehicles. The steam cleaner was deactivated in the mid 1970s when the steam cleaning unit west of building IA-12 became operational. Oily waste generated from the steam cleaning drained directly into the sump (Container No. IA-51). The oil was pumped out by a contractor's vacuum truck, and the sump was periodically cleaned by the contractor. The water was discharged to the sewer system with the approval of the Contra Costa County Sanitary District (CCCSD).

Until the early 1960s, a zinc chromate rust inhibitor was added to motor antifreeze. At that time, waste antifreeze was disposed of by a contractor. The change was made to a antifreeze which was believed to be free of chromates. This new antifreeze was typically discharged to the ground and into storm drains. In 1987, chromates were detected in Seal Creek. When it was discovered that the new antifreeze contained zinc chromate, the type of antifreeze was changed and biodegradable rust and scale inhibitor was added.

The area along the west side of the building is now being used to store old tires. Railroad tracks run east to west along the north and south sides of the building. A 40-foot long splash wall is 20 feet east of the building. A sump (Container No. IA-51), installed in 1945, is located 12 feet east of the center of the splash wall. The sump is made of concrete 6 inches thick and had a capacity of 40 gallons. It was filled with concrete when the steam cleaning unit was deactivated.

Aerial photographs show that a turntable for locomotive, approximately 44 feet in diameter, existed 100 feet east of building IA-51 until at least 1969. A semicircular crack in the asphalt indicates

where the turntable existed. The turntable is not present in the 1976 aerial photograph which shows activity occurring at the location of the former turntable. Though the exact nature of the activity is not evident from the aerial photograph, base personnel who work at building IA-51 say that an incinerator, used to destroy classified documents, was present in the excavation for the former turntable at approximately this time. A drop pit to collect steam cleaning water was located 10 feet north of the turntable. The drop pit was destroyed when the turntable was removed.

3.3.12 SWMU 20 - Building IA-55

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 20. Figure 3 shows the location of the building IA-55.

Building IA-55, constructed during the early 1950s, is located 60 feet north of Kinne Boulevard, approximately 3 miles from the main entrance. It is an office building where tools and supplies are issued and returned. New materials are locked in the nearby shed (building 422). Hazardous wastes generated include used paint spray cans and adhesives. The building serves as one of the hazardous waste satellite accumulation points for used paint spray cans.

A 500-gallon diesel UST is located near the northwest corner of building IA-55. The integrity of the UST was checked by precision testing in January 1988 and annually thereafter, and the UST has passed these tests. Adjacent to the UST, a shallow vadose-zone well was installed to monitor the vapors in the vadose zone in the vicinity of the UST. A faint diesel odor was reported from the surface down to 5 feet during drilling of the vadose-zone well in December 1987 (ERM-West 1989).

Building IA-55 has a septic tank and drain field. The sewer line connects with the building IA-24 sewer line adjacent to the southeast side of building IA-24.

3.3.13 SWMU 22 - Building 81

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 22. Figure 3 shows the location of the building 81

Building 81, constructed during the late 1950s, is located on Chosin Road approximately 1 mile east of the intersection of Kinne Boulevard and Willow Pass Road at an elevation of 320 feet msl. Fuses and hydraulic fluids are tested in this building for handling and temperature sensitivity. As part of the regular maintenance operation, labels are painted on the ordnance using stencils and paint spray cans. The hazardous waste satellite accumulation point for used paint spray cans is located in building 82.

Building 81 has cells or small rooms with reinforced walls and screened ceilings for safety. Each room has a fuse-detonating machine the size of a small oven where small quantities of ordnance fuses are detonated. Small volumes of air emissions, if any, are carried out of the building through exhaust fans. No permit from the Bay Area Air Quality Management District (BAAQMD) is needed because of the small volume of the emissions.

Three USTs are located between building 83 and building 86. The USTs, used to fuel the boilers in the boiler house and a generator, are scheduled to be removed and replaced under a separate program.

The area around the buildings is flat and covered with asphalt. A parking area parallels building 81, 60 feet to the southeast. The topography dips steeply from the parking lot to the southeast and south. To the north and northwest the topography climbs steeply. A drainage outfall at an elevation of 300 feet msl exits from underneath Chosin Drive 120 feet east of the northeast corner of building 81. The septic tank is located downslope from the outfall and 80 feet from building 81 at an elevation of 290 feet msl.

Building 81 has a sink and sanitary sewer system that drains through an 8-inch VCP to manhole No. 2, then drains through manhole No. 1 into a septic tank. The outlet of the septic tank connects to a splitter box through a 4-inch VCP. The splitter box again divides flow into two other splitter boxes. The first of these two splitter boxes divides the flow six ways through six 4-inch VCPs which drain along the 100 foot length of the drain field. The second splitter box divides the flow 12 ways through 4-inch VCPs which also drain along the full length of the drain field. The first and second splitter boxes are 200 feet from each other.

The septic tank was sampled on October 9, 1990, and August 17, 1993. TRPH was detected in the August 17, 1993, sludge sample, and TOG was detected in the August 17, 1993, liquid sample. TRPH and TOG were detected in the October 9, 1990, liquid sample. SVOCs detected in the October 9, 1990, liquid sample were di-n-octylphthalate and 4-methylphenol and in the August 17, 1993, liquid sample were 1,4-dichlorobenzene and 4-methylphenol. One VOC (total 1,2-dichloroethene) was detected in the October 9, 1990, liquid sample.

Harding Lawson & Associates (HLA) conducted an investigation on September 8, 1993, of the existing UST. A soil boring (No. 1) was drilled to a depth of 21.5 feet bgs and sampled at 15.25 feet bgs and 21.0 feet bgs. The analytical results indicated TPHd was present in the 15.25-foot sample. The analysis of the 21.0-foot sample did not indicate any TPHd above the detection limits. TPHd was also detected in groundwater which was encountered at 17.0 feet bgs and sampled.

3.3.14 SWMU 23 - Building 87

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 23. Figure 3 shows the location of the building 87.

Building 87, constructed in the late 1950s, is located on Inchon Drive approximately 1 mile east of the intersection of Kinne Boulevard and Willow Pass Road at an elevation of 455 feet msl. Minor maintenance, such as labeling of ordnance using stencil and paint spray cans, was done at this building. Hazardous wastes generated included used paint spray cans, oil, and solvents. No hazardous waste is now generated at this site. WPNSTA Concord no longer does the missile work at this facility.

Building 88 and building 89 are located to the south. A 6,000-gallon steel UST for diesel fuel storage is about 25 feet west of building 87. Associated gauge, oil suction/return, and vent lines are connected to the UST. The topography slopes steeply to the south and west and terraces were constructed to stabilize the slope. The slope climbs steeply to the north and northeast.

Building 87 has a sink and sanitary sewer system that drains from a 4-inch CI pipe to a 6-inch VCP that drains into a septic tank. The septic tank is about 70 feet west of the southwest corner of building 87. The effluent from the septic tank is divided into three distribution boxes. Each

distribution box again splits flow into three drain lines. Each drain line then flows along the entire length (100 feet) of the drain field. The UST discussed above is 8 feet from the edge of the drain field. A parking lot has been constructed over the drain field.

The septic tank was sampled on August 17, 1993. TOG was detected in the liquid sample. SVOCs detected in the liquid sample were diethylphthalate, butyl benzyl phthalate, bis(2-ethylhexyl)phthalate, and benzoic acid.

3.3.15 SWMU 24 - Building 93

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 24. Figure 3 shows the location of the building 93.

Building 93, constructed in the early 1960s, is on the south side of Kinne Boulevard at the east end of WPNSTA Concord at an elevation of approximately 224 feet msl. It appears to be the site of one of the biggest generators of hazardous waste at the WPNSTA Concord. These wastes include used paint spray cans, solvents, and adhesives. Generated wastes are stored at a satellite accumulation point provided at building 429.

The area to the west of building 93 is grass covered and slopes gradually to the edge of Seal Creek, which is approximately 400 feet west of the drain field. An elevation drop of approximately 20 feet exists between the top of the grassy field and the bottom of Seal Creek.

Sewage from building 93 is discharged through a 6-inch VCP to manhole A located 100 feet west of building 93. Manhole A connects to a 2,500-gallon prefabricated steel septic tank, located about 240 feet northwest of the manhole, through an 8-inch VCP. The outlet of the septic tank connects to a splitter box which divides the effluent into 13 4-inch open-joint VCP drains which run parallel to the distribution fields. The 13 VCP drains are each at least 7 feet apart. Each distribution field is about 2 feet wide and 2 feet deep. The drain field has a slope of 0.004 along the 100-foot length.

The septic tank was sampled on October 9, 1990, and August 17, 1993. TOG was detected in the October 9, 1990, liquid sample. TRPH and TOG were detected in the August 17, 1993, sludge

sample. SVOCs detected in the October 9, 1990, liquid sample were phenol, 4-methylphenol, and benzoic acid. VOC detected in the October 9, 1990, liquid sample was toluene.

3.3.16 SWMU 25 - Building 97

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 25. Figure 3 shows the location of the building 97.

Building 97, constructed in the early 1960s, is located at the east end of WPNSTA Concord at the end of R Street and was an ordnance assembly building for the Rocket Maintenance Facility of the Guided Missile Department in the Inland Area. Maintenance operations included the rebuilding of rocket motors, cleaning and painting rocket parts, and testing rocket engine components. The facility is currently unused but is being refurbished for new uses. Three USTs used to store JP-5 fuel were removed from the north side of the building in 1992 and a 4,000 gallon diesel UST was removed from the south side of building 96 during April 1994.

It was reported in the IAS that hazardous wastes generated included trichloroethane, epoxy, ethyl alcohol, contact cleaners, corrosion preventatives, oil, JP-5 rocket fuel, and solvent wastes. The hazardous wastes were collected per the WPNSTA Concord RCRA permit and disposed of off base. Paint sludge was bagged and similarly handled. During its operation, the Tidal Area Landfill received all wastes from the building.

Building 97 has a sink and sanitary sewer system that drains to a septic tank through a 6-inch VCP. The 2,500-gallon prefabricated steel septic tank is about 200 feet southwest of building 97. The outlet of the septic tank connects to a splitter box which divides the effluent into nine 4-inch open-joint VCP drains which run parallel to the drain field. The nine VCP drains are at least 7 feet apart. Each distribution field is about 2 feet wide and 2 feet deep. The drain field has a slope of 0.005 along the 100-foot length of the drain field.

The septic tank was sampled on October 9, 1990, and August 17, 1993. TOG was detected in the October 9, 1990, and August 17, 1993, liquid samples. SVOCs detected in the October 9, 1990, liquid sample were phenol, benzo(a)anthracene, 1,4-dichlorobenzene, 4-methylphenol, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, and dibenz(a,h)anthracene.

SVOCs detected in the August 17, 1993, liquid sample were 1,4-dichlorobenzene, phenol, and 4-methylphenol.

On December 9, 1990, the three USTs north of building 97 were removed. Results of analysis of the soil samples from the UST excavation were below the method detection limit (Minter & Fahy 1991). The excavation was overseen by the CCCEHD. No analytical results were available for the removal of the 4,000 gallon UST.

3.3.17 SWMU 37 - Building A-29

This section provides the physical description, past operations history, and summary of previous investigations for SWMU 25. Figure 2 shows the location of the building 97.

Building A-29 is at the end of Davidson Road, adjacent to the Wood Hogger site (IR Site 11) which is being investigated under the installation restoration program (IRP). The SWMU includes areas that have not been investigated under the IRP. The boundaries include Davidson Road to the south and east, building A-29 to the west, and the open field to the north. The Wood Hogger site is located to the south and west. The wood hogger machinery is still in place.

Approximately 600 cubic yards of treated wood debris was removed from the dunnage area in 1992. Most of this wood waste was chemically treated. Dark brown wood was treated with creosote, light brown wood with pentachlorophenol, and the greenish wood with copper arsenate. Most treated wood waste items, such as used railroad ties or wharf timbers, are recycled on base or off base through other federal or state agencies for projects such as landscaping and retaining walls or are sold to contractors who reuse the timbers for applications requiring use of treated wood. Some scrap treated wood was stockpiled near building A-29.

The storage yard is currently paved with asphalt, and aerial photographs from as far back as 1952 show this storage yard in use, with railroad tracks providing access to the storage yard from the northeast corner of the site. The storage yard now contains scrap metal and wood, other surplus materials, and is generally covered with weathered wood chips. The current storage practices in the storage area and historical photographs indicate that a variety of wood and metal materials have been stored in sections of the yard at various times. Because of the dispersed and different materials

disposed of in sections over a long period of time, it may be difficult to assign specific sources of chemicals as being associated with currently stored materials.

The open areas to the north are currently bare soil covered by intermittently sparse and dense vegetation. The bare soil areas just off the asphalt pavement show some debris resulting from stored materials being windblown or deposited into these areas.

The Wood Hogger site which surrounds SWMU 37 is being investigated under the IRP. IT conducted an SI at the wood hogger site during 1989 through 1991. The SI included installing four shallow monitoring wells located around and north of the wood hogger equipment, collecting 12 surface water samples, and drilling and sampling 15 soil borings. Groundwater, surface water, soil, and sediment samples were collected. Based on the site history, contaminants of concern were determined to be VOCs, SVOCs, pesticide/Polychlorinated biphenyls (PCBs), metals, explosives, and total organic carbon (TOC). Analytical results are not presented here because the Wood Hogger site is outside the investigation area. A summary of the investigation is presented since SWMU 37 will likely be incorporated into the IRP and it is necessary to know what the COPC are since the results of the SI will be incorporated into the IRP. Refer to the remedial investigation/feasibility study (RI/FS) work plan (PRC/Montgomery Watson 1992) for a more detailed summary of the investigation results. The following paragraphs summarize the investigation.

Groundwater samples were collected for four quarters. The only VOC detected was acetone. Five SVOCs were detected in the groundwater. Five of the six metals with background values were detected at concentrations above the background range determined by IT (IT 1992).

The surface water samples were collected from four surface locations. The two VOCs detected were methylene chloride and acetone. No metals were detected above the IT-defined background levels for the site (IT 1992).

Forty soil samples were collected from the soil borings. A total of 31 organic compounds were detected in the soil. VOCs detected were acetone, 2-butanone, carbon disulfide, methylene chloride, and tetrachloroethene. SVOCs detected included 2-methylnaphthalene, 3,3'-dichlorobenzidine, benzoic acid, polycyclic aromatic hydrocarbons (PAH), and phthalates. The chlorinated pesticides 4,4'-dichlorodiphenyltrichloroethane (DDT) and chlordane were detected five times. Three explosive

compounds were detected in two soil borings. Four of the six metals with background values were detected at concentrations above the background range determined by IT (IT 1992).

Eight sediment samples were collected from throughout the site. Four VOCs were detected in the samples, but all of the chemicals detected were common laboratory contaminants or a naturally occurring compound in the bay environment. Two phthalates were detected at all of the sample locations. Copper and zinc were detected along the southern portion of the site at concentrations above IT defined background range (IT 1992).

3.3.18 SWMU 40 - Building 174

This section provides the site description for SWMU 40. Figure 2 shows the locations of building 174.

Building 174 is at the southeast corner of the intersection of White Road and Anderson Road, and serves as an electric substation which houses the electrical transformer that steps power down to distribution voltage levels. The transformer does not contain PCBs. In the past, this site housed a PCB transformer and may have been used to temporarily store PCB transformers that were not in use. The "not in use" transformers were reported to have leaked. Drip pans were used to contain the leaks.

3.3.19 SWMU 44 - Building 350

This section provides the site description and summary of previous investigations for SWMU 44. Figure 2 shows the locations of building 350 and other features.

Building 350 is located at the east end of the Tidal Area, 200 feet south of Port Chicago Highway and is within a double fenced area. It is known as the "Q" Area. It was guarded by U.S. Marine Corps personnel. During the course of this operation, used paint spray cans, rags, and solvents are generated. This building is one of the satellite accumulation points for hazardous waste.

Building 350 has two USTs, UST 350A and UST 350B, for diesel fuel oil storage. UST 350A is used to fuel the steam boiler that provides heating to this building, and UST 350B provides fuel to an

emergency electrical generator for the building. Both USTs were installed in 1981 and have a capacity of 2,000 gallons. A yearly leak test is done on these USTs, and the results are submitted to the CCCEHD. In June 1991, a pressure gage leaked about 20 gallons of diesel fuel oil onto the floor in building 350. Navy personnel contained and cleaned up the spill using absorbent materials.

According to records, building 350 and building 351 (a former Marine guard post) have sinks and sanitary sewer systems that drain into a common septic tank. The septic tank is located 55 feet from the southeast corner of Building 350. Sanitary sewer lines from building 350 and building 351 hook into a common manhole (manhole 1) 12 feet southwest of the septic tank. The drain field extends north of the septic tank and parallels building 350.

The septic tank was sampled on August 17, 1993. TOG was detected in the liquid sample. The only SVOC detected in the liquid sample was 4-methylphenol. VOCs detected in the liquid sample were 1,4-dichlorobenzene and toluene.

3.3.20 SWMU 50 - Building E-108

This section provides the site description and summary of previous investigation for SWMU 50. Figure 2 shows the locations of building E-108.

The site of former building E-108 is located in a paved parking area south of the intersection of Christenbury Road and Born Road. Building E-108 was the boiler house that supplied heat to barracks located in this area. A 500-gallon fuel oil UST was used to fire the boilers. The building was declared surplus in March 1965 and was removed from the site. It is not known whether the UST designated E-108 was removed or abandoned in place.

The gate into the Tidal Area is approximately 300 feet to the south. Building E-85 also lies to the south. A 1,500-gallon fuel oil UST is located at the northeast corner of building E-85. Building E-109 is to the northeast and building E-106 to the west.

During 1994, construction began on a new parking lot north of building E-85. During leveling of the parking lot, the foundation for the old boiler house was encountered. To test the depth of the foundation, a test hole was made adjacent to the southwest corner of the foundation using a backhoe.

Discoloration of the soil from 4 to 6 feet bgs and a small amount of organic matter at 6 feet bgs were observed. Samples of the soil and groundwater were collected on December 30, 1993, and analyzed for TPHd. The analysis showed the presence of TPHd in water and in soil at 2 feet and 4 feet. TOG was also detected in water. Additional holes were excavated 20 feet to the north, south, west, and east on January 20, 1994. The results showed that the TPHd was not present in soil samples from the north and east holes, but was present in the west hole (E-85 West). No TPHd was detected in the south hole, but the soil was discolored. A groundwater sample was also collected from the monitoring well adjacent to UST E-85. The results showed the presence of nondiesel petroleum hydrocarbons.

HLA conducted an investigation of UST E-85 on September 10, 1993. A soil boring (No. 7) was drilled adjacent to the building E-85 UST to a depth of 10 feet bgs and sampled at 4.25 and 7.5 feet bgs. The results indicated TPHd was present in the soil samples. TPHd was also detected in groundwater which was encountered at 10.0 feet bgs and sampled.

3.3.21 SWMU 51 - Building IA-56

This section provides the site description and summary of previous investigations for SWMU 51. Figure 3 shows the locations of building IA-56.

Building IA-56 is at the old airport at the end of Beckman Road. The past operations of building IA-56 are not documented. It is believed that it was an administration building for the runway located at the site. The building is now being used as a forklift training school.

Building IA-56 has a sink and sanitary sewer system that drains through a 6-inch cast iron (CI) pipe into a septic tank about 50 feet away. In 1991 the drain field was replaced, but the septic tank was not. The old drain field is located east of the new drain field, which partially overlaps the old drain field. The outlet of the septic tank connects to a splitter box, about 25 feet away, through a 6-inch CI pipe. The splitter box divides effluent from the septic tank six ways through 4-inch-diameter polyvinyl chloride (PVC) perforated pipes. The distribution box and drain field were installed in 1992 adjacent to the old drain field. Each distribution field is about 2 feet wide and 3.5 feet deep. The drain field has a slope of 0.004 along the 50-foot length.

The septic tank was sampled on August 17, 1993. SVOCs detected in the liquid sample were benzoic acid, 4-methylphenol, and phenol.

3.3.22 SWMU 52 - Building 7SH5

This section provides the site description and summary of previous investigations for SWMU 52. Figure 3 shows the locations of building 7SH5.

Building 7SH5 is located between Sixteenth Street and Seventeenth Street and was formerly a missile wing and fin repair facility. The building is currently manufacturing mobile laboratories to be used during explosive inspection and test activities at remote sites. According to the IAS (E&E 1983), the building was an ammunition storage magazine before 1970. Activities at the building since 1970 included paint stripping, cleaning, and repainting missile wings and fins. Acetone, trichloroethane, methyl ethyl ketone, chloroethane, and several types of paint thinners were used. The quantity of wastes generated from activities in the building were probably less than 100 gallons per year. From 1970 to 1978, the Tidal Area Landfill reportedly received all wastes from building 7SH5. After 1978, generated wastes have been disposed of off base. However, during the IAS there was an allegation that paints, oil, and solvents were disposed of in a 24-inch-deep earthen pit or into a nearby drainage ditch (E&E 1983). IT (1989) determined the pit to have been in the parking lot near the southwest corner of building 7SH5, where a section of the pavement is missing. This disposal practice has ceased and subsequently the pit was backfilled (IT 1989). The procedure used to abandon the pit was not reported.

On the west side of building 7SH5, a 12-foot-wide, 7-foot-deep ditch drains portions of the parking lot to the south of building 7SH5. A 1,000 gallon steel UST for storing diesel is along the center of the south wall.

Building 7SH5 has a sink and sanitary sewer system that drains into a 500-gallon septic tank through a 4-inch VCP. The septic tank is about 40 feet northwest of building 7SH5. The septic tank is completely covered with dirt material. The distribution box splits the effluent into four 4-inch open-joint UCP which run parallel to the drain field and are about 8 feet apart. Each distribution field is about 2 feet wide and 3.5 feet deep. The drain field has a slope of 0.004 along the 60-foot length.

The IAS eliminated this site from consideration because of the small quantity of wastes that might be present. However, due to changes in regulations since the IAS and the absence of records on the disposal activities and pit abandonment, this site was included in the WPNSTA Concord Inland Area Sites SI to determine if it poses an environmental or health hazard under current regulations.

The investigation at SWMU 52 included the collection and analysis of soil samples from three soil borings within the backfilled pit and the collection and analysis of one composite surface soil sample from the bottom of the drainage ditch. The three soil borings within the backfilled pit were drilled to a depth of 4 feet. Three surface soil samples were also collected from the ditch parallel and adjacent to Seventeenth Street. The three soil samples from the ditch were composited in the laboratory into one sample for chemical analysis. The soil samples were analyzed for VOCs, SVOCs, metals, tributyltin (TBT), and total petroleum hydrocarbons (TPH).

Two soil samples were collected from each of the three soil borings at depths of approximately 2 and 4 feet. The soil sample at the 3.5-foot depth from SB-1 contained TPHd. The sample at the 2-foot depth in the same soil boring did not contain any TPHd. The majority of the metals from soil samples in the pit were not above the reference level of the arithmetic mean plus three standard deviations. The only metals above the 95 percent/95 percent tolerance interval reference level were arsenic, calcium, copper, lead, and mercury. The 95 percent/95 percent tolerance interval is presented because it was considered as being the most statistically meaningful value for evaluating the distribution of background data presented in the SI report (PRC/Montgomery Watson 1992)

The composite soil sample from the ditch detected TPHd, bis(2-ethylhexyl)phthalate, and toluene. No other VOCs and SVOCs were detected. Arsenic, for which the data was qualified, was the only analyzed metal from the composite ditch sample that exceeded the reference level for metals.

The septic tank was sampled on October 9, 1990, and August 17, 1993. TOG was detected in the liquid sample both times. SVOCs detected in the October 9, 1990, liquid sample were 4-methylphenol, naphthalene, phenol, benzoic acid, and 1,4-dichlorobenzene and in the August 17, 1993, liquid sample were 1,4-dichlorobenzene, 4-methylphenol, and naphthalene. VOCs detected in the October 9, 1990, liquid sample were 1,4-dichlorobenzene, toluene, and total 1,2-dichloroethene.

An investigation of the UST located south of building 7SH5 was conducted by HLA on September 27, 1993. A soil boring (No. 2) was drilled to a depth of 16.5 bgs and sampled at 4.5, 8, and 16 feet bgs. The soil sample results indicated that TPHd was present in the 4.5- and 8-foot samples. The 16-foot sample did not indicate any TPHd in the soil above the detection limits. SVOCs detected in the 4.5-foot soil sample were acenaphthene, fluorene, 2-methyl-naphthalene, and naphthalene. The SVOC detected in the 8-foot soil sample was naphthalene. No SVOCs was detected in the 16-foot sample.

3.3.23 SWMU 53 - Building 7SH14

This section provides the site description and summary of previous investigations for SWMU 53. Figure 3 shows the locations of building 7SH14.

Building 7SH14, constructed during the 1940s, is located on Seventeenth Street approximately 3/4 mile south of the intersection of Kinne Boulevard and Wilden Road. The building was used to store munitions in the past. The building is now used for inert storage, environmental testing, and training.

A 5,000-gallon UST is located at the northeast corner of building 7SH14 near the railway spur. It contained diesel fuel to serve oil-fired heaters inside the building. The UST is scheduled to be removed and replaced under a separate program.

Building 7SH14 has a sink and sanitary sewer system that drains through a 4-inch pipe to the inlet manhole of a septic tank. The septic tank has a capacity of 1,500 gallons. The outlet manhole of the septic tank connects to a splitter box through a 4-inch pipe. The splitter box divides effluent from the septic tank flow into nine 4-inch pipes which run parallel to the drain field and are about 7 feet apart. The drain pipes run along the entire 50-foot length of the drain field which has a slope of 0.02.

The old septic tank was sampled on October 9, 1990, and August 17, 1993. TOG was detected in the liquid samples.

3.3.24 SWMU 54 - Building 79

This section provides the site description and summary of previous investigations for SWMU 54. Figure 3 shows the locations of building 79.

Building 79, constructed during the 1950s, is at the intersection of Kula Gulf Street and Coral Sea Road approximately a quarter mile north of Kinne Boulevard. Building 79 housed the Reaction Fast Force consisting of 20 to 30 Marines who patrolled the Alpha high-security area. The Marines would remain in the building for shifts of up to 12 to 24 hours before being relieved. The facility maintained a kitchen and restrooms for the Marines. After being abandoned in the mid 1980s, plans were drawn up to convert the building into an x-ray facility. Construction began but was never completed. The building is no longer being used.

Building 79 has an old septic tank and drain field system that was abandoned in 1978. The old septic tank was about 60 feet east of the building. The drain field, which is about 60 feet by 120 feet, is just north of the Alpha area and about 80 feet east of building 79. The 6-inch VCP connected to the old septic tank was plugged with concrete.

The new sink and sanitary sewer system drains into a 2,175-gallon septic tank through a 4-inch VCP. The septic tank is about 80 feet west of building 79. The septic tank is completely covered with dirt. The outlet of the septic tank sends the effluent into a distribution box through a 4-inch VCP. The distribution box splits the effluent into 10 4-inch open-joint UCPs which run parallel to the drain field. Each UCP drain is about 10 feet apart. Each distribution field is about 2 feet wide and 2.5 feet deep. The drain field has a slope of 0.003 along the 100-foot length.

The septic tank was sampled on August 17, 1993. TOG was detected in the liquid sample. SVOCs detected in the liquid sample were 1,3-dichlorobenzene and 2,4-dichlorophenol.

4.0 SITE-SPECIFIC HAZARD EVALUATION

Summary of soil and water sampling activities to be conducted during the SI are presented in Table 1. OSHA permissible exposure limits (PELs) for on site chemicals are presented in Table 2. Hazardous materials to be potentially encountered are presented in Table 3 and a work task hazard analysis is

provided in Table 4. The Material Safety Data Sheets (MSDS), included in Attachment G, summarize the toxicological, human health, and safety information for hazardous materials that may be encountered at the site. The following sections describe the possible exposure pathways and health effects of hazardous chemicals at the site.

4.1 EXPOSURE PATHWAYS

Exposure to the hazardous chemicals during field activities may occur through inhalation, dermal contact, and ingestion. Descriptions of these exposure pathways are provided below.

4.1.1 Inhalation

A principal pathway of exposure to hazardous chemicals that may potentially be inhaled associated with on-site SI activity is through inhalation of organic vapors or dust emanating from a potential source of contamination.

4.1.2 Dermal Contact

Physical contact with contaminated media during on-site work tasks is the principal pathway of exposure to nonvolatile hazardous materials. The potential for direct contact with contaminated media exists during all field work tasks. PPE to be used during on-site activities will be resistant to the substances that may be encountered. The selection and use of PPE and standard safe operating procedures are described in Section 6.2 and 9.3, respectively.

4.1.3 Ingestion

Ingestion of hazardous materials usually occurs because of lack of proper hygiene or decontamination. Section 10.0 discuss practices that will prevent ingestion.

4.2 HEALTH EFFECTS

The following chapters describe the health effects of organic and inorganic chemicals, or nuisance dusts that may be encountered during site activities. Health effect information is drawn from "Pocket Guide to Chemical Hazards," NIOSH, 1990. Table 2 presents OSHA permissible exposure limits (PEL) for chemicals to be potentially encountered on site, in accordance with 29 CFR 1910.1000, "Air Contaminants."

4.2.1 Volatile Organic Compounds

Medium VOC levels may be encountered during SI activities. Generally, VOCs are central nervous system depressants. Exposure to some VOCs may occur through skin absorption. General symptoms of VOC exposure, both acute and chronic, may include euphoria, headache, weakness, dizziness, nausea, narcosis, and possibly a coma. Certain VOCs are also skin and eye irritants.

Worker exposure to VOCs will be controlled by the proper use of PPE and respirators, and qualitative atmospheric monitoring for organic vapors (see Section 8.0, Environmental Surveillance). The degree of respiratory protection used will depend on the monitoring results and the task to be performed.

4.2.2 Inorganic Compounds

Inorganic compounds are chemicals that do not contain carbon in their structure. These include metals or other compounds, such as asbestos. The symptoms of acute exposure to inorganic compounds consist of, but are not restricted to, abdominal pain, hypertension, anemia, insomnia, and restricted pulmonary function. Chronic exposure to some metals and asbestos may lead to development of cancer. Examples of other inorganic chemicals include asbestos, pesticides, and PCB.

4.3 PHYSICAL HAZARDS

Physical hazards associated with SI present a potential threat to on-site personnel. Dangers are posed by heavy equipment, utility and power lines, unseen obstacles, noise, heat stress, cold stress, poor illumination, and bodies of water.

Injuries may result from the following:

- Accidents due to slip, trip, or fall hazards
- Use of improper lifting techniques
- Moving or rotating equipment
- Equipment mobilization and operation (for example, electrocution from contact with overhead or underground power lines)
- Improperly maintained equipment

Injuries resulting from physical hazards can be avoided by adopting safe work practices (SWP) and by employing caution when working with machinery. SWPs to be employed during SI are described in Section 9.3. To help ensure a healthful and safe work place, the site-specific OHSO will conduct and document regular health and safety inspections and will make sure that all workers are informed of any potential physical hazards related to the site.

5.0 TRAINING REQUIREMENTS

All on-site personnel who may be exposed to hazardous on-site conditions, including PRC and subcontractor personnel and site visitors who will participate in on-site activities at WPNSTA Concord will be required to meet the training requirements outlined in 29 CFR 1910.120(e), which covers hazardous waste operations and emergency response. All personnel and visitors entering the site will be required to read this site-specific HSP and sign the Health and Safety Plan Compliance Agreement Form shown as Attachment A. Site workers also will be required to sign the Health and Safety Meeting Sign-off Sheet shown as Attachment B.

Before on-site activities begin, a briefing will be presented by the site-specific OHSO for all personnel who will participate in on-site activities. The following topics will be addressed during the briefing:

- Site history
- Work tasks
- Names of the site-specific OHSO and the designated alternate

- Hazardous chemicals that may be encountered during on-site activities
- Physical hazards that may be encountered on site
- Training requirements
- Contents of the Field Activities Equipment List shown as Attachment D to this site-specific HSP
- Levels of protection for various work tasks as described in Section 6.1, "Levels of Protection."
- Environmental surveillance equipment use and maintenance (discussed in Section 8.0, "Environmental Surveillance.")
- Action levels (discussed in Section 8.4, "Action Levels") and identification of situations requiring an upgrade or downgrade in levels of protection
- Site control measures, including site control zones, communications, and safety work practices (these measures are discussed in Section 9.1.1, 9.1.2, and 9.1.3, respectively).
- Emergency communication signals and codes
- Decontamination procedures
- Environmental accident emergency procedures (in case contamination spreads outside the exclusion zone)
- Personnel exposure and accident emergency procedures (in case of exposure to hazardous substances, falls, and other hazardous situations)
- Fire and explosion emergency procedures
- Emergency telephone numbers
- Emergency hospital route

Any other health-and safety-related topic that may arise before on-site activities begin will also be discussed at the pre-entry briefing.

Issues that arise during implementation of on-site activities will be addressed during "tailgate" safety meetings to be held daily, before the shift begins. Any changes in procedures or site-specific health-and-safety-related matters will be addressed during these meetings.

6.0 PERSONAL PROTECTION REQUIREMENTS

PPE will be worn to protect field personnel from known or suspected physical hazards, and air-, soil- and water-borne contamination. The levels of personal protection to be used for work tasks have been selected based on known or anticipated physical hazards, and concentrations of contaminants that may be encountered on site, and their chemical properties, toxicity, exposure routes, and contaminant matrices.

The following sections describe levels of protection, protective equipment and clothing, limitations of protective clothing, the duration of work tasks, and respirator selection, use, and maintenance. Because sufficient information regarding site hazards is available and minimal hazards are anticipated, all activities will initially be performed with D modified Level of Protection.

6.1 LEVELS OF PROTECTION

Personnel will wear protective equipment when site activities involve known or suspected atmospheric contamination; when vapors, gases, or particulates may be generated by site activities; or when direct contact with skin-affecting substances may occur. Full-face respirators protect lungs, the gastrointestinal tract, and eyes against airborne contaminants. Chemical-resistant clothing protects the skin from contact with skin-destructive and absorbable chemicals.

Levels of protection and necessary components for each are classified under five categories according to the degrees of protection afforded:

- | | |
|--------------------------|--|
| D Level: | This level of PPE should be worn only as a work uniform, not in any area with respiratory or skin hazards. |
| D Modified Level: | This level of PPE should be worn only as minimal protection against chemical hazards. |
| C Level: | This level of PPE should be worn when the criteria described for Level C protection in Section 6.2 for using air-purifying respirators are met, and a lesser level of skin protection is needed. |

- B Level:** This level of PPE should be worn when the highest level of respiratory protection is needed, but a lesser level of skin protection is required. Level B is the primary level of choice for unknown environments.
- A Level:** This level of PPE should be worn when the highest level of respiratory and skin protection is required.

6.2 PROTECTIVE EQUIPMENT AND CLOTHING

The following general levels of protection and the associated PPE have been selected for use by field personnel during drilling and sampling activities (see Table 4, Work Task Hazard Analysis). Because the anticipated hazard level is low, field work will be performed using Level D modified protection. If site conditions or the results of air monitoring performed during on-site activities warrant Level C protection, all field personnel will withdraw from the site, immediately notify the site-specific OHSO, and wait for further instructions.

Descriptions of equipment and clothing required for Levels D, D Modified, C, and B protection are provided below. It is not anticipated that site activities will warrant Level A protection. However, if site activities require A Level of Protection, the site-specific OHSO will develop a description of PPE on a site-specific basis after discussion with the HSPM and PRC's responsible PM.

- **D Level**
 - Coveralls or work clothes, if applicable
 - Steel-toed boots with shanks
 - Hard hat
 - Disposable boot covers (when entering wet or muddy areas with known elevated contamination levels, such as previously excavated waste areas)
 - Hearing protection (for areas with a noise level exceeding 85 decibels on the A-weighted scale)

- **D Modified Level**
 - Coveralls or work clothes
 - Steel-toed boots with shanks

- Hard hat (face shield)
- Disposable outer gloves (latex or nitrile)
- Chemical-resistant clothing (Tyvek® or Saranex®)
- Disposable boot covers
- Hearing protection (for areas with a noise level exceeding 85 decibels on A-weighted scale)

C Level

- Coveralls or work clothes, if applicable
- Chemical-resistant clothing (Tyvek® or Saranex®)
- Outer gloves (neoprene or nitrile)
- Inner gloves (latex or polyvinyl chloride)
- Steel-toed boots with shanks
- Disposable boot covers or chemical-resistant outer boots
- Full- or half-facepiece air-purifying respirator with NIOSH-approved cartridges to protect against organic vapors, dust, fumes, and mists (cartridges will be changed at the end of each shift or at breakthrough, whichever occurs first)
- Safety glasses or goggles (with half-face respiratory only)
- Hard hat (face shield optional)
- Hearing protection (for areas with a noise level exceeding 85 decibels on the A-weighted scale)

B Level

- Chemical-resistant clothing (Tyvek® or Saranex®)
- Outer gloves (neoprene or nitrile)
- Inner gloves (latex or polyvinyl chloride)
- Steel-toed boots with shanks
- Disposable boot covers or chemical-resistant outer boots

- Positive-pressure, demand-type airline respirator with an air cylinder, or SCBA approved by NIOSH
- Hard hat (face shield optional)
- Hearing protection (for areas with a noise level exceeding 85 decibels on the A-weighted scale)
- Duct tape connecting gloves to sleeves and cuffs to boots

6.3 LIMITATIONS OF PROTECTIVE CLOTHING

PPE clothing ensembles designated for use during site activities have been selected to provide protection against contaminants at known or anticipated concentrations in soil or water matrices. However, no protective garment, glove, or boot is entirely chemical-resistant, nor does any protective clothing provide protection against all types of chemicals.

Permeation of a given chemical through PPE depends on contaminant concentrations, environmental conditions, the physical condition of the protective garment, and the resistance of the garment to the specific contaminant. Chemical permeation may continue even after the source of contamination has been removed from the garment.

To obtain optimum use from PPE, the following procedures will be followed by all site personnel.

- When using Tyvek® or Saranex® coveralls, don a new, clean garment after each rest break or at the beginning of each shift.
- Inspect all clothing, gloves, and boots both before and during use for the following:
 - Imperfect seams
 - Nonuniform coatings
 - Tears
 - Poorly functioning closures
- Inspect reusable garments, boots, and gloves both before and during use for visible signs of chemical permeation such as the following:
 - Swelling
 - Discoloration
 - Stiffness
 - Brittleness

- Cracks
- Sign of puncture
- Sign of abrasion

Reusable gloves, boots, or coveralls exhibiting any of the characteristics listed above must be discarded. PPE clothing used in areas with known or suspected elevated concentrations of contaminants should not be reused. Reusable PPE will be decontaminated in accordance with procedures described in Section 10.1 and will be neatly stored in the support zone, away from work zones.

6.4 DURATION OF WORK TASKS

The duration of site activities involving the use of PPE will be established by the site-specific OHSO and will be based upon ambient temperature and weather conditions, the capacity of personnel to work in the designated level of PPE (taking into account such conditions as heat stress), and the limitations of the PPE. All rest breaks will be taken in the support zone after decontamination and removal of PPE.

6.5 RESPIRATOR SELECTION, USE, AND MAINTENANCE

All PRC and subcontractor personnel taking part in site activities must fulfill worker respiratory protection provisions outlined in 29 CFR 1910.120.134 "Respiratory Protection". PRC and subcontractor personnel will be informed of the proper use, maintenance, and limitations of air-purifying respirators during the site pre-entry briefing, if applicable. All site personnel must complete a qualitative fit test for the respirator to be used on site.

Respirator use is anticipated for the site. If necessary, a full- or half-face, air-purifying respirator equipped with NIOSH- approved cartridges will be selected for use to protect against organic vapors, dust, fumes, and mists. Respirators will be selected by the site-specific OHSO based upon knowledge of the substances that may be present and the concentrations of compounds previously encountered at the site.

Air-purifying respirators will be used only in conjunction with breathing zone air monitoring, which must be conducted with adherence to the action limits outlined in Section 8.0. Air-purifying respirators will be used only when the devices can provide protection against the substances encountered on site.

Factors precluding the use of air-purifying respirators are as follows:

- Oxygen-deficient atmosphere (less than 19.5 percent oxygen)
- Concentrations of substances that may be immediately dangerous to life and health (IDLH), as defined in the MSDSs found in Attachment D
- Confined or unventilated areas that may contain air contaminants not yet characterized
- Unknown air contaminant concentrations or concentrations that may exceed the maximum use levels of 1,000 parts per million (ppm) for the designated cartridges, in accordance with the selected cartridge manufacturer's instructions
- Unidentified air contaminants
- High relative humidity (which reduces the sorbent life of the cartridges)
- Identified substances with inadequate warning properties (for example, they are tasteless, odorless, and invisible), and respirator cartridges with an unknown sorbent service life, and respirator units with no end-of-service-life indicator

Respirators will be inspected daily, and any necessary repairs will be made during the time of inspection. Damaged respirators will be properly disposed. Respirators issued to individuals will be cleaned and disinfected in the support zone at least weekly. When a respirator is used by more than one person, the respirator will be cleaned and disinfected after each use. After being cleaned, respirators will be placed in clean, plastic bags and stored in the support zone. The following respirator inspection and cleaning procedures will be followed whenever respirator protection is used:

- **Daily Inspection and Checkout Procedures:**
 - Visually inspect the entire unit for obvious damage and deteriorated rubber.
 - Inspect the face piece harness for damage.
 - Inspect the lens for damage, and make sure the face piece has the proper seal.

- Pull off the plastic cover of the exhalation valve, and check the valve for debris and tears in the neoprene that could cause leakage.
 - Unscrew the cartridges of both inhalation valves, and visually inspect the neoprene valves for tears. Make sure the inhalation valves and cartridge receptacle gaskets are in place.
 - Make sure a protective cover is attached to the lens.
 - Make sure the speaking diaphragm retainer ring is hand-tight.
 - Don the respirator, and perform the negative pressure test.
- **Weekly Cleaning Procedures:**
 - Disassemble the respirator in the support zone by removing the cartridges, damaging them to prevent accidental reuse, and discarding them. To clean the respirator thoroughly, remove the inhalation and exhalation valves, speaking diaphragm, and any hoses.
 - To clean the respirator, dissolve cleaning and disinfecting solution (usually provided by the manufacturer) in warm water in an appropriate tub. With gloved hands, swirl the respirator in the tub for at least 1 minute. A soft brush may be used to facilitate cleaning.
 - Rinse the cleaned and disinfected respirator thoroughly with potable water to remove all traces of detergent and disinfectant. This step is very important in preventing dermatitis.
 - Air dry the respirator on a clean surface. The respirator may also be hung upside-down, but care must be taken not to damage or distort the face piece.
 - Reassemble the clean, dry, respirator and inspect it in an area separate from the disassembly area to avoid contamination. Inspect the respirator carefully for detergent or soap residue left by inadequate rinsing. Residue appears most often under the seat of the exhalation valve and can cause valve leakage or sticking.
- **Procedures to Follow after Routine Use in the Exclusion Zone:**
 - Wash and rinse the respirator in the support zone with soap and warm water.
 - At a minimum, wipe the respirator with disinfectant wipes that have been soaked in benzoalkaloid or isopropyl alcohol. Allow the respirator to air dry in the support zone.

The effectiveness of the respiratory protection program will be continuously monitored by the site-specific OHSO. Monitoring of worker stress levels during activities that require respiratory protection will also be performed by the site-specific OHSO as discussed in Section 8.0, "Environmental Surveillance."

7.0 MEDICAL SURVEILLANCE

The following sections describe PRC's medical surveillance program, including health monitoring, documentation and record keeping, and medical support and follow-up. This program will be followed for all work activities at WPNSTA Concord.

7.1 HEALTH MONITORING REQUIREMENTS

All PRC and subcontractor personnel involved in on-site activities at the WPNSTA Concord site must participate in a health monitoring program, as required by 29 CFR 1910.120(f). PRC has established a health monitoring program with Environmental Medicine Resources, Inc., of Atlanta, Georgia. Under this program, PRC personnel receive annual or biennial physical examinations consisting of the following.

- A baseline medical examination that includes the following:
 - Completion of a personal, family, and environmental history questionnaire
 - Physical examination
 - Vision screening
 - Laboratory test
 - Audiometric screening
 - Pulmonary function test
 - Resting electrocardiogram
 - Chest x-ray (required one every 3 years)

- A complete blood count that includes the following:
 - White blood count
 - Red blood count
 - Hemoglobin test
 - Hematocrit test
 - Liver function test
 - Kidney function test
 - Lipid metabolism test

- Carbohydrate metabolism test
- A urinalysis that includes the following:
 - Sugar content test
 - Albumin content test
 - Specific gravity test
- Laboratory chemistries for the followings:
 - Cholinesterase
 - Coproporphyrin and uroporphyrin

PRC receives a copy of the examining physician's written opinion after post-examination laboratory tests have been completed; PRC employees also receive a copy of the written opinion. This opinion includes the following information [in accordance with 29 CFR 1910.120(f)(7)]:

- The results of the medical examination and tests.
- The physician's opinion as to whether or not the employee has any medical conditions that would place the employee at an increased risk of health impairment from work in hazardous waste operations or during an emergency response.
- The physician's recommended limitations, if any, upon the employee's assigned work. Special emphasis is placed on fitness for duty, including the ability to wear any required PPE under conditions expected on-site (for example, temperature extremes).
- A statement that the employee has been informed by the physician of the medical examination results and of any medical conditions that require further examination or treatment.

All subcontractors must have equivalent health monitoring programs conducted by their own clinics in compliance with 29 CFR 1910.120(f).

7.2 DOCUMENTATION AND RECORD KEEPING REQUIREMENTS

PRC's Chicago office will maintain medical surveillance records for each PRC employee performing hazardous waste site activities. The records will be in compliance with 29 CFR 1910.120(f). The records will also be maintained at Environmental Medicine Resources, Inc., in Atlanta, Georgia and

individual PRC offices for that office's personnel. Subcontractors will be required to maintain similar records for their employees.

Any visitor or observer at the site will be required to provide records in compliance with 29 CFR 1910.120(f) before entering the site. PRC will be responsible for recording and reporting accidents, illnesses, and injuries involving PRC employees in accordance with 29 CFR 1910 and 1926 and the U. S. Navy's requirements. An Accident/Incident Report Form, to be completed by the site-specific OHSO, is shown as Attachment E. A copy of this completed report will be added to PRC's medical surveillance records in the event of a reportable accident, incident, illness, or injury.

7.3 MEDICAL SUPPORT AND FOLLOW-UP REQUIREMENTS

PRC employees and subcontractor personnel will be required to seek medical attention and physical testing in the event of injury or possible exposure above established exposure limits. Depending upon the type of injury or exposure, follow-up testing, if required, must be performed within 24 to 48 hours of the incident. The type of test to be performed to monitor exposure effects will be based on the circumstances involved and will be selected by a qualified health professional from Environmental Medicine Resources, Inc.

8.0 ENVIRONMENTAL SURVEILLANCE

Air monitoring will be performed during designated on-site work tasks to protect field personnel against exposure to airborne hazardous substances and to determine appropriate levels of PPE for work tasks. The following sections discuss initial air monitoring, periodic air monitoring, monitoring parameters, use and maintenance of survey equipment, heat stress monitoring, and cold stress monitoring.

8.1 INITIAL AIR MONITORING

Initial air monitoring of the work area will be performed before beginning any work task. This monitoring will be performed using real-time field survey instrumentation, such as a photoionization detector (PID), to determine the levels of airborne organic contaminants. These levels will also be

monitored at the beginning of each work day to identify background contaminant concentrations and to detect any potentially hazardous situation that might have developed during off-shift periods.

8.2 PERIODIC AIR MONITORING

Periodic air monitoring will be performed during all site activities. This type of monitoring will be performed as a minimum requirement when the following situations arise:

- Work begins on a different portion of the site.
- Contaminants other than those previously identified are encountered.
- A different type of operation is initiated. (For example, well installation is initiated after drilling activities).
- Workers handle leaking containers, or work in areas with obvious liquid contamination (for example, spill or lagoon areas).
- Obvious lithologic changes are noticed during drilling activities.
- Workers experience physical difficulties.

Required survey instrumentation, sampling procedures, and monitoring procedures are specified in Section 8.3, "Monitoring Parameters." Sampling methods will be subject to review by the site-specific OHSO.

8.3 MONITORING PARAMETERS

Air monitoring for VOCs will be performed at shoulder height (in the breathing zone) on workers most likely to be exposed to potentially hazardous concentrations of contaminants. Situations that will require air monitoring, monitoring parameters, detection devices, and action levels are discussed below.

8.3.1 Organic Vapors

The following instrument and monitoring frequency may be used to monitor for organic vapors during site activities.

- **Instrument:** Ultraviolet PID equipped with a 9.8 electron voltage lamp
- **Activity:** soil boring, sampling
- **Monitoring Frequency:** Monitoring will occur continuously during on-site activities. PID readings will initially be recorded in the field logbook every 30 minutes. If continued monitoring does not indicate the presence of VOCs, readings may be recorded every hour or longer based on the site-specific OHSO's review of the monitoring data collected.

Individual concentrations of VOCs of concern will not be determined by field instruments because mixtures of VOCs may be encountered and real-time field survey instrumentation may react to the total VOC mixture (by measuring positive interference, or giving a false-positive reading). It will be assumed that any VOC mixture detected will be entirely made up of the VOC with the lowest airborne PEL, benzene. The lower applicable values of the OSHA PEL benzene will be used to establish the measured atmospheric concentration at which respiratory protection levels will be upgraded or downgraded.

If PID readings in the breathing zone exceed 0.5 ppm above the background concentration, the air will be sampled with a Dräger® tube specific for benzene. If the concentration exceeding the PEL is detected with the Dräger® tube, the area will be evacuated, and the site-specific OHSO and PRC's responsible PM will be notified. If benzene is not detected, the constituent with the next lowest PEL will be monitored for action levels. PELs are listed in Table 2.

8.3.2 Explosive Atmospheres

When a flammable compound reaches a certain concentration air, it becomes explosive when exposed to an ignition source. The lowest concentration able to support combustion is known as the lower explosive limit (LEL). Each flammable compound has its own LEL. Monitoring indicates how close to this limit the airborne concentration of any flammable compound is. Site activities will be conducted until the airborne concentration of any flammable compound reaches above 10 percent of its LEL. The following instrument, monitoring frequency, and general action levels may be used to monitor for explosive atmospheres during site activities.

- Instrument: Combustible gas and OM (calibrated for pentene)
- Activity: Drilling activities
- Monitoring Frequency: Monitoring will occur continuously during site activities

8.3.3 Exposure to Inorganic Compounds in the Form of Particulates

Inorganic compounds and metals include mercury, nickel, and asbestos. It is possible to encounter those contaminants during the facility tour soil and sludge sampling activities, excavation activities and drilling. Fine particulates that may be encountered include contaminated and non-contaminated soil particles, heavy metal particulates, and pesticide dust. The concentrations of those contaminants may not be known. The specific health-related hazards associated with individual contaminants are presented in Table 3.

Particulates may be comprised of nuisance dust that inhibit the proper lung function. However, some inorganic compounds present in particulates can cause pulmonary fibrosis, systemic poisoning and allergic hypersensitivity reactions.

As a general rule, personnel should use appropriate PPE monitoring and engineering control methods to reduce hazards. A water mist must be used to suppress dust during intrusive activities, to reduce inhalation hazards due to resuspension.

8.4 ACTION LEVELS

The following sections present the action levels for organic vapors, and particulates. The action levels prescribe the necessary level of protection required in accordance with Section 6.0, "Personal Protection Requirements," and any required action depending on the measured levels of exposure.

8.4.1 Organic Vapors

8.4.1.1 Total Organic Vapors Where Specific Potential Air Contaminants Are Unknown

- **Situation:** concentration at background concentration determined by a photoionization detector (PID) or flame ionization detector (FID)
- **Action:** use **D level of protection**; continue work activities; continue air monitoring with a PID or FID
- **Situation:** concentration 0 to 5 ppm above background concentration
- **Action:** notify the site-specific OHSO; upgrade to **C level of protection**; continue work activities; continue air monitoring with a PID or FID
- **Situation:** concentration 5 to 500 ppm above background concentration
- **Action:** notify the site-specific OHSO; upgrade to **B level of protection**; continue work activities unless otherwise directed by the site-specific OHSO; continue air monitoring with a PID or FID
- **Situation:** concentration more than 500 ppm above background concentration
- **Action:** stop work; evacuate the site immediately; notify the site-specific OHSO; call the HSPM

8.4.1.2 Site-specific organic vapor

- **Situation:** concentration at background concentration up to the PEL for the site-specific organic vapor determined by the use of a colorimetric detector tube
- **Action:** Use **D level of protection**; continue work activities; continue air monitoring with a colorimetric detector tube
- **Situation:** concentration greater than the PEL up to less than 3 times the PEL for the site-specific organic vapor determined by the use of a colorimetric detector tube
- **Action:** notify the site-specific OHSO; upgrade to **C level of protection**; continue work activities; continuing air monitoring with a colorimetric detector tube
- **Situation:** concentration greater than 3 times the PEL for a site-specific organic vapor determined by the use of a colorimetric detector tube
- **Action:** notify the site-specific OHSO; upgrade to **B level of protection** unless directed otherwise by the site-specific OHSO; continue work activities; continuing air monitoring with a colorimetric detector tube; call the HSPM

8.4.2 Explosive Atmospheres

- **Situation:** concentration at background concentration to less than 10 percent of the Lower Explosive Limit (LEL) equivalent of the combustible gas indicator (CGI) calibration gas pentane
- **Action:** use D level of protection; continue work activities; continue air monitoring with a CGI
- **Situation:** background concentration up to 10 percent of the LEL equivalent of the CGI calibration gas pentane
- **Action:** use D level of protection; notify the site-specific OHSO; continue work activities with caution; continue air monitoring with a CGI
- **Situation:** concentration at more than 10 percent of the LEL equivalent of the CGI calibration gas pentane
- **Action:** stop work; evacuate the site immediately; notify the site-specific OHSO; call the HSPM

8.4.3 Total Particulates

- **Situation:** total particulates at background concentration determined by a Miniram total dust monitor
- **Action:** use D level of protection; continue work activities; continue air monitoring with a Miniram total dust monitor
- **Situation:** total particulates less than 5 mg/M³ determined by a Miniram total dust monitor
- **Action:** use D level of protection; continue work activities; continue air monitoring with a Miniram total dust monitor
- **Situation:** total particulates from 5 to 10 mg/M³
- **Action:** notify the site-specific OHSO; upgrade to C level of protection using respirators equipped with high efficiency particulate air (HEPA) filters; continue work activities; continue air monitoring with a Miniram total dust monitor
- **Situation:** total particulates greater than 10 mg/M³
- **Action:** notify the site-specific OHSO; upgrade to B level of protection; continue work activities; continue air monitoring with a Miniram total dust monitor; call the HSPM

8.5

USE AND MAINTENANCE OF SURVEY EQUIPMENT

The site-specific OHSO will brief all personnel using field survey equipment on its operation, limitations, calibration procedures, and maintenance. Maintenance and calibration will be performed in accordance with manufacturer guidelines by a designated individual familiar with the devices. All field air monitoring equipment should be calibrated before each use to monitor exposure to airborne toxic environments for an 8-hour work shift.

Repairs, maintenance, and routine calibration of these devices will be recorded in an equipment maintenance logbook that will be signed by the service technician. The equipment maintenance log book for each instrument will be kept in that instrument's case,

Air monitoring equipment such as PIDs will be calibrated before work begins. Only routine maintenance (such as changing batteries or lamps and cleaning lamps and fans) will be performed by on-site personnel. Any additional maintenance will be performed by a trained service technician.

8.6

HEAT STRESS MONITORING

Heat stress is a common and serious illness at hazardous waste sites. Occurrence of heat stress depends on such factors as environmental conditions, workload, an on-site worker's physical condition and characteristics, and the type of PPE required for the work task. Some types of PPE are heavy, increase the body's energy expenditure, and reduce the efficiency of the body's normal heat exchange mechanisms.

Heat stress may be of particular concern when the dry-bulb air temperature exceeds 70° Fahrenheit (F). Depending on the degree and nature of possible heat stress to be encountered on site, the site-specific OHSO will choose from the following heat stress control actions:

- Provide adequate liquids to replace lost body fluids. These liquids can be water, commercial mixes combined with potable water, or commercial liquids (such as Gatorade®).
- Establish a work regimen that will provide adequate rest periods for cooling down. This action may require additional shifts for workers or earlier or later work schedules.

- Provide cooling devices, such as vortex tubes or cooling vests, to be worn beneath protective garments.
- Require removal of impermeable protective garments during rest periods.
- Ensure that all rest periods are taken in a shaded rest area, if possible.
- Regulate rest periods, and ensure that workers will not be assigned other tasks during rest periods.
- Notify all workers of health hazards and the importance of adequate rest, acclimatization, and proper diet; teach workers to recognize heat stress and to conduct first aid to prevent heat stress.

The following chart contains general guidelines for wet bulb globe temperature (WBGT) measurements that can be used to pace hot-weather field work:

| | Degrees Fahrenheit | | |
|--|--------------------|---------------|------------|
| | Light Work | Moderate Work | Heavy Work |
| Continuous Work | 86.0 | 80.0 | 77.0 |
| 75 percent work and 25 percent rest each hour | 87.0 | 82.0 | 78.0 |

| | Degrees Fahrenheit | | |
|--|--------------------|---------------|------------|
| | Light Work | Moderate Work | Heavy Work |
| 50 percent work and 50 percent rest each hour | 89.0 | 85.0 | 82.0 |
| 25 percent work and 75 percent rest each hour | 90.0 | 88.0 | 86.0 |

Source: American Conference of Governmental Industrial Hygienists, 1992a

Higher heat exposures than shown above are permissible if workers have been undergoing medical surveillance and if it has been established that they are more tolerant of hot-weather work than an

average worker. Workers should not be permitted to continue work when deep body temperatures exceed 100.4° F.

8.7 COLD STRESS MONITORING

Cold stress may be of particular concern when a wind chill-adjusted temperature of 10 °F or less is expected. The following guidelines describe different forms of cold stress, conditions under which cold stress may occur, and preventative measures:

- Personnel working outdoors in temperatures at or below freezing may be frostbitten. Working in extreme cold even for a short time may cause severe injury to the skin of the body or may result in profound generalized cooling, causing hypothermia and possibly death. Areas of the body that have a high surface-area-to-volume ratio, such as ears, fingers, and toes, are most susceptible to frostbite.
- Local injury from cold is included in the generic term "frostbite." Frostbite symptoms can be categorized according to the following degrees of severity:
 - Frostbite nip or initial frostbite is characterized by sudden blanching or whitening of the skin.
 - Deep frostbite causes tissues to be cold, pale, and solid. This degree of frostbite is extremely serious.
 - Systemic hypothermia manifests itself in five stages of symptoms: (1) shivering; (2) apathy, listlessness, sleepiness, and sometimes rapid cooling of the body to less than 95 ° F; (3) unconsciousness, glassy eyes, and slow respiration and pulse; (4) freezing of the extremities; and (5) death.
 - Trench foot or immersion foot occurs when feet are kept cold and wet for an extended period of time. Feet become pale, cold, and possibly pulseless. During recovery, feet become red, hot, and swollen from excessive blood flow.
- Ambient temperatures and wind velocity influence the development of a cold injury. Wind chill (the chilling effect of moving air) should be taken into consideration along with the air temperature when determining whether or not outdoor work is safe.
- When chemical-resistant equipment is removed and the clothing underneath is perspiration-soaked, the body cools very rapidly. Workers should therefore avoid removing equipment until they are in a warm area.
- Thermal socks, long cotton or thermal underwear, hard-hat liners, and other cold-weather gear can help prevent hypothermia.

- Blankets, warm drinks (other than caffeine-containing coffee), and warm rest areas are essential.

9.0 SITE CONTROL

Work areas on or near the site will, depending on environmental monitoring, be divided into an exclusion zone (EZ), a contamination reduction zone (CRZ), also known as decontamination zone, and support zone (SZ). Usually, the EZ will be designated by barricade tape or traffic cones. Access to a contaminated EZ will be restricted to authorized personnel. A dated roster will be used to record the date of each person who enters the EZ. The log will include the person's name, signature, organization, the time of entry into the exclusion zone, and the time of exit from the EZ.

Any visitors to the area must present proper identification and be authorized to be on site. Visitors must comply with all provisions of this site-specific HSP. The site-specific OHSO will identify work areas that visitors or personnel are authorized to enter and will enforce site control measures. The following sections discuss site control zones, communications, safe work procedures, site-specific HSP enforcement, complaints, and safe operating procedures.

9.1 SITE CONTROL ZONES

The following sections describe the as well as the procedures to be followed in each. The purpose of delineated zones is to reduce the accidental spread of hazardous substances by workers from contaminated areas to clean areas. The zones will be specified where different types of operations will occur and the flow of personnel among the zones is controlled.

9.1.1 Exclusion Zone

A defined EZ will be established by the site-specific OHSO at the site during SI activities. The perimeter of the EZ and an approximate 15-foot radius around work task areas will be defined by barricade tape or traffic cones to restrict access. Visitors will not be permitted to enter the exclusion zone without the authorization of the site-specific OHSO. Work tasks that may require establishment of an exclusion zone around one or more work areas include the following:

- soil boring
- soil sampling
- well installation and sampling
- groundwater sampling

The EZ is the area of the site where equipment and contamination of personnel occurs or could occur. Within the EZ, a reasonable potential for exposure to hazardous substances exists. Accordingly, the boundaries in the EZ should be clearly marked, and a site-specific HSP is required for any entry. Within the EZ, the degree of contamination may vary. PRC's CLEAN project field team members will mark areas of higher contamination such as the area immediately surrounding a drilling operation.

The level of protection required in the EZ varies according to the work task and known or suspected contamination. Guidance for the selection of the appropriate level of protection is found in Section 6.0, "Personal Protection Requirements." The requirements for personal protection within higher contamination areas may be different than those for the rest of the EZ.

The EZ can only be entered and exited through controlled access corridors. This procedure permits field personnel to account for each entry and perform decontamination for each exit. Field personnel should establish a planned exit route and an emergency exit corridor for use in case of an emergency.

The outer boundary of the EZ, called the "hotline," should be established with clearly marked lines, placards, hazard tape and/or signs, or enclosed by physical barriers, such as chains, fences, or ropes. Access control points will be established at the periphery of the EZ to regulate the flow of personnel and equipment into and out of the EZ and to help verify that proper procedures for entering and exiting the EZ are followed. Visitors will not be permitted to enter the EZ without the authorization of PRC's site-specific OHSO.

9.1.2 Contamination Reduction (Decontamination) Zone

The CRZ is a transition zone between the EZ and the SZ. Decontamination is performed within this zone. The CRZ is designed to reduce the probability that contamination from a individual work site

will be transmitted to the clean SZ. The distance between the EZ and SZ provided by the CRZ, together with the decontamination of workers and equipment, limits the physical transfer of hazardous substances into clean areas.

The individual work site should be configured so that all personnel, vehicles, equipment, samples, and so on exit the EZ through the CRZ. Depending on the complexity of site operations, the CRZ may be staffed by a personnel decontamination station (PDS) operator and emergency response personnel. Emergency response equipment and backup equipment supplies also are available in this zone.

A decontamination line will be established within the CRZ. The CRZ decontamination station will contain facilities to decontaminate personnel and portable equipment as described in Chapter 10.0, "Decontamination Procedures." Where necessary, a steam-cleaning area for decontamination of drilling equipment will be established at a location readily accessible to an individual work site. Equipment decontamination procedures are described in Chapter 16.7, "Equipment Decontamination." Any potentially contaminated clothing, equipment, and samples must remain in the CRZ until decontaminated. Visitors will not be permitted to enter the CRZ unless authorized by PRC's site-specific OHSO.

9.1.3 Support Zone

The SZ will be situated in a clean, uncontaminated area outside the CRZ, where the chance of encountering hazardous materials or conditions is minimal. The SZ is the location of the administrative and other support functions needed to keep the operations in the EZ and the CRZ running smoothly. Personnel may wear normal work clothes in the SZ. Visitors will be permitted to enter the SZ provided that they wear Level D Modified PPE, unless otherwise specified.

No contaminated equipment, samples, or personnel are permitted in the SZ. They should first be decontaminated in the contamination reduction zone. Ideally, the SZ is located upwind of the EZ, is accessible to vehicles, and is equipped with telephone, electricity, and water, and is visible from the EZ.

9.2 COMMUNICATIONS

Both internal and external communication systems will be established for each site entry to work activities at WPNSTA Concord. Internal communications are used by PRC's CLEAN project field team members to communicate during on-site activity and may consist of verbal communications only or may be supplemented by flags, sirens, whistles, radio devices or other methods. The internal communications system should be understood by of PRC's CLEAN project field team members and tested to determine its effectiveness.

The following hand signals will be employed by site personnel in emergency situations or when verbal communication is difficult.

| <u>Signal</u> | <u>Definition</u> |
|--------------------------|---------------------------------------|
| Hands clutching throat | Out of air, cannot breathe |
| Hands on top of head | Need assistance |
| Thumbs up | Okay, I am all right, or I understand |
| Thumbs down | No or negative |
| Arms waving upright | Send backup support |
| Gripping partner's wrist | Exit area immediately |

An external communication system will be necessary to call for off-site emergency assistance and to handle essential administrative tasks. At WPNSTA Concord where a telephone is not readily available, alternatives, such as a mobile telephone or radio communications, will be made available. All of PRC's CLEAN project field team members will know the location of the nearest telephone or be instructed in the use of other communication devices.

9.3 SAFE WORK PRACTICES

9.3.1 Pre-entry Briefing

All of PRC's employees, subcontractors, or other personnel such as visitors who desire to enter the project work site shall undergo a pre-entry briefing by PRC's site-specific OHSO prior to initiating

any site activity. The pre-entry briefing will be held in accordance with 29 CFR 1910.120(b)(4)(iii), "Pre-entry Briefing."

The pre-entry briefing will be used to help ensure compliance with PRC's CLEAN Health and Safety Program, PRC's CLEAN IRPP, and this site-specific HSP. The information and data obtained from the site characterization and health and safety risk analysis work will be used to advise employees of the nature of potential health and safety risks and methods of control.

9.3.2 General

Standard safe work practices to be implemented at WPNSTA include the following.

- The number of personnel and equipment in the EZ should be minimized consistent with individual site operations.
- All site personnel will enter a designated EZ only through the CRZ. All personnel leaving an EZ must exit through the CRZ and undergo the CRZ decontamination procedure.
- Only vehicles and equipment necessary to complete project work tasks will be permitted within an EZ. All nonessential vehicles and equipment will remain within the SZ.
- Contact with potentially contaminated substances should be avoided. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling on the ground, leaning, or sitting on equipment on the ground. Do not place monitoring equipment on potentially contaminated surface (i.e., ground, etc.).
- PRC's CLEAN project work field team members will be familiar with the physical parameters of investigations, including:
 - wind direction in relation to the ground zero area
 - accessibility to associates, equipment, vehicles
 - communication
 - hot zone (areas of known or suspected contamination)
 - site access
 - nearest water sources
- PRC's CLEAN project field team members should be familiar with site access controls and procedures at a CLEAN project work site, accessibility of equipment and vehicles, and location and operation of communication systems.

- Containers will be moved only with the proper equipment and will be secured to prevent dropping or loss of control during transport.
- All personnel will avoid contact with potentially contaminated substances. Walking through puddles or mud and kneeling on the ground will be avoided whenever possible.
- Equipment will not be placed on potentially contaminated surfaces.
- Portable eyewash stations will be located near individual work sites.
- Eating, drinking, chewing tobacco, smoking, and carrying matches or lighters, and using cosmetics are prohibited in the EZ or CRZ.
- Matches and lighters will not be permitted in the EZ or CRZ.
- During rest periods, all personnel will be required to wash their hands and faces before eating, drinking, smoking, or applying cosmetics.
- All field members should make use of all their senses to alert them to potentially dangerous situations in which they should not become involved, i.e., presence of strong and irritating or nauseating odors.
- Site personnel will observe each other for signs of toxic exposure and heat or cold stress. Indications of adverse effects include but are not limited to the following:
 - Changes in complexion and skin discoloration
 - Changes in coordination
 - Changes in demeanor
 - Excessive salivation and pupillary response
 - Changes in speech patterns
- Site personnel will inform each other of nonvisual effects of illness, such as the following:
 - Headache
 - Dizziness
 - Nausea
 - Blurred vision
 - Cramps
 - Irritation of eyes, skin, or the respiratory tract
- Spills should be prevented to the greatest extent possible. In the event that a spillage occurs, contain liquid if possible.
- Splashing of the contaminated materials should be avoided.
- All hazardous wastes generated during PRC's and/or subcontractor activities should be disposed of as directed by the field investigation personnel.

The following sections describe safe work practices regarding the use of heavy equipment, trenching and confined space entry, avoidance of electrical hazards, avoidance of slip, trip, and fall hazards, conducting site activities near utility and power lines, and avoidance of excessive noise exposures. Also discussed are illumination, sanitation, working near bodies of water, and site housekeeping.

9.3.3 Use of Heavy Equipment

Truck-mounted heavy equipment and field trucks are among the types of equipment that may be used during SI. Heavy equipment can present a substantial hazard to workers. General requirements for motor vehicles and material-handling equipment are provided in the OSHA Construction Industry Standards, 29 CFR 1926, Subpart O, "Motor Vehicles, Mechanized Equipment, and Marine Operations." The following precautions will be followed when heavy equipment (such as drill rigs) is in use.

- Heavy equipment will be inspected by the operator before each work shift. PRC's site-specific OHSO will ensure compliance with this precaution.
- Equipment operators will be instructed to report any abnormalities, such as equipment failure, oozing liquids, and unusual odors to their supervisors or PRC's site-specific OHSO.
- Only qualified and licensed personnel will operate heavy equipment.
- Hard hats, steel-toed boots, and safety glasses or goggles will be worn at all times around heavy equipment.
- Workers will not assume that the equipment operator is keeping track of their exact location. Workers will never walk directly behind or to the side of heavy equipment without the operator's knowledge.
- Workers on the ground will maintain visual contact with equipment operators at all times.
- When an operator must maneuver equipment in tight quarters, the presence of a second person will be required to ensure adequate clearance. If much backing is required, two ground guides will be used: one in the direction the equipment is moving, and the other in the operator's normal field of vision to relay signals.
- All heavy equipment will be kept in the EZ until the work has been completed. Such equipment will then be decontaminated within the designated decontamination area.

- Hand-signal communications will be established when verbal communication is difficult. One person for each CLEAN project work site field work team will be designated to give hand signals to equipment operators.
- Equipment with an obstructed rear view must have an audible alarm that sounds when the equipment is moving in reverse (unless a spotter guides the operator).
- Parking brakes will be kept engaged when equipment is not in use.
- Blades, buckets and other hydraulic systems will be kept fully lowered when equipment is not in use.
- Equipment cabs will be kept free of all nonessential and loose items.
- Seat belts must be present in all vehicles having rollover protective structures (ROPS).
- With certain exceptions, all material-handling equipment will be provided with ROPS.
- Material-handling equipment that lacks a ROPS will not be operated on a grade unless the grade can safely accommodate the equipment involved.
- Auger sections and other equipment are extremely heavy. All precautions will be taken before moving heavy equipment. Appropriate equipment will be used to transport heavy equipment.
- Only chains, hoists, straps, and other equipment that safely aids transport of heavy materials will be used.
- Proper personal lifting techniques will be used. Workers will lift using their legs, not their backs.
- A safety barrier will be used to protect workers when tires are inflated, removed, or installed on split rims.
- An ongoing maintenance program for all tools and equipment will be implemented. All tools and moving equipment will be inspected regularly to ensure that parts are secured, are intact, and have no cracks or areas of weakness. The equipment must turn smoothly without wobbling and must operate according to manufacturer specifications. Defective items will be promptly repaired or replaced. Maintenance and repair logs will be kept.
- Tools will be stored in clean, secure areas to prevent damage, loss, or theft.
- Workers will not use heavy equipment with which they are not familiar. This precaution applies to light equipment, as well as heavy equipment.
- Loose-fitting clothing and loose long hair will be prohibited around moving machinery.

- Workers will make sure that no underground or overhead power lines, sewer lines, gas lines, or telephone lines present a hazard in the work area.
- All personnel who are not essential to work activities will be kept out of the work area.
- Workers will be aware of their footing at all times.
- Workers will remain alert at all times.

A potential chemical exposure hazard associated with heavy equipment operations is exposure to organic vapors, including dermal contact with these contaminants. Detailed information on monitoring air quality, use of air monitoring equipment, and field air monitoring procedures is presented in Section 8.0, "Environmental Surveillance." Action levels for VOCs, total particulates, explosive atmospheres, and oxygen (O₂) deficiency is presented in Section 8.4, "Action Levels."

PPE will be worn to minimize potential skin contact with contaminants in accordance with Section 6.0, "Personal Protection Requirements." The selection, use, and maintenance of respirators is presented in Section 6.5, "Respirator Selection, Use, and Maintenance." If necessary, the project work site will be evacuated or the level of protection altered at each work site based on continuous air monitoring results obtained for explosive atmospheres, VOCs, and toxic atmospheres.

The monitoring of noise levels and the selection and use of hearing protective devices are presented in Section 9.3.8, "Avoidance of Noise Excessive Noise Exposure."

9.3.4 Drill Rig Safety

9.3.4.1 General Health and Safety Requirements

A potential chemical exposure hazard associated with drilling activities is exposure to organic vapors, including dermal contact with these contaminants. Detailed information on monitoring air quality, use of air monitoring equipment, and field air monitoring procedures is presented in Section 8.0, "Environmental Surveillance." Action levels for VOCs, total particulates, explosive atmospheres, and O₂ deficiency is presented in Section 8.4, "Action Levels."

Specific requirements for drilling and soil sampling equipment are presented in the Sampling and Analysis Plan (a separate document). All drilling and soil sampling activities will be performed in accordance with these requirements and the health and safety requirements outlined within this site-specific HSP.

The best defense against injuries resulting from use of drilling equipment is employment of trained, experienced drill operators (drillers) and support personnel (helpers) who will follow this SWP. The procedures described below will be employed by drilling crews and enforced by the site-specific site-specific OHSO during drilling activities.

During site activities, the minimum drilling crew to be employed will consist of one trained, experienced driller and one helper. Additional personnel may include a hydrogeologist, a geologist, and engineers.

The drilling crew's minimum PPE will be D Level Modified (consisting of Tyvek® or Saranex® body suits, hard hats, steel-toed boots with shanks, safety glasses or goggles, hearing protection, and protective gloves), as outlined in Section 6.0, "Personal Protection Requirements."

Before beginning drilling and each morning thereafter, the driller will conduct a thorough inspection of the drilling rig for any defects or unsafe conditions, such as leaking fuel lines or hydraulic lines or fittings, and inoperable or poorly responding controls or equipment. The driller will make sure that all guards or safety devices are operational and in place over rotating machinery, as required by OSHA 29 CFR 1926.

The driller will also make sure that all wire ropes, slings, clevises, and other lifting equipment is in satisfactory condition and is rated for the work to be performed as required in OSHA 29 CFR 1926.550. Any defects identified during inspections will be corrected before drilling begins.

Wood timbers will be used when necessary to stabilize and level the drilling rig. Use of timbers to level a rig, however, must not result in an unstable working platform. Site grading may be required if the working platform is unstable.

Extreme care will be used during addition or removal of augers and casings and during startup of rotating drilling equipment (such as hollow-stem augers, rotary tables, and catheads). Injury or death can result from being caught or pinched in drilling equipment. Use of verbal commands, hand signals, and line-of-sight confirmation by the drilling crew will help workers avoid these types of accidents (see Section 9.2, "Communications.") Oversight workers will not help drillers with their work because it may distract the drillers. Oversight workers will, however, know how to turn off drilling equipment in case of an emergency.

PPE will be worn to minimize potential skin contact with contaminants in accordance with Section 6.0, "Personal Protection Requirements." The selection, use, and maintenance of respirators is presented in Section 6.5, "Respirator Selection, Use, and Maintenance." If necessary, the site will be evacuated or the level of protection altered at each work site based on continuous air monitoring results obtained for explosive atmospheres, VOCs, and toxic atmospheres, and O₂ deficiency, as appropriate, in accordance with Section 8.4, "Action Levels." Noise monitoring and the use of hearing protective devices will be in accordance with Section 9.3.8, "Avoidance of Excessive Noise Exposure."

Physical hazards include electrical hazards such as overhead power lines and underground utilities; rolling, spreading, or sliding of tools and supplies; rotating machinery; heat stress; noise; and physical obstructions that could cause slipping, tripping, or falling. Standard safe work practices for electrical hazards are presented in Section 9.3.9, "Avoidance of Electrical Hazards." Standard safe work practices for work activities near underground and aboveground utilities are presented in Section 9.3.7, "Site Activities Near Utility and Power Lines."

9.3.4.2 Underground Utilities Survey

An underground utilities survey will be used to locate underground utility lines, and drilling will not be allowed within 5 feet of underground utilities or within 20 feet of overhead high-voltage electrical hazards. The following safety provisions will be adhered to by the drill rig operator.

- Before raising the drill rig mast in the vicinity of electrical power lines, the operator will walk completely around the drill rig to determine the distance of the rig to the nearest power line when the mast is raised (this distance must be equal to or greater than 20 feet). Voltage greater than 370 to 550 kV will require a minimum distance of

30 feet. Voltage greater than 550 kV will require a minimum distance of 45 feet. Any questions regarding the appropriateness of a drilling location will be brought to the attention of PRC's site-specific site-specific OHSO.

- Before drilling, the location must be adequately cleaned and leveled to accommodate the drill rig.
- Suitable storage for all tools, materials, and supplies will be provided. Piping, casings, augers, and similar drilling tools will be arranged by using chocks to prevent rolling, spreading, or sliding.
- Work areas and drilling platforms will be kept free of materials, obstructions, and substances that could cause a surface to become slick or otherwise hazardous.
- Before raising the mast, all drill rig personnel will be cleared from the area immediately (with the exception of the operator and PRC CLEAN project field team members) to the rear and the sides of the mast. All drill rig personnel and other PRC CLEAN project field team members must be informed that the mast is being raised prior to raising it.
- Before the mast of the drill rig is raised and drilling commences, the drill rig will be leveled and stabilized with leveling jacks or solid cribbing. The drill rig should be revealed if it settles after initial setup. The mast must be lowered only when the leveling jacks are down, and the leveling jack pads will not be raised until the mast is lowered completely.
- Augers will be used in accordance with the manufacturer's recommended methods for securing the auger to the power coupling. Additionally, the operator and tool handler will be responsible for establishing safe procedures for drilling, auger connection and disconnection, and auger fork insertion and removal.
- Augers will only be cleaned when the drill rig is in neutral and the auger has ceased to rotate.
- Unattended bore holes will be properly covered or otherwise protected.

9.3.4.3 Safe Operating Procedures

PRC employees observing drilling activities should be aware of the physical hazards associated with drilling and will follow these safe operating procedures.

- At a minimum, individuals should wear coveralls, steel-toe boots, safety glasses, and hard hats.

- Hearing protection should be used when conditions prevent normal vocal discussion between two individuals at an arms-length distance. The monitoring of noise levels and the selection and use of hearing protective devices is presented in Chapter 13.0, "Hearing Conservation Program. Those workers observing drilling activities should maintain verbal contact with the drillers.
- Individuals will not enter the drilling area unless given approval by the driller. This will ensure that the drillers will be aware of your movements.
- Drilling activities must cease when weather conditions indicate lightning is possible.

Drill rig checkout and operation procedures will be in accordance with PRC's standard policies and standard industry practice.

9.3.5 Avoidance of Electrical Hazards

Electrical wiring if used during site activity will satisfy the requirements of OSHA 29 CFR 1926, Subpart K, and any applicable local electrical codes. Some specific electrical safety requirements are listed below.

- All wiring will be done by a licensed electrician.
- All extension cords must have functional grounding conductors.
- All equipment that is not double insulated must have a functional grounding conductor.
- All electrical cords must be in good condition.
- Instead of a documented "assured equipment grounding conductor program," ground-fault protected circuits may be used.
- Electrical cords and power tools will be inspected before use.

9.3.6 Avoidance of Trip, Slip, and Fall Hazards

Workers will be informed of any potential slip, trip, and fall hazards during regular health and safety meetings. Whenever possible, slip, trip, and fall hazards will be eliminated or clearly identified with yellow caution tape by the site-specific OHSO.

9.3.7 Site Activities Near Utility and Power Lines

Site activities will proceed with caution in any area where historical data or instrument surveys indicate the presence of utility lines (such as gas and telephone). All site activity locations will be coordinated by appropriate personnel.

The following clearances will be maintained between equipment and energized power lines:

| <u>Voltage</u> | <u>Working Clearance</u> | <u>Equipment Clearance (feet)</u> |
|-----------------------------|---|-----------------------------------|
| Less than 50 kilovolts (kV) | 10 feet | 4 |
| 50 to less than 345 kV | 10 feet, plus 4 inches per extra kV (50 kV or more) | 10 |
| 345 to 750 kV | 10 feet, plus 4 inches per extra kV (50 kV or more) | 16 |

Guidelines to observe when working in areas with underground and overhead utilities are as follows:

- The location of any utility that could pose a risk to workers will be communicated to all workers during the initial daily health and safety meeting. Utilities will be marked or access otherwise restricted to avoid a chance of accidental contact.
- Overhead transmission and distribution lines will be carried on towers and poles that provide safe clearance over roadways and structures.
- Clearance will be adequate for the movement of vehicles and for the operation of construction equipment.
- Overhead or aboveground electric lines should be considered "live" or "active" until a reliable source, such as a base electrician or personnel from the relevant operating company, has documented them to be otherwise.
- Elevated work platforms, ladders, scaffolding, man-lifts, and drill or vehicle superstructures will be erected a minimum of 20 feet (the actual distance is dependent upon the voltage of the line) from overhead electrical lines until the line is de-energized, grounded, or shielded and a competent electrician has certified that arcing cannot occur between the work place and superstructure.

- Workers will be instructed to use care in working under or around utilities, to avoid hot surfaces, loud noises, pressurized gases or air, leaking pipelines discharging steam or hot liquids, and must work to prevent accidental contact with breakage.

If activities at a CLEAN project work site near power lines are required, necessary arrangements to turn off the power will be coordinated by PRC's responsible PM and PRC's site-specific site-specific OHSO.

Site activities near power lines are not anticipated at this time. However, if site activities near power lines are required, necessary arrangements to turn off the power will be coordinated by PRC's PM.

9.3.8 Avoidance of Excessive Noise Exposure

Workers will be protected from excessive noise exposure by means of equipment maintenance, noise monitoring, and hearing conservation programs that comply with OSHA 29 CFR 1926.52, "Occupational Noise Exposure." Hearing protection will be required if the sound level continuously equals or exceeds 85 decibels on the A-weighted scale or if the sound level exceeds 140 decibels regardless of the duration of exposure. Sound level will be measured with a sound level meter during site activities. The decibel level will be measured using a slow response setting on the A-weighted scale.

Ear inserts with a noise reduction rating of at least 26 decibels on the A-weighted scale or similar equipment will be provided to PRC personnel. Such equipment will be worn during work task involving heavy equipment, internal combustion engines, drilling rigs, or other sources of elevated noise levels.

9.3.9 Illumination

Outdoor work will not be performed after sunset or when a lack of natural illumination makes outdoor work difficult.

9.3.10 Sanitation

Potable water, drinking cups, nonpotable water, toilet facilities, washing facilities, and other sanitation requirements will be provided in compliance with specifications of OSHA 29 CFR 1926.51, "Sanitation."

9.3.11 Working Near Bodies of Water

When working over or near bodies of water 3 or more feet deep, workers will observe the requirements of OSHA 29 CFR 1926.106. The following precautions will be taken:

- Personnel will be provided with life jackets or work vests approved by the U.S. Coast Guard (USCG).
- Life jackets and work vests will be inspected before use.

9.3.12 Site Housekeeping

Potentially hazardous wastes generated during site activities will be drummed, if necessary, and handled in accordance with Resource Conservation and Recovery Act (RCRA) requirements. Nonhazardous waste and debris will be disposed of as standard municipal waste.

9.4 HEALTH AND SAFETY PLAN ENFORCEMENT

The site-specific OHSO will be responsible for enforcement of the site-specific HSP during SI. Personnel who fail to follow the site-specific HSP procedures will face disciplinary action that may, at a maximum, include dismissal from the site.

At least one copy of this site-specific HSP will be available to all site personnel at all times. Any necessary changes in HSP procedures will be made at the beginning of each work day by the site-specific OHSO.

Personnel will be encouraged to report to the site-specific OHSO any conditions or practices that they consider detrimental to their health or safety or that they believe are in violation of applicable health and safety standards. Such complaints may be made orally or in writing. Personnel who believe that an imminent danger threatens human health or the environment will be encouraged to bring the matter to the immediate attention of the site-specific OHSO for resolution.

10.0 DECONTAMINATION

Decontamination is the process of removing or neutralizing contaminants from personnel or equipment. When properly conducted, decontamination procedures protect the worker from contaminants that may have accumulated on PPE, tools, and other equipment. Proper decontamination also prevents transport of potentially harmful materials to unaffected areas. Personnel and equipment decontamination procedures are described in the following sections.

10.1 PERSONNEL DECONTAMINATION

Minimal personnel decontamination is anticipated for the WPNSTA Concord site because disposable PPE will be used. If necessary, personnel decontamination will be completed according to the procedures given in Chapter 9.0, "Decontamination," *Standard Operating Safety Guides* (EPA, 1992). Personnel and PPE will be decontaminated with potable water or a mixture of detergent and water. Liquid and solid wastes produced during decontamination will be collected and drummed.

The following decontamination procedure will be conducted if personnel decontamination is required:

- **Wash neoprene boots** (or disposable booties) with a Liquinox® or Alconox® solution, **and rinse them with water**. Remove and retain neoprene boots for reuse, if possible. **Place disposable booties in plastic bags for disposal.**
- **Wash outer gloves** in a Liquinox® or Alconox® solution and rinse them in water. Remove outer gloves, and place them in a plastic bag for disposal.
- **Remove the Tyvek® or Saranex® body suit**, and place it in a plastic bag for disposal.

- Remove the air-purifying respirator, if used, and place the spent filter in a plastic bag for disposal. The filter may be changed daily or at longer intervals, depending on the use and application. Clean and disinfect the respirator with towelettes or a nonphosphate cleaning solution. Air dry the respirator and place it in a plastic bag for storage.
- Remove inner gloves, and place them in a plastic bag for disposal.
- Thoroughly wash the hands and face with water and soap.

Used, disposable PPE will be collected in 55-gallon drums and disposed of as municipal waste, unless otherwise specified. Further personnel decontamination procedures may be established as needed.

10.2 EQUIPMENT DECONTAMINATION

Decontamination of all drilling, sampling, and field monitoring equipment used during site activities will be required. The equipment decontamination procedures described in the following sections are based on guidelines appropriate for low-level contamination. When appropriate, Liquinox® or Alconox® cleaning solutions and deionized water rinses will be used to decontaminate equipment. Waste water from equipment decontamination activities will be stored in 55-gallon drums until proper disposal is possible.

10.2.1 Drilling Equipment

Drilling equipment will be decontaminated at a designated location in the CRZ (generally referred to as the "decon pad"). Decontamination will be performed before drilling operations begins, after each boring is drilled, and after completion of drilling activities.

The drilling subcontractor will provide a steam-cleaner for decontamination, and U.S. Navy will provide water for the steam-cleaner. Drilling equipment will be steam-cleaned before it is used.

Decontamination will consist of steam-cleaning the drilling equipment with a high-pressure steam spray. If equipment still has soil on it after spraying, an appropriate cleaning brush will be used to loosen debris, and the equipment will be rinsed again with the steam spray. All waste water from decontamination activities will be collected and stored in 55-gallon drums until proper disposal is possible.

10.2.2 Sampling Equipment

Sampling equipment, such as split-spoons, will be decontaminated before and after each use.

Distilled water will be used for the following sampling equipment decontamination procedures.

- Scrub the equipment with a brush in a bucket containing Liquinox® or Alconox® solution and potable, distilled water.
- Triple-rinse the equipment with distilled water, and allow it to air dry.
- Reassemble the equipment and place it in a clean area on plastic or aluminum foil. If aluminum foil is used, wrap the equipment with the dull side of the aluminum foil toward the equipment.

11.0 EMERGENCY CONTINGENCY PLANNING

The site-specific OHSO will be notified of any on-site emergencies and will be responsible for ensuring that appropriate emergency procedures are followed. Standard emergency procedures to be used by site personnel are described in the following sections. The local fire or emergency response department will be supplied with a copy of this site-specific HSP before site work begins.

11.1 INJURY IN THE EXCLUSION OR CONTAMINATION REDUCTION ZONE

In the event of an injury in the EZ or CRZ, all personnel will exit the EZ and assemble at the decontamination line, and the site-specific OHSO will be immediately notified of the event, if necessary. The site-specific OHSO will contact the HSPM, and together they will evaluate the nature and extent of the injury.

The affected person will be decontaminated to the extent practical before being moved to the SZ. Appropriate first aid procedures will be performed, an immediate request for an ambulance will be made (if necessary), and the designated medical facility will be notified (if necessary). No personnel will re-enter the EZ until the cause of injury or illness is determined and re-entry is considered safe.

In case of severe injury, the site-specific OHSO will implement procedures to minimize the possibility of further injury. If the need to transport the patient to the medical facility supersedes the need to

decontaminate the patient, the medical facility will be notified that the patient has not been decontaminated before the patient arrives. Documentation requirements are given in Section 7.2, "Documentation and Recording Keeping Requirements."

11.2 INJURY IN THE SUPPORT ZONE

If an injury occurs in the SZ, the site-specific OHSO will be notified immediately. Appropriate first aid will be administered and, if necessary, the injured individual will be transported to the designated medical facility. If the injury does not affect the safety or performance of site personnel, operations will continue. ~~Emergency equipment, such as first aid kit, fire extinguisher and spill containment equipment will be located in the SZ.~~ Documentation requirements are given in Section 7.2, "Documentation and Recording Keeping Requirements."

11.3 FIRE OR EXPLOSION

In the event of a fire or explosion at the site, the Safety Department's WPNSTA Concord Fire Department will be contacted as soon as possible at 510/246-5028, and evacuation of the site will begin immediately.

11.4 PROTECTIVE EQUIPMENT FAILURE

If any worker in the exclusion zone experiences a failure of protective equipment that affects his or her personal protection, the worker and all coworkers will immediately leave the exclusion zone. Re-entry to the exclusion zone will not be permitted until the protective equipment has been repaired or replaced and the cause of equipment failure has been determined and is no longer considered a threat.

11.5 EMERGENCY INFORMATION TELEPHONE NUMBERS

The nearest telephone accessible to site workers is located at the support vehicle. Emergency telephone numbers not presented below can be obtained by calling the operator of PRC's San Francisco office at 415/543-4880.

| <u>Emergency Service</u> | <u>Telephone Number</u> |
|---|---|
| Local Police Department | 911 |
| Local Fire Department | 911 |
| Local Hospital | Mount Diablo Hospital 2540 East Street 510/682-2000 |
| Local Ambulance Service | 911 |
| Poison Control Center | 1-800/822-3232 |
| National Response Center | 1-800/424-8802 |
| Chemical Transportation Emergency Center | 1-800/424-9300 |
| Base Security | 510/246-5003 |
| Base Hospital | 510/246-5867 |
| Base Public Works | 510/246-5650 |
| PRC San Francisco Office | 415/222-8200 |
| Santiago Lee, Project Manager | 415/222-8279 |
| Fred Stanley, HSPM | 415/222-8273 |
| Client Contact: Ronald Yee | 415/244-2558 |

11.6 HOSPITAL ROUTE DIRECTIONS

Before performing any site activities, PRC personnel will conduct a pre-emergency hospital run to familiarize them with the route to the hospital. A map showing the hospital route is provided on Figure 3.

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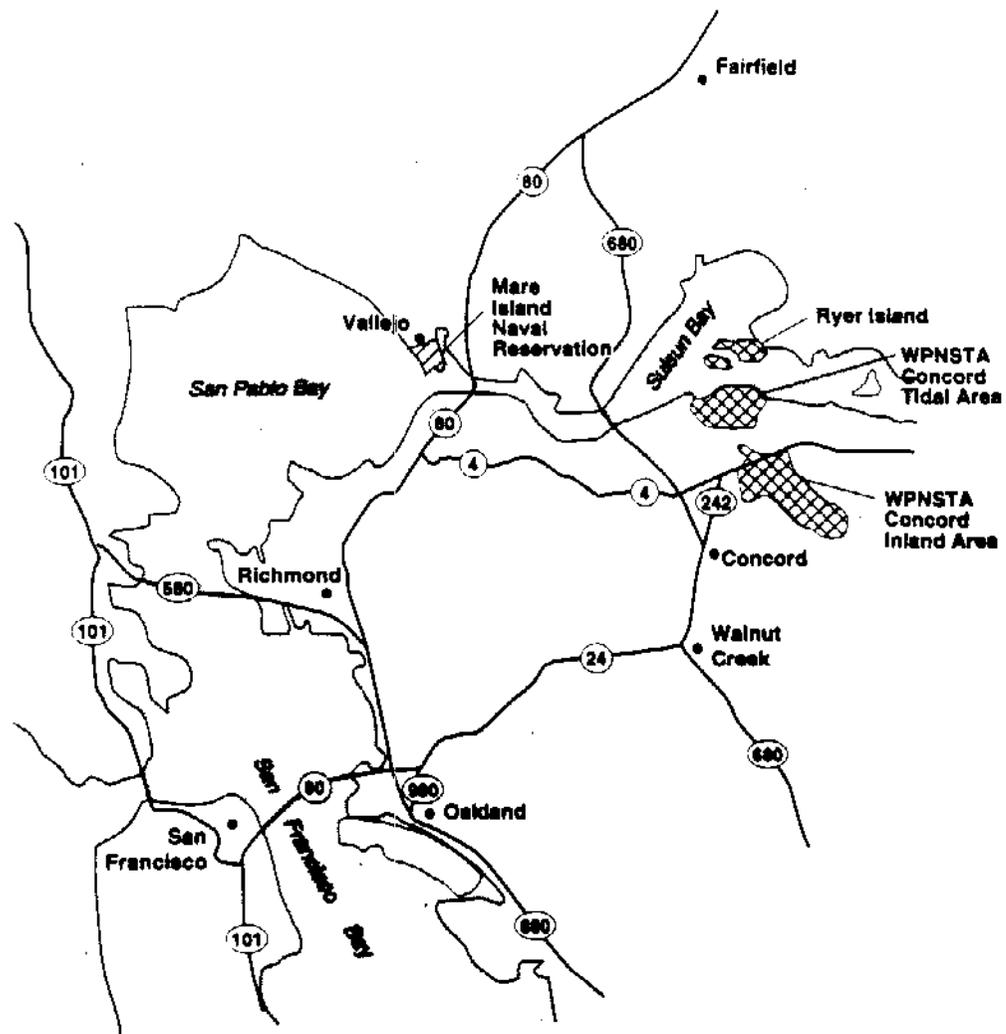
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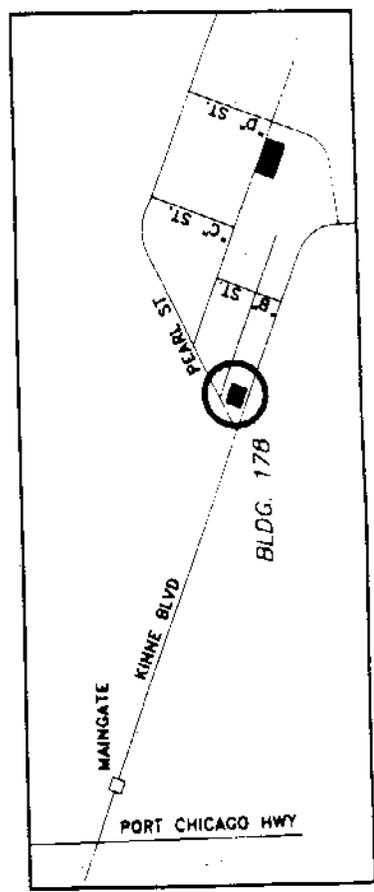
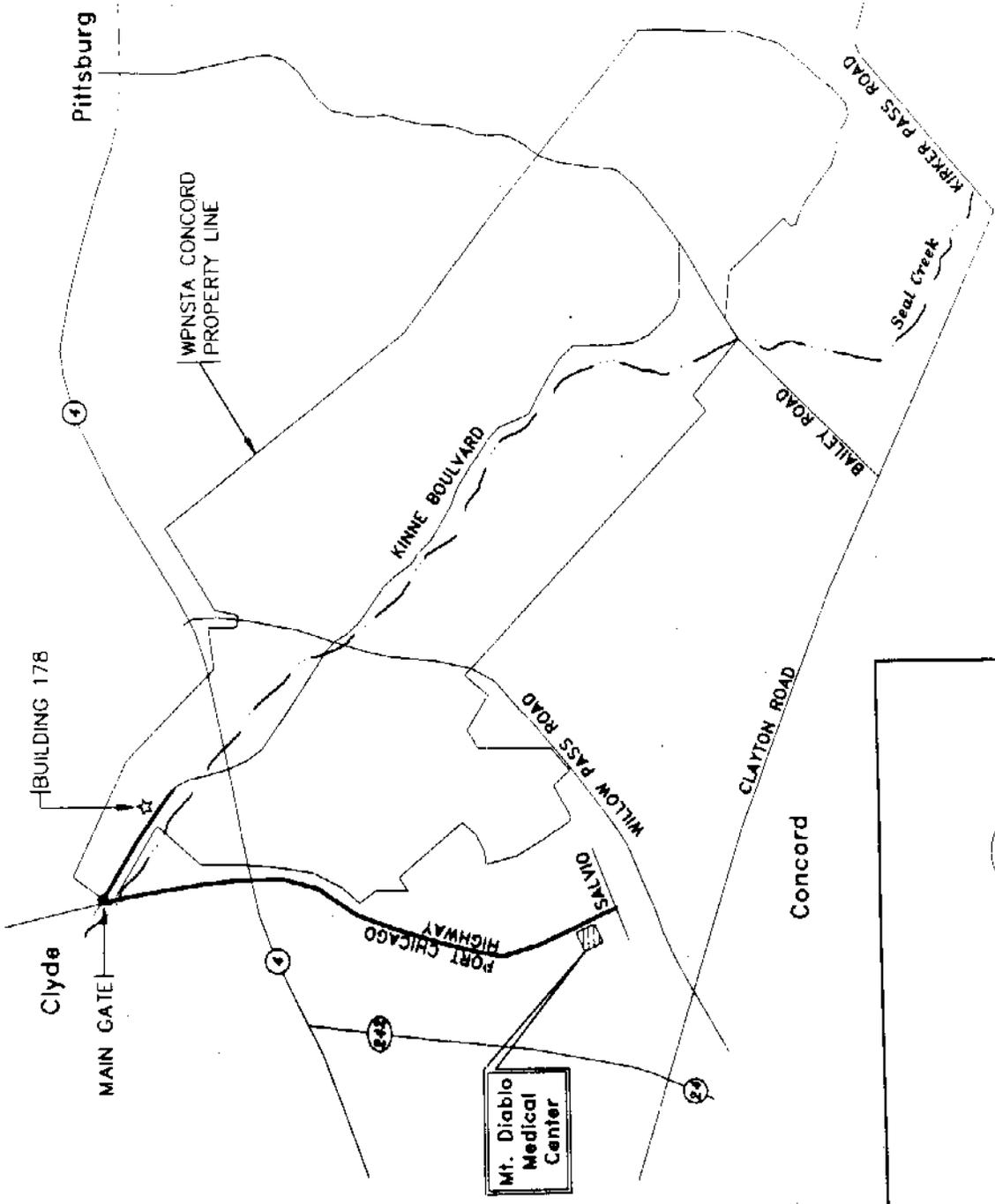
 WPNSTA Concord Property



FIGURE 1
NAVAL WEAPONS STATION CONCORD
REGIONAL LOCATION MAP

Figures 2-3

These detailed station maps have been deleted from the Internet-accessible version of this document as per Department of the Navy Internet security regulations.



**FIGURE 4
HOSPITAL
ROUTE
DIRECTIONS**



**TABLE 1
SUMMARY OF SOIL AND WATER SAMPLING**

| SWMU/ Building No. | Number of Sampling Locations | Samples per Boring or Trench | Surface Samples* | Total Number of Field Samples | | Field QC | | Comments |
|-------------------------|------------------------------------|------------------------------------|---------------------|-------------------------------------|-------|-----------|----------|---------------------------|
| | | | | Soil | Water | Duplicate | Rinseate | |
| 1 IA-6 | Soil Borings | 3 | 1 | 13 | | | 1 | Drill to groundwater |
| | Wells | 4 | | | 4 | 1 | 1 | Sample existing wells |
| 2 IA-7 | Shallow Borings | 8 | 8 | 16 | | | 1 | Hand-auger to 5 feet |
| | Soil Borings | 1 | 3 | 4 | | | 1 | Drill to 15 feet |
| | Trenches | 3 | 3 | 9 | | | 1 | 10 feet long, 4 feet deep |
| 5 IA-12 | Shallow Borings | 4 | 1 | 4 | | | 1 | Hand-auger to 5 feet |
| | Soil Borings | 4 | 4 | 16 | | | 2 | Drill to groundwater |
| 7 IA-16 | HydroPunch Samples | 4 | | | 4 | 1 | 1 | Sample from soil borings |
| | Shallow Borings | 5 | 1 | 10 | | | 1 | Hand-auger to 5 feet |
| | Soil Borings | 4 | 4 | 16 | | | 1 | Drill to groundwater |
| 12/20 IA-24 IA-55 | HydroPunch Samples | 4 | | | 4 | 1 | 1 | Sample from soil borings |
| | Shallow Borings | 4 | 2 | 8 | | | 1 | Hand-auger to 5 feet |
| | Soil Borings | 3 | 3 | 9 | | | 1 | Drill to 15 feet |
| | Septic Tanks | 2 | 2 | 2 | 2 | | | Sludge and liquid samples |

INLAND AREA SWMU

**TABLE 1
SUMMARY OF SOIL AND WATER SAMPLING
(Continued)**

| SWMU/ Building No. | Number of Sampling Locations | Samples per Boring or Trench | Surface Samples* | Total Number of Field Samples | | Field QC | | Comments |
|-----------------------|------------------------------------|------------------------------------|---------------------|-------------------------------------|-------|-----------|----------|--------------------------------|
| | | | | Soil | Water | Duplicate | Rinseate | |
| 13 IA-25 | Shallow Borings | 1 | 1 | 2 | | | 1 | Hand-auger to 5 feet |
| | | 2 | 2 | 4 | | | | Hand-auger to 5 feet |
| | Soil Borings | 3 | 3 | 9 | | | 1 | Drill to 15 feet |
| | Surface Water | 1 | | | 1 | | | Pit drain outfall |
| 14 IA-27 | Septic Tank | 1 | 1 | 1 | 1 | | | Sludge and liquid samples |
| | Shallow Borings | 3 | 1 | 6 | | | 1 | Hand-auger to 5 feet |
| | | 2 | 2 | 4 | | | | Hand-auger to 5 feet |
| | Soil Borings | 3 | 3 | 9 | | | 1 | Drill to 15 feet |
| 15 IA-41 | Septic Tank | 1 | 1 | 1 | 1 | | | |
| | Shallow Borings | 3 | 1 | 6 | | | 1 | Hand-auger to 5 feet |
| 16 IA-46 | Shallow Borings | 5 | 1 | 10 | | | 1 | Hand-auger to 5 feet |
| | Soil Borings | 1 | 3 | 4 | | | 1 | Drill to 15 feet |
| 17 IA-50 | Shallow Borings | 2 | 2 | 4 | | | 1 | Hand-auger to 5 feet |
| | Soil Borings | 3 | 3 | 9 | | | 1 | Drill to 15 feet |
| | Septic Tank | 1 | | 1 | 1 | | | Sludge and liquid samples |
| 18 IA-51 | Shallow Borings | 4 | 1 | 8 | | | 1 | Hand-auger to 5 feet |
| | Soil Borings | 2 | 4 | 8 | | | 1 | Drill to groundwater (20 feet) |
| | Surface Water | 2 | | | 2 | | | Drainage ditch |
| | HydroPunch Samples | 2 | | | 2 | 1 | 1 | Sample from soil borings |

TABLE 1
SUMMARY OF SOIL AND WATER SAMPLING
 (Continued)

| SWMU/ Building No. | Number of Sampling Locations | Samples per Boring or Trench | Surface Samples* | Total Number of Field Samples | | Field QC | | Comments |
|-----------------------|------------------------------------|------------------------------------|---------------------|-------------------------------------|-------|-----------|----------|---------------------------|
| | | | | Soil | Water | Duplicate | Rinseate | |
| 22 Bldg 81 | Shallow Borings | 7 | | | 14 | | 1 | Hand-auger to 5 feet |
| | Soil Borings | 2 | | | 6 | | 1 | Drill to 15 feet |
| | Septic Tank | 1 | | 1 | 1 | 1 | | Sludge and liquid samples |
| 23 Bldg 87 | Shallow Borings | 4 | | | 8 | | 1 | Hand-auger to 5 feet |
| | Soil Borings | 3 | | | 9 | | 1 | Drill to 15 feet |
| | Septic Tank | 1 | | 1 | 1 | 1 | | Sludge and liquid samples |
| 24 Bldg 93 | Shallow Borings | 4 | | | 8 | | 1 | Hand-auger to 5 feet |
| | Soil Borings | 2 | | | 6 | | 1 | Drill to 15 feet |
| | Septic Tank | 1 | | 1 | 1 | 1 | | Sludge and liquid samples |
| 25 Bldg 97 | Shallow Borings | 4 | | | 8 | | 1 | Hand-auger to 5 feet |
| | Soil Borings | 2 | | | 6 | | 1 | Drill to 15 feet |
| | Septic Tank | 1 | | 1 | 1 | 1 | | Sludge and liquid samples |
| 51 IA-56 | Shallow Borings | 4 | | | 8 | | 1 | Hand-auger to 5 feet |
| | Soil Borings | 2 | | | 6 | | 1 | Drill to 15 feet |
| | Septic Tank | 1 | | 1 | 1 | 1 | | Sludge and liquid samples |
| 52 7SH5 | Shallow Borings | 2 | | 2 | 4 | | 1 | Hand-auger to 5 feet |
| | Soil Borings | 4 | | | 8 | | 1 | Drill to 15 feet |
| | Septic Tank | 2 | | 1 | 1 | 1 | | Sludge and liquid samples |
| Surface Water | Soil Borings | 2 | | | 6 | | 1 | Hand-auger to 5 feet |
| | Surface Water | 1 | | | | | | Drainage Ditch |
| | Septic Tank | 1 | | 1 | 1 | 1 | | Sludge and liquid samples |

TABLE 1
SUMMARY OF SOIL AND WATER SAMPLING
 (Continued)

| SWMU/ Building No. | Number of Sampling Locations | Samples per Boring or Trench | Surface Samples* | Total Number of Field Samples | | | Comments | |
|------------------------|------------------------------------|------------------------------------|---------------------|-------------------------------------|----------|------------|----------|--------------------------------|
| | | | | Soil | Water | Field QC | | |
| | | | | Duplicate | Rinseate | | | |
| 53 7SH14 | Shallow Borings | 4 | 2 | | | 8 | 1 | Hand-auger to 5 feet |
| | Soil Borings | 2 | 3 | | | 6 | 1 | Drill to 15 feet |
| | Septic Tank | 1 | | 1 | | 1 | | Sludge and liquid samples |
| 54 Bldg 79 | Shallow Borings | 8 | 2 | | | 16 | 1 | Hand-auger to 5 feet |
| | Soil Borings | 4 | 3 | | | 12 | 1 | Drill to 15 feet |
| | Septic Tanks | 2 | | 2 | | 2 | | Sludge and liquid samples |
| Total | | | | | | 345 | 4 | 42 |
| TIDAL AREA SWMU | | | | | | | | |
| 37 A-29 | Shallow Borings | 10 | 1 | 10 | | 20 | 2 | Hand-auger to 5 feet |
| | Soil Borings | 2 | 3 | | | 6 | 1 | Drill to groundwater (10 feet) |
| | HydroPunch | 2 | | | | 2 | 1 | Sample from soil boring |
| 40 Bldg 174 | Shallow Borings | 3 | 1 | 3 | | 6 | 1 | Hand-auger to 5 feet |

TABLE I
SUMMARY OF SOIL AND WATER SAMPLING
 (Continued)

| SWMU/ Building No. | Number of Sampling Locations | Samples per Boring or Trench | Surface Samples* | Total Number of Field Samples | | Field QC | | Comments |
|-------------------------------------|------------------------------------|------------------------------------|---------------------|-------------------------------------|-------|-----------|----------|---|
| | | | | Soil | Water | Duplicate | Rinseate | |
| 44 Bldg 350 | Shallow Borings | 2 | | 4 | | | 1 | Hand-auger to 5 feet |
| | Soil Borings | 2 | | 4 | | | 1 | Install monitoring wells |
| | Wells | 2 | | | 2 | 1 | 1 | Sample two new wells |
| | Septic Tank | 1 | | | 1 | | | Sludge and liquid samples |
| 50 E-108 | Soil Borings | 4 | | 8 | | | 1 | Install monitoring wells |
| | Wells | 3 | | | 3 | 1 | 1 | Sample two new and one existing monitoring wells |
| TOTAL | | | | | | | | |
| | | | | 49 | 8 | 3 | 10 | |
| TOTAL INLAND AND TIDAL AREAS | | | | 394 | 43 | 7 | 52 | |

* Includes septic tank samples.

**TABLE 2
OSHA PERMISSIBLE EXPOSURE LIMIT FOR ON SITE CHEMICALS**

| SITE | ON SITE CHEMICAL | PEL (ppm) or (m/m³) |
|----------------|---|---|
| Building IA-6 | diesel fuel tetrachloroethene 1,1-dichloroethene 1,1,1-trichloroethane trichloroethene chloroform | 5 mg/m ³ 1 ppm 100 ppm 10 ppm 10 ppm 2 ppm |
| Building IA-7 | potassium chloride sodium chloride ammonium phosphate potassium carbonate | NA NA NA NA |
| Building IA-12 | oily wastes diesel fuel antifreeze petroleum hydrocarbons battery acid | NA NA NA NA NA |
| Building IA-16 | gasoline diesel fuel leftover paint lead | 900 mg/m ³ 5 mg/m ³ NA 0.050 mg/m ³ |
| Building IA-24 | diesel petroleum battery acid sulfate cadmium lead sodium zinc antimony manganese methylene chloride trichloroethene (TCA) | 5 mg/m ³ 400 ppm NA NA NA 0.050 mg/m ³ NA 5 mg/m ³ 0.5 mg/m ³ 10 mg/m ³ 50 ppm 50 ppm |
| Building IA-25 | lead styphnate lead azide nitrogen-based compounds solvents pesticides asbestos paints and solvents nitrates potassium phosphorous | NA NA NA NA NA 0.2 fb/cm ³ NA NA NA 0.1 mg/m ³ |
| Building IA-27 | paints and solvents | NA |
| Building IA-41 | paints | NA |

TABLE 2
OSHA PERMISSIBLE EXPOSURE LIMIT FOR ON SITE CHEMICALS
(Continued)

| SITE | ON SITE CHEMICAL | PEL (ppm) or (mg/m ³) |
|----------------|---|---|
| Building IA-46 | paints acetylene asbestos mercury vapors pesticides PCBs | NA NA 0.2 fb/cm ³ 0.05 mg/m ³ NA 0.001 mg/m ³ |
| Building IA-50 | ordnance 1,4-dichlorobenzene benzene chlorobenzene | NA 75 ppm (450 mg/m ³) 0.1 ppm 75 ppm |
| Building IA-57 | antifreeze oily wastes zinc chromate | NA NA NA |
| Building IA-55 | diesel paints | 5 mg/m ³ NA |
| Building 81 | hydraulic fluids di-N-Octylphthalate 1,4-dichlorobenzene 4-methylphenol petroleum hydrocarbons | NA 5 mg/m ³ 75 ppm (450 mg/m ³) 100 mg/m ³ (diesel) 5 mg/m ³ |
| Building 87 | paints oils solvents diethylphthalate butyl benzyl phthalate bis(2-ethylhexyl)phthalate benzoic acid | NA NA NA 5 mg/m ³ NA NA NA |
| Building 93 | phenol benzoic acid toluene | 5 ppm (19 mg/m ³) NA 100 ppm |
| Building 97 | trichloroethane epoxy ethyl alcohol JP-5 rocket fuel paints dichlorobenzene phenol benzo(a)anthracene dichlorobenzene 4-methyl phenol benzo(b)fluoranthene benzo(k)fluoranthene benzo(a)pyrene dibenz(a,h)anthracene | 10 ppm 19 mg/m ³ 0.5 ppm NA NA 300 mg/m ³ NA NA 100 mg/m ³ NA NA NA NA NA |

TABLE 2
OSHA PERMISSIBLE EXPOSURE LIMIT FOR ON SITE CHEMICALS
(Continued)

| SITE | ON SITE CHEMICAL | PEL (ppm) or (mg/m ³) |
|----------------|---|--|
| Building A-29 | scrap metal and wood creolite-treated logs pentachlorophenol copper arsenate | NA 2.5 mg/m ³ 0.5 mg/m ³ NA |
| Building 174 | PCBs | 0.5 mg/m ³ |
| Building 350 | diesel fuel | 5 mg/m ³ |
| Building E-108 | diesel fuel | 5 mg/m ³ |
| Building IA-56 | benzoic acid 4-methylphenol phenol | NA 100 mg/m ³ 5 ppm (19 mg/m ³) |
| Building 7SH5 | diesel acetone trichloroethane methyl ethyl ketone chloroethane tributyltin arsenic copper lead mercury methylene chloride naphthalene phenol benzoic acid 1,4-dichlorobenzene 4-methylphenol toluene | 5 mg/m ³ 750 ppm (1500 mg/m ³) 10 ppm (45 mg/m ³) 200 ppm (590 mg/m ³) NA NA 0.010 mg/m ³ 1 mg/m ³ 0.050 mg/m ³ 0.05 mg/m ³ 500 ppm 10 ppm 5 ppm NA 75 ppm (450 mg/m ³) 100 mg/m ³ 100 ppm |
| Building 7SH14 | diesel fuel | 5 mg/m ³ |
| Building 79 | 1,3-dichlorobenzene 2,4-dichlorophenol | 300 mg/m ³ NA |

TABLE 3
HAZARDOUS MATERIALS TO BE POTENTIALLY ENCOUNTERED

| SITE | SUBSTANCE | ENVIRONMENTAL MEDIA | EXPOSURE PATHWAY | TOXIC CHARACTERISTICS |
|----------------|---------------------------------|---------------------|---------------------------------------|--|
| Building A29 | Cresote | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of nose, throat, and respiratory tract; gastrointestinal distress; vomiting; diarrhea; abdominal pain; muscular pain; tremors; convulsion; weak pulse |
| | Pentachlorophenol (PCP) | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, nose, throat; sneezing, coughing; weak, headaches, dizziness; nausea, vomiting; high fever |
| | Copper Arsenate | soil/groundwater | inhalation, dermal contact, ingestion | Ulceration of nasal septum, gastrointestinal disturbances, respiratory irritation; lung, liver, kidney damage |
| Building 174 | Polychlorinated biphenyls (PCB) | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, skin; acne-form, carcinogenic |
| Building 350 | Diesel Fuel | soil/groundwater | inhalation, dermal contact, ingestion | Respiratory tract irritation; headache, dizziness; vomiting; loss of coordination |
| Building E-108 | Diesel Fuel | soil/groundwater | inhalation, dermal contact, ingestion | Respiratory tract irritation; headache, dizziness; vomiting; loss of coordination |
| Building IA-56 | Benzoic Acid | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of upper respiratory tract; nausea; gastrointestinal disorders |
| Building IA-56 | 4-Methyl phenol | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, nose, and upper respiratory tract; headache, drowsiness, deep anesthesia, death; reddening of the skin, damage to conjunctive |
| | Phenol | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, nose, throat; low-weight; weak, ache, pain; dark urine; skin burns; tremor, convulsions, twitch |

TABLE 3
HAZARDOUS MATERIALS TO BE POTENTIALLY ENCOUNTERED
(Continued)

| SITE | SUBSTANCE | ENVIRONMENTAL MEDIA | EXPOSURE PATHWAY | TOXIC CHARACTERISTICS |
|---------------|---------------------|---------------------|---------------------------------------|--|
| Building 7SH5 | Diesel | soil/groundwater | inhalation, dermal contact, ingestion | Respiratory tract irritation, headache, dizziness, vomiting, loss of coordination |
| | Acetone | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, nose, throat; headache, dizziness |
| | Trichloroethane | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, nose; CNS; liver, kidney damage; carcinogenic |
| | Methyl ethyl ketone | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, nose; headache; dizziness; vomiting |
| | Tributyltin | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, gastric irritation, sore throat, cough, retching |
| | Arsenic | soil/groundwater | inhalation, dermal contact, ingestion | Ulceration of nasal septum; dermatitis; GI disturbances; respiratory irritation; carcinogenic |
| | Copper | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of nasal mucus membranes; phlegm; nasal perforation; eye irritation; metallic taste; dermatitis |
| | Lead | soil/groundwater | inhalation, dermal contact, ingestion | Weak, insomnia; facial pallor; low weight, constipation, abdominal pain, colic; anemia; hypertension |
| | Mercury | soil/groundwater | inhalation, dermal contact, ingestion | Cough, chest pain, tremor, insomnia; headache, weak, stomatitis; irritation of eyes and skin |
| | Methylene Chloride | soil/groundwater | inhalation, dermal contact, ingestion | Weak, sleepiness; limbs numb, tingle; nausea; irritation of eyes and skin carcinogenic |

TABLE 3
HAZARDOUS MATERIALS TO BE POTENTIALLY ENCOUNTERED
(Continued)

| SITE | SUBSTANCE | ENVIRONMENTAL MEDIA | EXPOSURE PATHWAY | TOXIC CHARACTERISTICS |
|---------------------------|---------------------|---------------------|---------------------------------------|--|
| Building 7SH5 (continued) | Naphthalene | soil/groundwater | inhalation, dermal contact, ingestion | Eye irritation; headache; excitement, nausea, vomiting, abdominal pain; bladder irritation; profuse sweating; dermatitis |
| | Phenol | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, nose, throat; low-weight, weakness, headache, pain; dark urine, skin burns; tremor |
| | 1,4-Dichlorobenzene | soil/groundwater | inhalation, dermal contact, ingestion | Headache; eye irritation, swell; profuse sweating; nausea, vomiting; low-weight carcinogenic |
| | 4-Methylphenol | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, nose, and upper respiratory tract; headache, drowsiness; death; redness of skin, damage to conjunctive |
| Building 7SH14 | Toluene | soil/groundwater | inhalation, dermal contact, ingestion | Weak; euphoria; dizziness, headache; dilated pupils, lacrimation; muscle pain, insomnia; dermatitis |
| | Diesel Fuel | soil/groundwater | inhalation, dermal contact, ingestion | Respiratory tract irritation; headache, dizziness; vomiting; loss of coordination |
| Building 79 | 1,3-Dichlorobenzene | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, nose; liver, kidney damage; skin blisters |
| | 2,4-Dichlorophenol | soil/groundwater | inhalation, dermal contact, ingestion | Toxic by ingestion, strong irritant to skin tissue |
| Building 81 | Di-N-octylphthalate | soil/groundwater | inhalation, dermal contact, ingestion | Mild skin and eye irritation; CNS depression |
| | 1,4-Dichlorobenzene | soil/groundwater | inhalation, dermal contact, ingestion | Headache; eye irritation; swell periods; profuse sweating; nausea; vomiting; low-weight; carcinogenic |

TABLE 3
HAZARDOUS MATERIALS TO BE POTENTIALLY ENCOUNTERED
(Continued)

| SITE | SUBSTANCE | ENVIRONMENTAL MEDIA | EXPOSURE PATHWAY | TOXIC CHARACTERISTICS |
|-------------------------|-----------------------|---------------------|---------------------------------------|---|
| Building 81 (continued) | 4-Methylbenzol | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, nose, and upper respiratory tract; headache, drowsiness, deep anesthesia, death; reddening of the skin; damage to conjunctive |
| | Diesel | soil/groundwater | inhalation, dermal contact, ingestion | Respiratory tract irritation; headache, dizziness, vomiting, loss of coordination |
| Building 87 | Diethylphthalate | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of the respiratory tract, skin, eyes; irritation of mucous membrane |
| | Butylbenzyl phthalate | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of lung, diminished mental alertness; irritation of mucous membrane |
| Building 97 | Benzoic Acid | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of upper respiratory tract, nausea, gastrointestinal disorders |
| | Trichloroethane | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of the nose, eyes; CNS depression; liver, kidney damage; carcinogenic |
| | Epoxy | soil/groundwater | inhalation, dermal contact, ingestion | Dermatitis, blistering, and scaly skin; deep-seeded pain |
| | Ethyl alcohol | soil/groundwater | inhalation, dermal contact, ingestion | Corrosive and irritating to skin, eyes, and mucous membranes; chest pain; dyspnea, lethargy, nausea |
| | JP-5 rocket fuel | soil/groundwater | inhalation, dermal contact, ingestion | Dizziness, headache, nausea, fatigue, neurosthenic; kidney cancer |
| | Dichlorobenzene | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of nose, eyes; liver, kidney damage; skin blistering |
| | Phenol | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, nose, and throat; low-weight; weakness; ache, pain; dark urine, skin burns; tremor, convulsions, twitching |

TABLE 3
HAZARDOUS MATERIALS TO BE POTENTIALLY ENCOUNTERED
(Continued)

| SITE | SUBSTANCE | ENVIRONMENTAL MEDIA | EXPOSURE PATHWAY | TOXIC CHARACTERISTICS |
|-------------------------|-----------------------|---------------------|---------------------------------------|---|
| Building 97 (continued) | Benzo(a)anthracene | soil/groundwater | inhalation, dermal contact, ingestion | Probable human carcinogen; produced tumors in mice; produced mutations in bacteria |
| | 4-Methyl phenol | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, nose, and upper respiratory tract; headache, drowsiness, deep anesthesia, death; reddening of skin, damage to conjunctive |
| | Benzo(b)fluoranthene | soil/groundwater | inhalation, dermal contact, ingestion | Probable human carcinogen, produced tumors in mice |
| | Benzo(a)pyrene | soil/groundwater | inhalation, dermal contact, ingestion | Highly toxic, carcinogenic |
| | Dibenz(a,h)anthracene | soil/groundwater | inhalation, dermal contact, ingestion | Probable human carcinogen, produced carcinomas and tumors in mice; induced DNA damage and gene mutation in bacteria |
| Building 1A-27 | Paints and Thinners | soil/groundwater | inhalation, dermal contact, ingestion | Toxic if paint vapors are inhaled over a long period; thinner is toxic by ingestion; inhalation and skin absorption |
| Building 1A-41 | Paints | soil/groundwater | inhalation, dermal contact, ingestion | Toxic if vapors are inhaled over a long period |
| Building 76 | Acetylene | soil/groundwater | inhalation, dermal contact, ingestion | Anesthetic; nonirritating to the skin |
| | Asbestos | soil/groundwater | inhalation, dermal contact, ingestion | Interstitial irritation, restricted pulmonary function, finger clubbing carcinogenic |
| Building 46 | Mercury Vapors | soil/groundwater | inhalation, dermal contact, ingestion | Coughing, chest pain; tremor, insomnia, indigestion; headache, weakness; stomatitis, irritation of eyes and skin |
| | PCBs | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, skin; acne-from dermatitis; carcinogenic |

TABLE 3
HAZARDOUS MATERIALS TO BE POTENTIALLY ENCOUNTERED
(Continued)

| SITE | SUBSTANCE | ENVIRONMENTAL MEDIA | EXPOSURE PATHWAY | TOXIC CHARACTERISTICS |
|----------------|---------------------|---------------------|---------------------------------------|--|
| Building IA-50 | 1,4-Dichlorobenzene | soil/groundwater | inhalation, dermal contact, ingestion | Headache; eye irritation; profuse rhinitis; nausea, vomiting; low-weight |
| | Benzene | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of eyes, nose, respiratory system; headache, nausea, staggered gait; dermatitis; bone marrow gait; carcinogenic |
| | Chlorobenzene | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of skin, eyes, nose; drowsiness |
| Building IA-51 | Antifreeze | soil/groundwater | inhalation, dermal contact, ingestion | Reported high incidences of pleuritis and pericarditis in mice |
| | Zinc chromate | soil/groundwater | inhalation, dermal contact, ingestion | Chronic exposure produced anemia; slight leukocytosis, metal fume fever, respiratory disease and hypocalcemia |
| Building IA-55 | Diesel | soil/groundwater | inhalation, dermal contact, ingestion | Respiratory tract irritation, headache, dizziness, nausea, vomiting, loss of coordination |
| | Diesel | soil/groundwater | inhalation, dermal contact, ingestion | Respiratory tract irritation, headache, dizziness, nausea, vomiting, loss of coordination |
| Building IA 24 | Petroleum | soil/groundwater | inhalation, dermal contact, ingestion | Dizziness, drowsiness, headache, nausea; irritation of eyes, nose, throat; dry cracked skin |
| | Lead | soil/groundwater | inhalation, dermal contact, ingestion | Weak, insomnia; low-weight; constipation, abdominal pain; anemia |
| | Zinc | soil/groundwater | inhalation, dermal contact, ingestion | Sweat, metallic taste; dry throat, coughing; chills; fever; tight chest; blurred vision; nausea, vomiting |
| | | | | |
| | | | | |

TABLE 3
HAZARDOUS MATERIALS TO BE POTENTIALLY ENCOUNTERED
(Continued)

| SITE | SUBSTANCE | ENVIRONMENTAL MEDIA | EXPOSURE PATHWAY | TOXIC CHARACTERISTICS |
|----------------------------|--------------------|---------------------|---------------------------------------|--|
| Building IA 24 (continued) | Antimony | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of the nose, throat, mouth; coughing; dizziness; headache, nausea, vomiting, diarrhea, skin cramps; skin irritation; unable to smell properly |
| | Manganese | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of the eyes, nose; metal fume fever; coughing, chest pain; flu-like fever |
| | Methylene Chloride | soil/groundwater | inhalation, dermal contact, ingestion | Weak, sleepiness; limbs numb, tingle; nausea; irritation of eyes and skin carcinogenic |
| | Trichloroethane | soil/groundwater | inhalation, dermal contact, ingestion | Headache, distress, tremors, may vomit; eye irritation; dermatitis; carcinogenic |
| | Lead Styphnate | soil/groundwater | inhalation, dermal contact, ingestion | Severe explosion risk when heated |
| Building IA-25 | Lead | soil/groundwater | inhalation, dermal contact, ingestion | Weak, insomnia; facial pallor; low weight, constipation, abdominal pain, colic; anemia; hypertension |
| | Asbestos | soil/groundwater | inhalation, dermal contact, ingestion | interstitial irritation, restricted pulmonary function, finger clubbing; carcinogenic |
| | Phosphorous | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of the eyes, respiratory tract; abdominal pain, nausea, pain, anemia; cachexia; dental pain, excess saliva, jaw pain |
| Building IA-6 | Diesel Fuel | soil/groundwater | inhalation, dermal contact, ingestion | Respiratory tract irritation; headache, dizziness, vomiting; loss of coordination |
| | Tetrachloroethane | soil/groundwater | inhalation, dermal contact, ingestion | Nausea, vomiting, abdominal pain, tremor fingers; jaundice, kidney damage |

TABLE 3
HAZARDOUS MATERIALS TO BE POTENTIALLY ENCOUNTERED
(Continued)

| SITE | SUBSTANCE | ENVIRONMENTAL MEDIA | EXPOSURE PATHWAY | TOXIC CHARACTERISTICS |
|---------------------------|-----------------------|---------------------|---------------------------------------|---|
| Building IA-6 (continued) | 1,1-Dichloroethane | soil/groundwater | inhalation, dermal contact, ingestion | CNS depression; skin irritation; liver, kidney damage |
| | 1,1,1-Trichloroethane | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of the nose, eyes; CNS depression; liver, kidney damage |
| | Chloroform | soil/groundwater | inhalation, dermal contact, ingestion | Dizziness |
| Building IA-7 | Potassium Chloride | soil/groundwater | inhalation, dermal contact, ingestion | Gastrointestinal irritation, burning, weakness and circulation disturbance |
| | Sodium Chloride | soil/groundwater | inhalation, dermal contact, ingestion | Irritation of upper respiratory tract, eyes, skin; nausea, vomiting |
| | Ammonium Phosphate | soil/groundwater | inhalation, dermal contact, ingestion | NA |
| | Potassium Carbonate | soil/groundwater | inhalation, dermal contact, ingestion | Irritation to skin tissues, dryness, chemical burns |
| | Diesel | soil/groundwater | inhalation, dermal contact, ingestion | Respiratory tract irritation; headache, dizziness, nausea, vomiting; loss of coordination |
| Building IA-12 | Anti-freeze | soil/groundwater | inhalation, dermal contact, ingestion | Produced high incidences of pleuritis and pericarditis in mice |
| | Gasoline | soil/groundwater | inhalation, dermal contact, ingestion | Burning of the mucous membranes, throat, respiratory tract; pulmonary edema; dermatitis, hyperemia of the conjunctive |
| Building IA-16 | Diesel | soil/groundwater | inhalation, dermal contact, ingestion | Respiratory tract irritation; headache, dizziness, nausea, vomiting; loss of coordination |

**TABLE 4
WORK TASK HAZARD ANALYSIS**

| Task | Potential Hazard | Anticipated Level of Protection | Upgraded Level of Protection |
|--|-------------------------|--|-------------------------------------|
| Task 1 Soil boring, HydroPunch, Geoprobe, sampling of existing wells | chemical physical | D modified | C |
| Task 2 Septic tank sampling | chemical physical | D modified | C |
| Task 3 Hand augering | chemical physical | D modified | C |
| Task 4 Groundwater sampling | chemical physical | D modified | C |
| Task 5 Soil sampling | chemical physical | D modified | C |
| Task 6 Installation of monitoring wells | chemical physical | D modified | C |

**ATTACHMENT A
HEALTH AND SAFETY PLAN COMPLIANCE AGREEMENT FORM**

ATTACHMENT B
HEALTH AND SAFETY MEETING SIGN-OFF SHEET

**ATTACHMENT C
DAILY SITE LOG**

ATTACHMENT D
FIELD ACTIVITIES EQUIPMENT LIST

PRC

FIELD ACTIVITIES EQUIPMENT LIST

(Sheet 1 of 3)

Directions: Check as appropriate and indicate quantity taken out from stock. Write in any additional personal protective equipment not listed here.

RESPIRATORY PROTECTION:

None needed (✓)

() SCBA, airline

() Air-purifying respirator

() Cartridge Type: _____

() Escape mask

() Other _____

HEAD, EYES & EAR PROTECTION:

() Safety glasses, goggles

(✓) Hard hat

() Face shield

() Ear plugs

() Other _____

PROTECTIVE CLOTHING:

None needed ()

() Encapsulating suit

() Saranex® coveralls

(✓) Tyvek® coveralls

() Coveralls

() Other _____

FIELD ACTIVITIES EQUIPMENT LIST

(Sheet 2 of 3)

GLOVES:

None needed ()

- () Inner gloves/liners Type: _____
(✓) Work gloves Type: _____
(✓) Outer gloves Type: Neoprene

BOOTS:

- (✓) Steel toed/steel shank, work boots
() Overboots Type: _____
() Disposable booties Type: _____
() Other Type: _____

MONITORING EQUIPMENT:

- () Ultraviolet photoionization detector
() 10.2 lamp () 11.7 lamp () other _____
() Organic vapor analyzer
(✓) Dust monitor
() Radiation survey meter
() Thermoluminescent dosimeters
() Self-reading dosimeters
() Oxygen deficiency/combustible gas indicator
() Colorimetric Detector tubes

Type of detector tubes: _____

() Other (such as hydrogen sulfide or hydrogen cyanide analyzer)

FIELD ACTIVITIES EQUIPMENT LIST

(Sheet 3 of 3)

MISCELLANEOUS EQUIPMENT:

- First aid kit _____
- Eyewash and/or shower _____
- Absorbent material (if required) _____
- Adequate water supply _____
- Fire extinguishers (if required) _____
- Stretcher _____
- Hand-held alarm horns (if required) _____
- Communication radios _____
- Decontamination equipment _____
- Other (specify) _____

**ATTACHMENT E
ACCIDENT/INCIDENT REPORT FORM**

PRC

ACCIDENT/INCIDENT REPORT FORM

**FIELD TEAM LEADER'S REPORT OF ACCIDENT/INCIDENT
(USE FOR ON-SITE ACCIDENTS OR EXPOSURES ONLY)**

To: Kurt Sorensen, Chicago

From: _____, On-site Health and Safety Officer

Telephone Number: ____ / ____ - _____

CTO No.: _____

Site Name: _____ Exact Location of Accident/Incident: _____

Name of Injured/Ill Employee: _____

Date and Time of Accident/Incident: _____

Description of Accident/Incident:

Nature Of Illness or Injury and Part Of Body Involved:

Probable Disability (check one):

- Fatal
- Lost work days (No. of days: ____)
- Restricted activity (No. of days: ____)
- No lost work days
- First aid only

Corrective Action(s) Taken by Reporting Unit:

Corrective Action That Remains to be Taken (By whom and by when):

Name of PRC Field Team Leader: _____

Signature: _____

Date: _____

Copies to: Fred L. Stanley, Ph.D., CIH, CSE, CLEAN Health and Safety Program Manager
Daniel Chow, CLEAN Program Manager
CLEAN Health and Safety Files, San Francisco

**ATTACHMENT F
SITE HEALTH AND SAFETY AUDIT**

SITE HEALTH AND SAFETY AUDIT

Date of Site Visit: _____ CTO Number: _____
 Project Name: _____
 Site Name/Location: _____
 PRC's Project Manager: _____
 PRC's On-Site Health and Safety Officer (OHSO): _____
 PRC On-Site Radiation Protection Officer (ORPO): _____
 Auditor: _____

| | Compliance | | Comments Attached | | |
|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | Yes | No | Yes | No | NA |
| <u>HEALTH AND SAFETY PLAN</u> | | | | | |
| 1. Is H&S plan available at site | <input type="checkbox"/> |
| 2. Are site personnel familiar with H&S plan contents | <input type="checkbox"/> |
| 3. Has H&S plan been signed by site personnel | <input type="checkbox"/> |
| 4. Does H&S plan cover all tasks scheduled for the site | <input type="checkbox"/> |
| 5. Is the hazard evaluation in H&S plan complete for all risks identified at the site | <input type="checkbox"/> |
| 6. Is the H&S plan complete, including all necessary material | <input type="checkbox"/> |
| 7. Has the H&S plan been amended as needed | <input type="checkbox"/> |
| 8. Are personnel adequately supplied with PPE for associated levels of protection | <input type="checkbox"/> |
| <u>RESPIRATORY PROTECTION</u> | | | | | |
| 1. Has site personnel been properly trained in the use and maintenance of respirators and SCBA units | <input type="checkbox"/> |
| 2. Are records of respirator use and maintenance properly kept (specify location) | <input type="checkbox"/> |
| 3. Are records of SCBA units use and maintenance properly kept (specify location) | <input type="checkbox"/> |
| <u>AIR MONITORING EQUIPMENT</u> | | | | | |
| 1. Is site personnel properly trained in air monitoring equipment | <input type="checkbox"/> |
| 2. Are records of calibration, use, and maintenance properly kept (specify location) | <input type="checkbox"/> |

SITE HEALTH AND SAFETY AUDIT (Continued)

| | <u>Compliance</u> | | <u>Comments Attached</u> | | |
|---|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | Yes | No | Yes | No | NA |
| <u>MEDICAL SURVEILLANCE</u> | | | | | |
| 1. Is site personnel in compliance with medical requirements (have form with current updates) | <input type="checkbox"/> |
| <u>EMERGENCY PLAN</u> | | | | | |
| 1. Is emergency plan adequate | <input type="checkbox"/> |
| 2. Are emergency phone numbers and route to hospital posted in a conspicuous location | <input type="checkbox"/> |
| 3. Are enough personnel (at least two preferred) trained in First Aid and CPR | <input type="checkbox"/> |
| 4. Is first aid, fire, and monitoring equipment in good condition | <input type="checkbox"/> |
| <u>OTHER</u> | | | | | |
| 1. Is site control, set-up, and entry adequate | <input type="checkbox"/> |
| 2. Are decontamination procedures appropriate | <input type="checkbox"/> |
| 3. Do subcontractors have adequate H&S plan and follow it | <input type="checkbox"/> |

I have received and reviewed this audit

Project Manager

Date

Health and Safety Director

Date

CLEAN Health and Safety Program Manager

Date

I prepared and submitted this document

Auditor

Date

ATTACHMENT G
MATERIAL SAFETY DATA SHEETS



Section 1 - Chemical Product and Company Identification

39

Material Name Acetone
Chemical Formula CH₃COCH₃
CAS No. 67-64-1
Other Designations: A13-01238, Chevron acetone, dimethylformaldehyde, dimethylketal, dimethyl ketone, β-ketopropane, methyl ketone, propanone, 2-propanone, pyroacetic acid, pyroacetic ether.
Derivation: Derived by the dehydrogenation or oxidation of isopropyl alcohol with a metallic catalyst, the oxidation of cumene, the vapor phase oxidation of butane; and as a by-product of synthetic glycerol production.
Use: Used as a solvent for paint, varnish, lacquer, fat, oil, wax, resin, rubber, plastic, and rubber cement; to clean and dry parts of precision equipment; in the manufacture of chemicals (methyl isobutyl ketone, methyl isobutyl carbinol, methyl methacrylate, bisphenol-A, acetic acid (ketene process), mesityl oxide, diacetone alcohol, chloroform, iodoform, bromoform), explosives, airplane dopes, rayon, photographic films, isoprene; acrylene gas storage cylinders; in purifying paraffin; in nail polish remover; in the extraction of various principles from animal and plant substances; in hardening and dehydrating tissues; in cellulose acetate (especially as spinning solvent); as a solvent for potassium iodide and permanganate; as a delusterant for cellulose acetate fibers; in the specification testing of vulcanized rubber products.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemical Week Buyers' Guide*⁽⁷³⁾ for a suppliers list.

Section 2 - Composition / Information on Ingredients

Acetone: 99.5% 0.5% Water

1991 OSHA PELs *
8-hr TWA: 750 ppm (1,800 mg/m³)
15-min STEL: 1,000 ppm (2,400 mg/m³)

1990 NIOSH REL
TWA: 250 ppm (590 mg/m³)

1990 DFG (Germany) MAK
1,000 ppm (2,400 mg/m³)
Category IV: Substances eliciting very weak effects (MAK > 500 mL/m³)
Peak: 2,000 ppm, 60 min. momentary value, † 3 peaks/shift

1992-93 ACGIH TLVs
TWA: 750 ppm (1,780 mg/m³)
STEL: 1,000 ppm (2,380 mg/m³)

1990 IDLH Level
20,000 ppm

* In the cellulose acetate fiber industry, enforcement of the OSHA TWA for "doffers" was stayed on 9/5/89 until 9/1/90; the OSHA STEL does not apply to that industry.

† Momentary value is a level which the concentration should never exceed.

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, highly volatile liquid; sweetish odor. Acetone vapor is a dangerous fire and explosion hazard. High vapor concentrations may produce narcosis (unconsciousness). Prolonged or repeated skin contact causes dryness, irritation, and mild dermatitis.

Potential Health Effects

Carcinogenicity: IARC, NTP, and OSHA do not list acetone as a carcinogen.

Summary of Risks: Acetone has been placed among solvents of comparatively low acute and chronic toxicities. In industry, the most common effects reported are headache from prolonged vapor inhalation and skin irritation resulting from its defatting action. Exposure to less than 1,000 ppm acetone vapor produces only slight eye, nose, and throat irritation. Acetone does not have sufficient warning properties to prevent repeated exposures. It is narcotic at high concentrations (above 2,000 ppm). Concentrations above 12,000 ppm cause loss of consciousness.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Target Organs: Respiratory and central nervous systems, skin.

Primary Entry Routes: Inhalation, skin and eye contact, ingestion. Liquid acetone is slowly absorbed through the skin.

Acute Effects:

Eye: Direct eye contact by liquid acetone may produce painful burning and stinging; watering of eyes; conjunctival inflammation; and corneal injury.

Skin: Skin contact produces a cold feeling, dryness, and mild irritation.

Inhalation: Human systemic effects by inhalation include eye, nose, and throat irritation; nausea and vomiting; changes in EEG (electroencephalogram) and carbohydrate metabolism; muscle weakness; drunken behavior; mental confusion and visual disturbance. In extreme cases, breathing high concentrations may produce coma.

Ingestion: Human systemic effects by ingestion include gastrointestinal irritation, kidney damage (often indicated by albumin and red and white blood cells in urine), liver damage (indicated by high levels of urobilin and early appearance of bilirubin).

| |
|--------------------------|
| Wilson Risk Scale |
| R 1 |
| I 1 |
| S 1* |
| K 3 |
| * Slight skin absorption |

| |
|---------|
| HMIS |
| H 1 |
| F 3 |
| R 0 |
| PPE† |
| †Sec. 8 |

Acute Effects (cont.):

coma, metabolic changes, and systemic effects described for inhalation.

Chronic effects: Cases of chronic poisoning resulting from prolonged exposure to low concentrations of acetone are rare.

Workers exposed to 1,000 ppm, 3 hr per day for 7-15 yr, complained of dizziness, asthenia (lack or loss of strength), and chronic inflammation of the airways, stomach, and duodenum. Prolonged or repeated skin contact with liquid acetone may defat the skin and cause eczematoid dermatitis.

Section 4 - First Aid Measures

Eyes: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. Carefully dispose of contaminated clothing because it may pose a fire hazard.

Inhalation: Remove exposed person to fresh air, monitor for respiratory distress and administer 100% humidified supplemental oxygen as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have that *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: In symptomatic patients, monitor serum and urine acetone levels, fluid intake, blood glucose, and arterial pH. Because of the prolonged elimination half-life of acetone, the symptomatic patient may need medical supervision for many hours (up to 30 hr). Patients may develop hyperglycemia and ketosis mimicking acute diabetic coma. The hyperglycemia may persist for several days following acute exposure.

Section 5 - Fire Fighting Measures

Flash Point 0°F (-18°C), CC

Autoignition Temperature 869°F (465°C)

LEL 2.6% v/v

UEL 12.8% v/v



Extinguishing Media: *Do not* extinguish fire unless flow can be stopped. For small fires, use dry chemical, carbon dioxide (CO₂), water spray, or alcohol-resistant foam. For large fires, use water spray, fog, or alcohol-resistant foam. Use water in flooding quantities as fog because solid streams may be ineffective.

Unusual Fire or Explosion Hazards: Acetone is a dangerous fire and explosion hazard; it is a Class IB flammable liquid. Vapors may travel to a source of ignition and flash back. Fire-exposed containers may explode. A vapor explosion hazard may exist indoors, outdoors, or, in sewers.

Fire-Fighting Instructions: If feasible, remove all fire-exposed containers. Otherwise, apply cooling water to sides of containers until well after fire is extinguished. If the fire becomes uncontrollable or container is exposed to direct flame, consider evacuation of a one-third mile radius. In case of rising sound from venting safety device or any discoloration of tank during fire, withdraw immediately. Do not release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighters' protective clothing provides limited protection. For massive cargo fires, use unmanned hose holder or monitor nozzles.

Section 6 - Accidental Release Measures

Spill / Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove all heat and ignition sources and provide adequate ventilation. Cleanup personnel should protect against inhalation and skin or eye contact. If feasible and without risk, stop leak. Use water spray to reduce vapor but it may not prevent ignition in closed spaces.

Small Spills: For small spills, take up with sand or other noncombustible absorbent material and using nonsparking tools, place into containers for later disposal.

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways. Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Storage Requirements: Store in closed containers in a cool, dry, well-ventilated area away from heat, sparks, flames, and other incompatibles. Keep large stocks away from inhabited buildings.

Handling Precautions: Use nonsparking tools to open containers. Keep dry chemical or CO₂ extinguishers on hand in case of fire.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment during fluid transfer. For bulk storage rooms, install electrical equipment, Class I, Group D.

Ventilation: Provide general and local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source. (103)

Administrative Controls: Consider preplacement and periodic medical examinations with emphasis on the skin and respiratory tract. Also consider liver and kidney function tests and urinalysis.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Polyethylene/ethylene vinyl alcohol, Teflon, or butyl rubber with breakthrough times > 8 hr is recommended for PPE. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For concentrations < 1,000 ppm, wear any chemical cartridge respirator with organic vapor cartridge(s) and wear eye protection to avoid irritation or damage. For concentrations < 6,250 ppm, wear any supplied-air respirator operated in a continuous-flow mode. For concentrations < 12,500 ppm, wear any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister. For concentrations < 20,000 ppm, wear any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

| | | | |
|------------------------|---|-------------------------------|---|
| Physical State | Liquid | Other Solubilities | Alcohol, benzene, dimethyl formamide, chloroform, ether, and most oils |
| Color | Colorless | Specific Gravity | 0.7889 @ 20°C /4°C |
| Odor | Sweet | Vapor Pressure | 180 mm Hg at 68°F (20°C), 400 mm Hg at 103.1°F (39.5°C) |
| Odor Threshold | 47.5 mg/m ³ to 1,613.9 mg/m ³ * | Saturated Vapor Density | (Air = 1.2 kg/m ³ , 0.075 lb/ft ³) 1.48 kg/m ³ , .093 lb/ft ³ |
| Boiling Point | 133.2°F (56.2°C) at 760 mm Hg | | |
| Freezing Point | -139.6°F (-95.35°C) | | |
| Refractive Index | 1.3588 @ 20°C | | |
| Water Solubility | Soluble | | |
| Molecular Weight | 58.08 | | |

* Odor thresholds recorded as a range from the lowest to the highest concentration.

Section 10 - Stability and Reactivity

Stability: Acetone is stable at room temperature in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Acetone may form explosive mixtures with hydrogen peroxide, acetic acid, nitric acid, nitric acid + sulfuric acid, chromic anhydride, chromyl chloride, nitrosyl chloride, hexachloromelamine, nitrosyl perchlorate, nitryl perchlorate, permonosulfuric acid, thiodiglycol + hydrogen peroxide. Acetone reacts vigorously with oxidizing materials and ignites on contact with activated carbon, chromium trioxide, dioxygen difluoride + carbon dioxide, and potassium-*tert*-butoxide. Other incompatibles include air, bromoform, bromine, chloroform + alkalis, trichloromelamine, and sulfur dichloride.

Conditions to Avoid: Keep acetone away from plastic eyeglass frames, jewelry, pens, pencils, and rayon garments.

Hazardous Products of Decomposition: Thermal oxidative decomposition of acetone can produce CO₂ and carbon monoxide (CO).

Section 11- Toxicological Information**Toxicity Data:****Eye Effects:**

Human, eye: 500 ppm

Acute Oral Effects:Rat. oral. LD₅₀: 5800 mg/kg altered sleep time and produced tremors.**Acute Inhalation Effects:**Human, inhalation. TC_{LO}: 500 ppm produced olfaction effects, conjunctival irritation, and other changes involving the lungs, thorax, or respiration.Mammal, inhalation. TC_{LO}: 31,500 µg/m³/24 hr administered to pregnant female from the 1st to 13th day of gestation produced effects on fertility (post-implantation mortality).

* See NIOSH, RTECS (AL3150000), for additional irritation, mutation, reproductive, and toxicity data.

Section 12 - Ecological InformationEcotoxicity: LC₅₀ *Salmo gairdneri* (rainbow trout): 5,540 mg/L/96 hr at 54°F (12°C).LC₅₀ (oral) Ring-necked pheasant: > 40,000 ppm.

Environmental Degradation: Acetone biodegrades when released into the environment. The biological oxygen demand for 5 days (BOD5) is 46-55%.

Soil Absorption / Mobility: Acetone volatilizes, leaches, and biodegrades if released on soil.

Section 13 - Disposal Considerations

Disposal: Acetone is a good candidate for fluidized bed, rotary kiln incineration, or catalytic oxidation. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information**Transportation Data (49 CFR 172.101):**

DOT Shipping Name..... Acetone

DOT Hazard Class..... 3

ID No. UN1090

DOT Packing Group..... II

DOT Label..... Flammable

Liquid

Special Provisions (172.102)T8

Packaging Authorizations:

a) Exceptions.....173.150

b) Non-bulk Packaging.....173.202

c) Bulk Packaging.....173.242

Quantity Limitations:

a) Passenger, Aircraft, or Railcar ...5L

b) Cargo Aircraft Only..... 60L

Vessel Stowage Requirements:

a) Vessel Stowage..... B

b) Other..... —

Section 15 - Regulatory Information**EPA Designations:**

Listed as a RCRA Hazardous Waste (40 CFR 261.33): Hazardous Waste No. U002 (Ignitability), (40 CFR 261.31): F003 (spent solvent)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 5,000 lb (2,270 kg) [* per Clean Water Act, Sec. 311(b)(4)]

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations:

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 16 - Other Information

MSDS Collection References: 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 149, 153, 159, 163, 164, 167, 168, 171, 174, 176, 180.

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MATERIAL SAFETY DATA SHEET

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No. 70

ANTIMONY METAL/POWDER

Date September 1980

| SECTION I. MATERIAL IDENTIFICATION | | | | |
|---|-------------------------------------|-------------------------------------|--|-------|
| MATERIAL NAME: ANTIMONY METAL/POWDER OTHER DESIGNATIONS: Stibium, Sb, ASTM B237, GE Material B10F2, CAS #007 440 360 MANUFACTURER: Available from several suppliers. | | | | |
| SECTION II. INGREDIENTS AND HAZARDS | | % | HAZARD DATA | |
| Antimony | | > 99 | 8-hr TWA 0.5 mg/m ³ * (as Sb) Rat. intraperitoneal LDLo 100 mg/kg Rat. oral LD50 100 mg/kg | |
| *Current OSHA Standard and ACGIH (1980) TLV. NIOSH has proposed a 10-hr TWA of 0.5 mg/m ³ with an Action level at 0.25 mg/m ³ . TLV was establish at a level to prevent irritation and systemic effects. | | | | |
| SECTION III. PHYSICAL DATA | | | | |
| Boiling point, @ 1 atm, deg C ----- 1750 | | Specific gravity, @ 25 C ----- 6.68 | | |
| Vapor pressure @ 886 deg C, mm Hg - 1 | | Melting point, deg C ----- 630.5 | | |
| Solubility in water ----- Insoluble | | Mohs hardness ----- 3-3.5 | | |
| | | Molecular weight ----- 121.76 | | |
| Appearance: A brittle, flaky, crystalline solid with a lustrous blue-white color; an amorphous gray allotrope is also known. The powder form is dark gray, lustrous. | | | | |
| SECTION IV. FIRE AND EXPLOSION DATA | | | LOWER | UPPER |
| Flash Point and Method | Autoignition Temp. | Flammability Limits in Air | 0.42 | — |
| — | 320 C (cloud) 330 C (dust layer) | Dust cloud explosion* | oz/ft ³ | — |
| Extinguishing Media: (Obtain detailed fire-fighting information from supplier.) Antimony bulk metal is combustible in air at high temperature. When ignited it burns with a brilliant flame, giving off dense white fumes (Sb ₂ O ₃). When powdered antimony is exposed to heat or ignition sources it is a moderate fire and explosion hazard. Particle size and dispersion in air determine reactivity. Firefighters should use self-contained breathing equipment and eye protection. 91% of dust goes thru a 74 micron sieve. Sb dust cloud can be ignited by a 1.92 J spark. | | | | |
| SECTION V. REACTIVITY DATA | | | | |
| Antimony metal (bulk) is stable in dry air at room temperature. It slowly tarnishes in moist air. It is not very reactive with cold, dilute acids, but reacts readily with aqua regia and hot, concentrated sulfuric acid. Nascent hydrogen can react with Sb or its alloys with Mg or Zn to form stibine (SbH ₃), a colorless, highly toxic gas with a disagreeable odor (TLV 0.1 ppm). Sb can react vigorously or violently with oxidizing agents, such as nitrate salts, halogens, nitric acid, perchloric acids, ClF ₃ , KMnO ₄ , etc. Powdered antimony reacts more vigorously than the bulk material and forms dangerous mixtures with oxidizing agents. Reactivity is further increased on heating. | | | | |

| | |
|--|---------------------------|
| SECTION VI. HEALTH HAZARD INFORMATION | TLV 0.5 mg/m ³ |
|--|---------------------------|

Antimony is an irritant of the mucous membranes, eyes, and skin. Exposures to dust/powder can cause eye inflammation, nasal irritation, chronic dermatitis ranging from mild rashes to blemishes resembling chicken pox, and muscle pain and weakness. Chronic inhalation of subtoxic doses of dust or fume above the TLV may result in chemical pneumonia, intraalveolar lipid deposits, liver and cardiac involvement, and possible kidney disease. Acute ingestion may cause violent vomiting, diarrhea, slow pulse and low blood pressure, shallow breathing, and death.

FIRST AID:

Eye Contact: Flush with running water for 15 minutes, including under the eyelids.

Skin Contact: Wash area with soap and water. Treat burns as usual.

Inhalation: Remove to fresh air.

Ingestion*: Contact physician! Gastric lavage followed by saline catharsis.

In **ALL CASES** of excessive exposure get prompt medical help for further treatment, support, and observation.

*Chelation therapy with Dimercaprol (BAL) under a physician's care will increase Sb elimination rate in urine.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel of powder spills. Small spills can be removed by vacuuming or wet sweeping in order to keep airborne dust at a minimum. Clean up personnel should use protective equipment.

DISPOSAL: Scrap metal can be returned to supplier. Unsalvageable waste may be buried in an approved secure landfill. Follow Federal, State, and Local regulations.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation to meet TLV requirements in the workplace where Sb powder is used or where Sb-containing metal is heated.

Respirators should be available for nonroutine or emergency use above the TLV: High efficiency dust respirator below 5 mg/m³ and self-contained or air-supplied respirators with full facepiece above 5 mg/m³.

Avoid eye contact by use of chemical safety goggles where dusty conditions occur. Use protective clothing appropriate for the work situation to minimize skin contact.

Clothing to be changed daily and laundered. Showering after work with a complete change to street clothing is desirable. (Separate lockers for street clothes).

Eyewash stations and washing facilities should be readily accessible.

Provide preplacement and periodic medical examinations for those regularly exposed to antimony, with emphasis directed to skin and mucous membranes and the pulmonary, cardiac, and reproductive systems. Provide suitable training to those working with antimony. Monitor the workplace. Keep records.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store in a dry, well-ventilated, low-fire risk area. Avoid heat and direct sunlight.

Use good housekeeping practices to prevent accumulation of dust and follow sound cleaning techniques that will keep airborne particulate at a minimum.

Avoid breathing dust or fume. Minimize skin contact by using barrier creams, rubber gloves and aprons, and good personal hygiene. Keep Sb dust off clothing. Wash hands and face before eating, drinking or smoking after handling this material.

DATA SOURCE(S) CODE: 2-12,24,26,27,31,37,41

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J.M. Jensen

Industrial Hygiene
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Material Safety Data Sheets Collection:

Sheet No. 15
Asbestos and Asbestos-containing Material

Issued: 11/90

Section 1. Material Identification

Asbestos and Asbestos-containing Materials Description: Asbestos is a generic term applied to many naturally occurring, hydrated silicates (minerals) found in rock which separate into flexible fibers when crushed or processed. Commercially important forms are amosite, anthrophyllite (mined and used only in Finland), chrysotile, and crocidolite. Other types include tremolite and actinolite. Most widely used in US industry is chrysotile, a fibrous form of serpentine. Since asbestos is insensitive to chemical attack and noncombustible, there are over 2000 uses as processed fiber. It is added to such diverse materials as cement, vinyl, plaster, asphalt, and cotton, although due to its health hazards other materials are now replacing it wherever possible. Its use is now limited to products that bind fibers within the product. The largest use of asbestos is in asbestos cement for pipes in water supply, sewage disposal, and irrigation systems; ducts; and flat and corrugated sheets for a wide variety of construction applications. Other uses include fire-resistant textiles, floor tiles, underlayment and roofing papers, friction materials (brake linings), reinforcing filler in elastomers for packing and gaskets, reinforcing pigment in surface coatings and sealants, thermal and electrical insulation media, as a component of taping compound and industrial talcs, and as filler in industrial greases. About 98% of crocidolite is used in production of asbestos cement pipe. Between 1950 and 1972 asbestos was used as spray insulation in buildings, but OSHA now prohibits spray application of actinolite, anthrophyllite, asbestos, or tremolite (29 CFR 1910.1001).

Other Designations: CAS No. 12172-73-5, amosite, brown asbestos; CAS No. 1332-21-4, asbestos; CAS No. 12001-29-5, chrysotile, white asbestos; CAS No. 12001-28-4, crocidolite, blue asbestos; Ascarite; earth flax; mountain cork; stone flax.

Molecular Formulas: Amosite, (FeMg)SiO₃; anthrophyllite, (MgFe)₂Si₂O₇(OH)₂; chrysotile, 3MgO·2SiO₂·H₂O; crocidolite, NaFe₃(Si₃O₁₀)₂·FeSiO₃·H₂O; tremolite, Ca₂Mg₅Si₈O₂₂(OH)₂.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*TM for a suppliers list.

Caution: Asbestos causes three specific diseases: asbestosis (fibrous lung scarring), lung cancer, and mesothelioma (cancer of the chest lining and abdominal cavities). Prevent or maintain exposures at the lowest feasible level.

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Section 2. Ingredients and Occupational Exposure Limits

| | 1989 OSHA PELs* | | 1990-91 ACGIH TLVs | | 1988 NIOSH REL |
|-------------|-----------------|----------------------------|----------------------------|----------------|----------------|
| Asbestos | TWA: 0.2 f/cc† | Action Level TWA: 0.1 f/cc | Excursion Limit: 1.0 f/cc‡ | TWA: 2.0 f/cc§ | 0.1 f/cc |
| Amosite | 0.2 f/cc | 0.1 f/cc | 1.0 f/cc | 0.5 f/cc | 0.1 f/cc |
| Chrysotile | 0.2 f/cc | 0.1 f/cc | 1.0 f/cc | 2.0 f/cc | 0.1 f/cc |
| Crocidolite | 0.2 f/cc | 0.1 f/cc | 1.0 f/cc | 0.2 f/cc | 0.1 f/cc |

1985-86 Toxicity Data for Asbestos (CAS No. 1332-21-4)**

Human, inhalation, TC₀₁: 1.2 fb/cc, continuous exposure over 19 years. Toxic to lungs.

* OSHA has proposed a lower asbestos exposure limit of 0.1 f/cc as an 8-hr TWA (*Industrial Safety and Hygiene News*, 8/90).

† Fiber/cm³

‡ Average over a 30-min sampling period.

§ As determined by membrane filter method at 400 to 450X magnification (4-mm objective) phase contrast illumination. Fibers longer than 5 µg and with an aspect ratio ≥ 3:1 (ACGIH).

** See NIOSH, *RTCS* (C16475000), for additional toxicity data.

Section 3. Physical Data

Melting Point: Decomposes **Water Solubility:** Insoluble (breaks down slowly in hot water)
Molecular Weight: Varies with asbestos form (Sec. 1)
Appearance and Odor: White or greenish (chrysotile), blue (crocidolite), or gray-green (amosite) fibrous, odorless solids.

Section 4. Fire and Explosion Data

Flash Point: None reported **Autoignition Temperature:** None reported **LEL:** None reported **UEL:** None reported

Extinguishing Media: Asbestos is nonflammable. Use dry chemical, CO₂, water spray, or regular foam. Do not scatter spilled material with high pressure water streams. **Special Fire-fighting Procedures:** Isolate hazard area and deny entry. Since there may be airborne asbestos fibers, use a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode; structural firefighting protective clothing provides limited protection. If feasible, remove containers from fire area. Avoid dust generation. Be aware of runoff from control methods. Do not release to sewers or waterways. Develop decontamination procedures for protective clothing and equipment.

Section 5. Reactivity Data

Stability/Polymerization: Asbestos is inert under ordinary room temperature and heated use conditions. It is heat resistant, but decomposes alters its microscopic fiber structure above 600 °C (1112 °F). Chrysotile dehydroxylates at 1112 to 1436 °F (600 to 780 °C); the "asbestos anthrophyllite" in turn breaks down to a mixture of silica (SiO₂) and forsterite (Mg₂SiO₄) at 1472 to 1562 °F (800 to 850 °C). Above 1832 °F (1000 °C) magnesium pyroxene form and melt at -2642 °F (1450 °C). **Chemical Incompatibilities:** Strong acids can attack chrysotile and rapidly extract its MgO and H₂O content; glacial acetic acid can decompose it. Hot water slowly breaks down chrysotile. Like other asbestos forms, it resists strong alkali (5M NaOH at least up to 100 °C).

Section 6. Health Hazard Data

Carcinogenicity: The NTP, IARC, OSHA, and ACGIH list asbestos as a human carcinogen. **Summary of Risks:** Asbestos may cause 1) asbestosis, 2) lung cancer, 3) mesothelioma, 4) pleural plaques, and 5) several other forms of cancer. Asbestosis is fibrosis (scarring) of lung tissue after many years of high-level occupational exposure. Scarring may be progressive even after exposure ceases. Even though detectable lungs of a high proportion of adults in industrialized areas, asbestosis does not result from lower level environmental exposure. Its symptoms range from mild shortness of breath and dry cough to severe disabling breathlessness, heart failure, and ultimately death. Lung scarring can be seen on X-ray and alterations in lung function can be detected with spirometry (a medical test). Examination typically detects rales (crackling sounds in lungs). Severe cases may have cyanosis (bluish skin discoloration) and clubbing of fingertips. Lung cancer can result from lower exposure levels than asbestosis, but also takes many years to develop. Smokers exposed to asbestos are at 5 to 10X higher risk than exposed nonsmokers. **Mesothelioma** is a very aggressive cancer of the pleura (lining around the lungs) or peritoneum (lining of the abdomen), and develops after decades of (sometimes low level) exposure. Symptoms may include chest and abdominal pain, weight loss, and/or shortness of breath, with death within 2 years of diagnosis. **Pleural plaques** are thickenings, sometimes with calcium deposits, of the lungs' lining and are seen on X-ray. While not associated specifically with health effects, they indicate significant exposure. **Other sites of cancer** include larynx (vocal cords), portions of digestive tract, and possibly the kidney. Asbestos's toxicity depends on fiber type (crocidolite > amosite > chrysotile), size (longer > shorter), shape (long, thin needle-like > curly), and solubility. Health effects depend on dose (exposure concentration and duration), smoking habits, and individual susceptibility. Prevent or maintain exposures at lowest feasible level.

CONTINUE ON NEXT

Section 6. Health Hazard Data, continued

Medical Conditions Aggravated by Long-Term Exposure: Long-term, high-level exposure may aggravate any chronic lung (asthma, emphysema, bronchitis) or heart condition. Target Organs: Respiratory system, possibly digestive system. Primary Entry Routes: Inhalation, ingestion, dermal contact. Acute Effects: Nose, throat, skin and eye irritation are possible with high exposure. Chronic Effects: Asbestosis, lung cancer, and mesothelioma typically develop decades (20 to 40 years) after exposure begins, but may occur sooner. **FIRST AID Emergency:** *Personnel should protect against asbestos exposure.* Eyes: Do not rub. Gently lift eyelids and flush with flooding amounts of water. Skin: Shower with water and soap. Wet contaminated clothing prior to removal and seal in a plastic bag for disposal as hazardous waste. If rash develops, consult physician. Inhalation: Remove to fresh air. Clean any fibers from nose and mouth. Encourage victim to cough, spit, and blow nose to remove fibers. Ingestion: Induce vomiting *only* if awake and alert. Consult a physician. After first aid, consult medical care provider. Note to Physicians: Asbestos diagnosis is based on chest X-ray with an abnormal (LO "B" reading (small irregular opacities), rates, restrictive pattern spirometry, adequate exposure history, and symptoms. Consider pneumovax, annual flu shot, and other supportive treatment as needed.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel and evacuate all unnecessary personnel. Cleanup personnel should protect against dust inhalation and skin or eye contact. Avoid dust generation, blowing, dry brushing, and dry mopping. Provide HEPA-filtered (high-efficiency particulate air) portable ventilation systems. Use wet cleaning methods or approved HEPA vacuum cleaning system to pick up spills. The techniques used must collect particulate without dispersing dust into air. Place waste in properly labeled dust-tight containers or sealed, heavy-gauge, impervious plastic bags for disposal. Follow applicable OSHA regulations (29 CFR 1910.120). Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* per Clean Water Act, Sec. 307(a); Clean Air Act, Sec. 112]

Listed as a SARA Toxic Chemical (40 CFR 372.65)
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
OSHA Designations
Listed as Air Contaminant (29 CFR 1910.1000, Table Z-1-A, Z-3)

Section 8. Special Protection Data

Note: Do not substitute personal protective clothing or equipment for proper handling and engineering controls. Goggles: Wear protective eye-glasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For airborne concentration of asbestos, tremolite, anthophyllite, actinolite, or a combination of these minerals not in excess of 2 f/cc (10 X PEL), use a half-mask air-purifying respirator, other than a disposable respirator, equipped with high-efficiency filters; not in excess of 10 f/cc (50 X PEL), a full facepiece air-purifying respirator equipped with high-efficiency filters; not in excess of 20 f/cc (100 X PEL), any powered air-cleaning (1000 X PEL), a full facepiece supplied-air respirator operated in continuous flow mode; not in excess of 200 f/cc (>1,000 X PEL) or unknown concentration, a full facepiece supplied-air respirator operated in pressure-demand mode and equipped with an auxiliary positive-pressure self-contained breathing apparatus (29 CFR 1910.1001). Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact. Ventilation: Provide general and local exhaust ventilation and dust collection systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into work area by controlling it at its source. Safety Stations: Make available in work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. Contaminated Equipment: Never wear contact lenses in the work area; soft lenses may absorb, and all lenses concentrate, irritants. Never enter lunchroom facilities or leave workplace wearing clothing or equipment worn during workshift. Separate contaminated work clothes from street clothes. If proper hygiene is not rigorously followed, family members can be exposed to asbestos fibers. Place contaminated protective devices or work clothing in labeled, impermeable, and sealed containers or bags. Do not remove asbestos from clothing by blowing or shaking. Launder contaminated clothing before wearing. Inform laundering service of asbestos-contaminated clothing and of asbestos' potential harmful effects (29 CFR 1910.1001). Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using asbestos, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed (dust-tight) containers or heavy-gauge impervious plastic bags in a clean, secure area protected from physical damage. Do not open containers that can release asbestos dust without providing proper enclosure or control measure. Engineering Controls: Educate workers about asbestos and asbestos-containing materials' hazards. Inform employees of asbestos standard (29 CFR 1910.1001). Exposure to asbestos, tremolite, anthophyllite, and actinolite in construction work is covered by 29 CFR 1926.58. ("OSHA is proposing an expanded requirement for a trained 'competent person' to ensure compliance with the standard on all construction operations involving asbestos, and requiring more stringent housekeeping to remove asbestos in general industry." *Industrial Safety and Hygiene News*, 8/90.) Instruct employees in proper practices for handling asbestos-containing materials and correct use of protective equipment. Prevent or minimize asbestos exposure. Regulate areas where exposure in excess of the PEL is likely. Post warning signs in all regulated areas (see legend below). Work with asbestos only in a sufficient wet state to prevent emission of airborne fibers. Practice good personal hygiene and housekeeping procedures. Do not substitute personal protective equipment for proper handling and engineering controls. If exposures exceed the PEL, ensure employees wear appropriate protective clothing. Inhaling or ingesting asbestos fibers from contaminated clothing or skin can be hazardous. Do not allow dusts and asbestos-containing wastes to accumulate. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Monitor work areas that expose employees to airborne concentrations at or above the action level (Sec. 2). Whenever production, process, control equipment, personnel, or work practices change, institute new monitoring. Other Precautions: Medical surveillance is required for all employees possibly exposed at or above the action level. Provide preplacement medical examination that includes complete medical and work history, complete physical examination that emphasizes respiratory and cardiovascular systems and digestive tract, the respiratory disease standardized questionnaire, a posterior-anterior 14" x 17" chest roentgenogram, and pulmonary function tests [FVC and FEV(1)]. Annual periodic medical examinations shall include all these elements and an abbreviated questionnaire. If it is 10+ years since first asbestos exposure, an individual should have a chest roentgenogram every 5 years (ages 15 to 35), every 2 years (ages 35 to 45), every year (age 45+). Within 30 days of employment termination, an individual should receive a periodic medical examination with the elements listed above. Keep medical surveillance records for duration of employment, plus 30 years.

Transportation Data (49 CFR 172.101, 102)

DOT Shipping Name: Asbestos
DOT Hazard Class: ORM-C
ID No.: -
DOT Label: None
DOT Packaging Exceptions: 173.1090
DOT Packaging Requirements: 173.1090
Other Requirements: Stow and handle to avoid airborne particle
IMO Shipping Name: Asbestos, blue; asbestos, white
IMO Hazard Class: 9
ID No.: UN2212, UN2590
IMO Label: None
IMDG Packaging Group: II, III

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

MSDS Collection References: 2-4, 6, 12, 14, 20, 26, 32, 38, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138-140, 142, 143, 146, 148, 152, 153, 156-158
Prepared by: MJ Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH, Medical Review: MJ Uffel, MD, MPH; Edited by: JR Stuart, MS

MATERIAL SAFETY DATA SHEET

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No. 467

AUTOMOTIVE
GASOLINE, LEAD-FREE

Date October 1981

| SECTION I. MATERIAL IDENTIFICATION | | | | |
|--|--------------------|---|---|-------|
| <p>MATERIAL NAME: AUTOMOTIVE GASOLINE, LEAD-FREE DESCRIPTION: A volatile blend of hydrocarbons for automotive fuel OTHER DESIGNATIONS: Petrol, CAS #008 006 619, ASTM D439 MANUFACTURER: Available from several suppliers.</p> | | | | |
| SECTION II. INGREDIENTS AND HAZARDS | | X | HAZARD DATA | |
| <p>Gasoline A hydrocarbon blend that can include normal and branched chain alkanes, cycloalkanes, alkenes, aromatics and other additives.** (Lead max 0.013 g/L, phosphorus max 0.0013 g/L, sulfur max 0.10 wt%. May contain benzene, <5%; see ASTM D3606). *ACGIH 1981 TLV (Intended Changes List). See also Am. Ind. Hyg. A. 39 110-117 (1978) **The composition of fuel is varied with altitude and seasonal requirements for a locality. The blend must meet antiknock requirements. (Antiknock Index min 85, ASTM D439.)</p> | | 100 | <p>8-hr TWA 300 ppm or 900 mg/m³* Man Eye: 500 ppm/1H Moderate irritation Inhalation: TCLo 900 ppm/1H TFX:CNS</p> | |
| SECTION III. PHYSICAL DATA | | | | |
| <p>Distillation at 1 atm, Initial, deg C >39 50% distilled - 77-121 End point ----- <240</p> | | <p>Specific gravity, 60/60 F - 0.72-0.76 Melting point, deg C ----- -90.5-95.4 Evaporation rate ----- N/A</p> | | |
| <p>Vapor density (Air=1) ----- 3.0-4.0 Solubility in water ----- Insoluble</p> | | | | |
| <p>Appearance and Odor: A clear, mobile liquid with a characteristic odor which can be recognized at about 10 ppm in air. (Gasoline may be colored with dye.)</p> | | | | |
| SECTION IV. FIRE AND EXPLOSION DATA | | | LOWER | UPPER |
| Flash Point and Method | Autoignition Temp. | Flammability Limits In Air | | |
| -45 F | 536-853 F | % by volume | 1.4 | 7.6 |
| <p>Extinguishing Media: Dry chemical, carbon dioxide, alcohol foam. Use of water may be ineffective to extinguish fire, but use water spray for cooling fire-exposed drums and tanks to prevent pressure rupture. It is a dangerous fire and explosion hazard when exposed to heat and flames. Vapors can flow along surfaces, reach distant ignition sources and flash back. Can react violently with oxidizing agents. Firefighters should wear self-contained breathing apparatus and full protective clothing.</p> | | | | |
| SECTION V. REACTIVITY DATA | | | | |
| <p>This is a stable material in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization. This is an OSHA Class 1A flammable liquid. A mixture of gasoline vapors and air can be explosive. It is incompatible with oxidizing agents. Thermal-oxidative degradation can yield carbon monoxide and partially oxidized hydrocarbons.</p> | | | | |

SECTION VI. HEALTH HAZARD INFORMATION TLV 300 ppm (See Sect. II)

Inhalation causes intense burning of the mucous membranes, throat and respiratory tract; overexposure to vapors can lead to bronchopneumonia. Inhalation of high conc. can cause facial pulmonary edema. Repeated or prolonged skin exposure causes dermatitis. Can cause blistering of skin due to its defatting properties. Exposure to eyes can cause hyperemia of the conjunctiva.
 Ingestion or excessive vapors can cause inebriation, drowsiness, blurred vision, vertigo, confusion, vomiting and cyanosis (2000 ppm produces mild anesthesia in 30 min, higher conc. are intoxicating in less time.) Aspiration after ingestion causes bronchitis, pneumonia, or edema which can be fatal.

FIRST AID:
Eye Contact: Flush thoroughly with running water for 15 min. including under eyelids.
Skin Contact: Remove contaminated clothing. Wash affected area with soap and water.
Inhalation: Remove to fresh air. Restore breathing and administer oxygen if needed.
Ingestion: Do not induce vomiting. Aspiration hazard. Contact physician.

Seek prompt medical assistance for further treatment, observation and support.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel of leaks or spills. Remove sources of heat or ignition. Provide adequate ventilation. Clean-up personnel require protection against liquid contact and vapor inhalation. If a leak or spill has not ignited, use water spray to disperse vapors and to protect men attempting to stop the leakage. Contain spill. Do not allow to enter sewer or surface water. Add absorbent solid to small spills or residues and pick up for disposal.

DISPOSAL: Burn scrap material in an approved incinerator. Burn contaminated liquid by spraying into an incinerator. Follow Federal, State, and Local regulations.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Use general and local exhaust ventilation (explosion-proof) to keep vapors below the TLV requirements in the workplace. Respirators should be available for nonroutine or emergency use above the TLV.

Avoid eye contact by use of chemical safety goggles and/or full faceshield where splashing is possible. Wear protective clothing appropriate for the work situation to minimize skin contact such as rubber gloves and boots. Clothing to be changed daily and laundered.

Eyewash fountains, showers and washing facilities should be readily accessible. Provide suitable training to those handling and working with this material.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store in closed containers in a cool, dry, well-ventilated area away from sources of heat, ignition and strong oxidizing agents. Protect containers from physical damage. Avoid direct sunlight. Storage must meet requirements of OSHA Class IA liquid.

Outdoor or detached storage preferred. No smoking in areas of use. Prevent static electric sparks and use explosion-proof electrical services. (Must meet code.) Avoid skin and eye contact. Avoid inhalation of vapors. Wear clean work clothing daily.

Indoor use of this material requires exhaust ventilation to remove vapors.
 ICC Flammable Liquid, Red Label. LABEL: Flammable Liquid DOT I.D. No. UN 1203.

DOT Classification: **FLAMMABLE LIQUID**
 DATA SOURCE(S) CODE: 2,4-9,34,37

APPROVALS: MIS
 CRD *J.M. Quinn*
 Industrial Hygiene
 and Safety *JHU*
 MEDICAL REVIEW: 4 November 1981

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Material Safety Data Sheets Collection:

Sheet No. 316
Benzene

Issued: 11/78

Revision: E. 8/90

Section 1. Material Identification

Benzene (C₆H₆) Description: Derived by fractional distillation of coal tar, hydroalkylation of toluene or pyrolysis of gasoline, catalytic reforming of petroleum, and transalkylation of toluene by disproportionation reaction. Used as a fuel; a chemical reagent; a solvent for a large number of materials such as paints, plastics, rubber, inks, oils, and fats; in manufacturing phenol, styrene monomer, nitrobenzene (for aniline), dodecylbenzene (for detergents), cyclohexane (for nylon), chlorobenzene, diphenyl, benzene hexachloride, maleic anhydride, benzene-sulfonic acid, artificial leather, anoleum, oil cloth, varnishes, and lacquers; for printing and lithography; in dry cleaning; in adhesives and coatings; for extraction and rectification; as a degreasing agent; in the tire industry; and in shoe factories. Benzene has been banned as an ingredient in products intended for household use and is no longer used in pesticides.

Other Designations: CAS No. 0071-43-2, benzol, carbon oil, coal naphtha, cyclohexatriene, mineral naphtha, nitraton benzene, pnone, phenyl hydride, pyrobenzol.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*TM for a suppliers list.

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| | | |
|---|----|------|
| R | 1 | NFPA |
| L | 4 | |
| S | 2* | |
| K | 4 | |

*Skin absorption

HMIS
H 3
F 3
R 0
PPG†
† Sec. 8

Cautions: Benzene is a confirmed human carcinogen by the IARC. Chronic low-level exposure may cause cancer (leukemia) and bone marrow damage, with injury to blood-forming tissue. It is also a dangerous fire hazard when exposed to heat or flame.

Section 2. Ingredients and Occupational Exposure Limits

Benzene, ca 100%*

1989 OSHA PELs

(29 CFR 1910.1000, Table Z-1-A)

8-hr TWA: 1 ppm, 3 mg/m³

15-min STEL: 5 ppm, 15 mg/m³

(29 CFR 1910.1000, Table Z-2)

8-hr TWA: 10 ppm

Acceptable Ceiling Concentration: 25 ppm

Acceptable Maximum Peak: 50 ppm (10 min)†

1989-90 ACGIH

TLV-TWA: 10 ppm, 32 mg/m³

1988 NIOSH RELs

TWA: 0.1 ppm, 0.3 mg/m³

Ceiling: 1 ppm, 3 mg/m³

1985-86 Toxicity Data:

Man, oral, LD₅₀: 50 mg/kg; no toxic effect noted

Man, inhalation, TC₅₀: 150 ppm inhaled intermittently over 1 yr in a number of discrete, separate doses affects the blood (other changes) and nutritional and gross metabolism (body temperature increase)

Rabbit, eye: 2 mg administered over 24 hr produces severe irritation

* OSHA 29 CFR 1910.1000, Subpart Z, states that the final benzene standard in 29 CFR 1910.1028 applies to all occupational exposures to benzene except in some subsegments of industry where exposures are consistently under the action level (i.e., distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures); for the excepted subsegments, the benzene limits in Table Z-2 apply.

† Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift.

‡ See NIOSH, RTECS (CY1400000), for additional irritative, mutagenic, reproductive, carcinogenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 176 °F (80 °C)

Melting Point: 42 °F (5.5 °C)

Vapor Pressure: 100 mm Hg at 79 °F (26.1 °C)

Vapor Density (Air = 1): 2.7

Evaporation Rate (Ether = 1): 2.8

Molecular Weight: 78.11

Specific Gravity (15 °C/4 °C): 0.8787

Water Solubility: Slightly (0.180 g/100 g of H₂O at 25 °C)

% Volatile by Volume: 100

Viscosity: 0.6468 mPa at 20 °C

Appearance and Odor: A colorless liquid with a characteristic sweet, aromatic odor. The odor recognition threshold (100% of panel) is approximately 5 ppm (unfatigued) in air. Odor is not an adequate warning of hazard.

Section 4. Fire and Explosion Data

Flash Point: 12 °F (-11.1 °C), CC

Autoignition Temperature: 928 °F (498 °C)

LEL: 1.3% v/v

UEL: 7.1% v/v

Extinguishing Media: Use dry chemical, foam, or carbon dioxide to extinguish benzene fires. Water may be ineffective as an extinguishing agent since it can scatter and spread the fire. Use water spray to cool fire-exposed containers, flush spills away from exposures, disperse benzene vapor, and protect personnel attempting to stop an unignited benzene leak.

Unusual Fire or Explosion Hazards: Benzene is a Class IB flammable liquid. A concentration exceeding 3250 ppm is considered a potential fire explosion hazard. Benzene vapor is heavier than air and can collect in low lying areas or travel to an ignition source and flash back. Explosive and flammable benzene vapor-air mixtures can easily form at room temperature. Eliminate all ignition sources where benzene is used, handled, or stored.

Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Structural firefighter's protective clothing provides limited protection. Stay out of low areas. Be aware of runoff from fire control methods. Do not release to sewers or waterways. Runoff to sewer can create pollution, fire, and explosion hazard.

Section 5. Reactivity Data

Stability/Polymerization: Benzene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Benzene explodes on contact with diborane, permanganic acid, bromine pentafluoride, peroxydisulfuric acid, and peroxymonosulfuric acid. It ignites on contact with dioxygen difluoride, dioxygen tetrafluoroborate, iodine heptafluoride, and sodium peroxide - water. Benzene forms sensitive, explosive mixture with iodine pentafluoride, ozone, liquid oxygen, silver perchlorate, nitryl perchlorate, nitric acid, and arsenic pentafluoride - potassium methoxide (explodes above 30 °C). A vigorous or incandescent reaction occurs with bromine trifluoride, uranium hexafluoride, and hydrogen - Raney nickel [above 410 °F (210 °C)]. Benzene is incompatible with oxidizing materials.

Conditions to Avoid: Avoid heat and ignition sources.

Hazardous Products of Decomposition: Thermal oxidative decomposition of benzene can produce toxic gases and vapors such as carbon monoxide.

Section 6. Health Hazard Data

Carcinogenicity: The ACGIH, OSHA, and IARC list benzene as, respectively, a suspected human carcinogen, a cancer hazard, and, based on sufficient human and animal evidence, a human carcinogen (Group I).

Summary of Risks: Prolonged skin contact or excessive inhalation of benzene vapor may cause headache, weakness, appetite loss, and fatigue. The most important health hazards are cancer (leukemia) and bone marrow damage with injury to blood-forming tissue from chronic low-level exposures. Higher level exposures may irritate the respiratory tract and cause central nervous system (CNS) depression.

Medical Conditions Aggravated by Long-Term Exposure: Exposure may worsen ailments of the heart, lungs, liver, kidneys, blood, and CNS.

Target Organs: Blood, central nervous system, bone marrow, eyes, upper respiratory tract, and skin.

Primary Entry Routes: Inhalation, skin contact.

Acute Effects: Symptoms of acute overexposure include irritation of the eyes, nose, and respiratory tract, breathlessness, euphoria, nausea, dizziness, headache, dizziness, and intoxication. Severe exposure may lead to convulsions and unconsciousness. Skin contact may cause a rash (dermatitis).

Chronic Effects: Long-term chronic exposure may result in many blood disorders ranging from aplastic anemia (an inability to form blood cells) to leukemia.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical center. Consult a physician immediately.

Skin: Quickly remove contaminated clothing. Immediately rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.

Inhalation: Remove exposed person to fresh air. Emergency personnel should protect against inhalation exposure. Provide CPR to support breathing or circulation as necessary. Keep awake and transport to a medical facility.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* since aspiration may be fatal. Call a physician immediately.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Physician's Note: Evaluate chronic exposure with a CBC, peripheral smear, and reticulocyte count for signs of myelotoxicity. Follow up any early indicators of leukemia with a bone marrow biopsy. Urinary phenol conjugates may be used for biological monitoring of recent exposure. Acute management is primarily supportive for CNS depression.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Design and practice a benzene spill control and countermeasure plan (SCCP). Notify safety personnel, evacuate all unnecessary personnel, eliminate all heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against vapor inhalation, eye contact, and skin absorption. Absorb as much benzene as possible with an inert, noncombustible material. For large spills, dig far ahead of spill and contain liquid. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of confined areas such as sewers, watersheds, and waterways because of explosion danger. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33), Hazardous Waste No. U019
 Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1000 lb (454 kg) (* per Clean Water Act, Sec. 307 (a), 311 (b)(4), 112; and per RCRA, Sec. 3001)
 SARA Extremely Hazardous Substance (40 CFR 355): Not listed
 Listed as SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Tables Z-1-A and Z-2)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations at least below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area; soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, dry, well-ventilated area away from all heat and ignition sources and incompatible materials. *Caution! Benzene vapor may form explosive mixtures in air.* To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas. When opening or closing benzene containers, use nonsparking tools. Keep fire extinguishers readily available.

Engineering Controls: Because OSHA specifically regulates benzene (29 CFR 1910.1028), educate workers about its potential hazards and dangers. Minimize all possible exposures to carcinogens. If possible, substitute less toxic solvents for benzene; use this material with extreme caution and only if absolutely essential. Avoid vapor inhalation and skin and eye contact. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Designate regulated areas of benzene use (see legend in the box below) and label benzene containers with "DANGER, CONTAINS BENZENE, CANCER HAZARD."

Other Precautions: Provide preplacement and periodic medical examinations with emphasis on a history of blood disease or previous exposure.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Benzene (benzol)
 DOT Hazard Class: Flammable liquid
 ID No.: UN1114
 DOT Label: Flammable liquid
 DOT Packaging Exceptions: 173.118
 DOT Packaging Requirements: 173.119

IMO Shipping Name: Benzene
 IMO Hazard Class: 3.2
 ID No.: UN1114
 IMO Label: Flammable liquid
 IMDG Packaging Group: II

**DANGER
 BENZENE
 CANCER HAZARD
 FLAMMABLE—NO SMOKING
 AUTHORIZED PERSONNEL ONLY
 RESPIRATOR REQUIRED**

MATERIAL SAFETY DATA SHEET

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No. 15A

CHRYSTOLE ASBESTOS

Date November 1979

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: CHRYSTOLE ASBESTOS
DESCRIPTION: A crystalline serpentine mineral, or layered, hydrated magnesium silicate in fine fiber form (asbestiform). The end of a sliver of this material with a cross-section of 0.1 mm² can show about 20 million tubules (scroll-like fibrils about 0.01 μm diameter) in approximate parallel orientation. It is possible to strip from a fiber bundle very fine chrysotile threads, each an agglomerate of hundreds or thousands of hollow fibrils. (90% of asbestos used is chrysotile.)
OTHER DESIGNATIONS: Asbestos, CAS #001 332 214, GE Material D4E11

SECTION II. INGREDIENTS AND HAZARDS

| | % | HAZARD DATA |
|--|-------|--|
| Idealized Chrysotile (unit cell) - Mg ₃ Si ₂ O ₅ (OH) ₄ * | ca 95 | 8-hr TWA 2 fibers/cc,** Ceiling 10 fibers/cc (>5 μm in length) "Asbestos" Human, inhal. IDLo 1.2 fb/cc for 19 years (Pulmonary effects) |
| *Impurities include low levels of Mn, Fe ⁺² , Fe ⁺³ , and Al in the structure, replacing randomly 4% av. of the Mg atoms. Impurities depend on the mineral source; the unit cell hydroxyl content can also vary with an average of 4.25. | | |
| **Current OSHA TLV. OSHA (1975) proposed TLV of 0.5 fb/cc with a Ceiling of 5 fb/cc (15 min. sample). NIOSH (1976) proposed 0.1 fb/cc. ACGIH (1979 Intended Changes List) has retained TLV of 2 fb/cc for chrysotile asbestos. Asbestos is <u>carcinogenic</u> and/or <u>co-carcinogenic</u> for humans! | | |

SECTION III. PHYSICAL DATA

Melting point ----- Decomposes (see Sect. V)
 Vapor pressure ----- Nil
 Water solubility ----- Insoluble (slowly breaks down in hot water)
 Appearance: White, fibrous solid, as long flexible textile fibers down to dust-like filler power. (Milled chrysotile asbestos (powder-like) has an aspect ratio (ratio of length/diameter) as high as 50 for most particles.)

SECTION IV. FIRE AND EXPLOSION DATA

| | LOWER | UPPER |
|----------------------------|-------|-------|
| Flash Point and Method | | |
| Autoignition Temp. | | |
| Flammability Limits In Air | | |
| N/A | N/A | N/A |

This material is not combustible in air. Use extinguishing media as appropriate for the surrounding materials in a fire situation.

SECTION V. REACTIVITY DATA

This material is inert under ordinary room temperature and heated use conditions. It is resistant to heat, but it will decompose and alter its microscopic fiber structure (see Sect. I) above 600 C (1112 F): Chrysotile dehydroxylates at 600-780 C; the "asbestos anhydride" in turn breaks down to mixture of silica (SiO₂) and forsterite (Mg₂SiO₄) at 800-850 C. Above 1000 C (1832 F) magnesium pyroxenes are formed which melt at about 1450 C.
 Strong acids can attack chrysotile and rapidly extract its MgO and H₂O content; it can be decomposed by glacial acetic acid. Hot water slowly breaks down chrysotile. It, like other forms of asbestos, resists strong alkali (5 M NaOH at least up to 100 C).

SECTION VI. HEALTH HAZARD INFORMATION

TLV 2 fibers/cc
>5 um in length (See Sect. II)

As a particulate material, chrysotile asbestos can be irritating to the respiratory tract, skin or eyes. However, the significant industrial hazards arise from excessive dust inhalation with damage requiring years to become evident. Chronic inhalation of high levels of asbestos particles can produce asbestosis, a disabling fibrosis of the lungs which gradually reduces lung capacity and efficiency. (Usually over 4 years is required for a serious condition to develop.) Excessive inhalation can also cause pleural plaque, a thickening of the lung lining. Compliance with TLV is expected to control these hazards. Cancer can result from excessive inhalation of asbestos particulate, which may require decades to develop. Lung cancer is a special risk to those who smoke cigarettes regularly in addition to having asbestos exposure. Rare mesotheliomas of the pleura and peritoneum (lining around the lungs or abdominal cavity) and possibly cancers of the GI tract and larynx (also smoking related) have been associated with inhalation exposure to asbestos particles. (Crocidolite asbestos has been suggested as the major mesothelioma risk.)

In groups of workers exposed to asbestos, lung cancer death is 3 or 4 times more common than mesothelioma death, and 97.5% of asbestos-related lung cancers occur with those workers who also smoke cigarettes! For non-smokers asbestos exposure increases risk of lung cancer 5X.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel of spills! Exclude all from spill area except trained clean-up personnel who have approved respiratory protection against dust. Provide exhaust ventilation with capture filtration, but do not stir up the dust. Use a wet method or an approved vacuum cleaning system to pick up spills. The techniques used must collect particulate without dispersing dust into the air. Waste must be placed in dust-tight containers or sealed plastic bags for disposal. Label properly!

DISPOSAL: Deposit waste containers in a secured landfill where asbestos will remain buried. Follow Federal, State and local regulations. Also note that chrysotile can be converted into non-asbestos waste by heating at high temperature (see Sect.V).

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide exhaust ventilation and capture filtration to remove airborne asbestos particulate from the workplace (as much as possible) without dispersing it into the environment. Isolate work areas (also post signs) where asbestos particulate may occur at excessive levels.

For nonroutine or emergency conditions where excessive dust is present, approved respirators must be used: Single use or re-usable air-purifying respiratory up to 10X TLV; full-facepiece powered air-purifying respirator up to 100X TLV; full-facepiece air-supplied (continuous flow or pressure-demand type) respirator above 100X TLV.

Depending on exposure levels, it may be necessary to provide body-covering work clothes, special vacuuming facilities for clothes and suitable laundering or disposal arrangements, change areas with dual lockering facilities, showers before changing to street clothing after work, etc. Be sure workers do not carry asbestos dust home on their clothing or person. Prevent asbestos dust from being carried to rest rooms, to eating areas, to non-asbestos workplaces, etc.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Store asbestos in closed containers (dust tight) in a clean, secure area. Protect containers from physical damage. Do not open containers that can release asbestos dust without providing proper enclosure or control measures. Use dust suppression control measures at all stages of asbestos handling, use and disposal. Follow good housekeeping practices to prevent accumulations of asbestos-containing dust. Avoid inhalation of asbestos. The effects on cancer incidence of chronic exposure are not yet fully known. Monitor areas where asbestos dust is present to be sure of worker exposure levels; keep records to define exposures and retain for at least 20 years. Provide replacement and annual medical examinations for those exposed in the workplace to 8-hr TWA of 0.1 asbestos fibers or more/cc which are >5 um in length. Retain medical records for at least 20 years.

DATA SOURCE(S) CODE: 2-4, 6, 12, 14, 20, 26, 32

APPROVALS: MIS. *J. M. J. [Signature]*
Industrial Hygiene
and Safety

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MEDICAL REVIEW: 12/79



Section 1 - Chemical Product and Company Identification

Product/Chemical Name: Copper (II) Oxide

Chemical Formula: CuO

CAS No.: 1317-38-0

Synonyms: black copper oxide, chrome brown, copper brown, copper monoxide, cupric oxide, natural tenorite, paramelaconite

Derivation: Occurs in nature as the minerals *tenorite* (trigonal crystals) and *paramelaconite* (tetrahedral, cubic crystals).

Prepared commercially by ignition of copper carbonate or copper nitrate, by oxidation of copper turnings at 1472 °F (800 °C) in air or oxygen, or by heating copper (II) hydroxide.

General Use: As a fungicide and insecticide, optical glass polishing agent, flux in copper metallurgy, exciter in phosphor mixtures, pigment in glass, ceramics, enamels, porcelain glazes, and artificial gems, a catalyst for organic reactions and a heat collecting surface in solar energy devices; in manufacture of rayon and other copper compounds, sweetening petroleum gases, galvanic electrodes, anti-fouling paints, pyrotechnic compositions, cloud seeding, hydrogen purification, and for correcting copper deficiencies in soil.

Vendors: Consult the latest *Chemical Week Buyers' Guide*. (73)

Section 2 - Composition / Information on Ingredients

Copper (II) Oxide, 100 %wt

OSHA PELs

8-hr TWA: 0.1 mg/m³ (as Cu fume).

1 mg/m³ (as Cu dusts & mists)

ACGIH TLVs

TWA: 0.2 mg/m³ (as Cu fume).

1 mg/m³ (as Cu dusts & mists)

NIOSH REL

10-hr TWA: 0.1 mg/m³ (as Cu fume).

1 mg/m³ (as Cu dusts & mists)

DFG (Germany) MAK

TWA: 0.1 mg/m³ (as Cu fume).

1 mg/m³ (as Cu dusts & mists)

Category II: substances with systemic effects

Half life: < 2 hr

Peak Exposure Limit: 0.2 mg/m³,
30 min. average value, 4/shift

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Copper (II) oxide is highly irritating to the eyes, skin, and respiratory tract. Prolonged inhalation or skin contact can lead to ulceration and necrosis of the respiratory passages and skin, respectively. When heated and inhaled, it can cause a flu-like syndrome called "metal fume fever". It is noncombustible.

Potential Health Effects

Primary Entry Routes: Inhalation, skin and eye contact, ingestion.

Target Organs: Eyes, skin, respiratory tract.

Acute Effects

Inhalation: Inhalation of dusts and mists is very irritating to the eyes and respiratory tract. Ulceration and perforation of the nasal septum (tissue between the nostrils) and sloughing and ulceration of the respiratory tract is possible. Inhalation of copper fume (when copper oxide is heated) can cause leukocytosis, metallic or sweet taste sensation, and flu-like symptoms of "metal fume fever" such as nausea, chills, aching muscles, fever, dry throat, cough, and tiredness. "Metal fume fever" is generally resolved within 24 hr.

Eye: Contact is irritating and can cause conjunctivitis or even ulceration and turbidity of the cornea.

Skin: Hair and skin discoloration is possible from exposure to copper fume. Direct contact with copper (II) oxide can be irritating and cause itching eczema and vesicular lesions. Continued contact can lead to necrosis (tissue death).

Ingestion: If ingested in large amounts, gastrointestinal irritation will occur with salivation, nausea and vomiting, gastric pain, diarrhea, and possible hemorrhagic gastritis. Because of its irritating and astringent nature, copper (II) oxide will usually produce vomiting, but if it doesn't occur or is delayed, then absorption through the stomach and systemic toxicity may occur. Symptoms include widespread capillary damage, kidney and liver injury, and central nervous system excitation followed by depression. Circulatory shock and intravascular hemolysis (destruction of red blood cells) may lead to tubular kidney injury or death due to kidney failure.

Carcinogenicity: IARC, NTP, and OSHA do not list copper (II) oxide as a carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: Skin, liver, or kidney disorders. Persons with Wilson's disease (total intolerance to copper) are very susceptible to exposure to copper (II) oxide.

Chronic Effects: Dermatitis may result from repeated skin exposure. Persons affected by Wilson's disease may develop hemolytic anemia secondary to copper accumulation in the liver.

Wilson
Risk
Scale
R 1
I 3
S 3
K 1

HMIS
H 2
F 0
R 0

PPE*
*Sec. 8

Other: Other metals such as zinc, iron, and molybdenum may affect absorption, distribution, and metabolism. Copper (II) oxide is excreted in the bile.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. If spontaneous vomiting does not occur, gastric lavage is recommended.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Notes to Physicians: Maintain electrolyte and fluid balances. Morphine or Demerol may be necessary for pain control, particularly if gastric hemorrhaging occurs. Chelating agents are recommended for severe poisonings, but few pharmacokinetic data on humans exist to guide their use. Either intravenous disodium monocalcium ethylene diaminetetraacetate or intramuscular BAL can be used.

Section 5 - Fire-Fighting Measures

Flash Point: No flash point is given. Copper (II) oxide is not considered a fire hazard although large quantities exposed to moist air at > 212 °F (100 °C) can result in spontaneous combustion.

Autoignition Temperature: Noncombustible

LEL: None reported

UEL: None reported

Extinguishing Media: Use extinguishing media suitable for surrounding area.

Unusual Fire or Explosion Hazards: None reported

Hazardous Combustion Products: Copper fume

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Genium



Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Cleanup personnel should protect against exposure.

Small Spills: To avoid dust generation, do not sweep. Carefully scoop up or vacuum (with appropriate filter). Damp mop any residue.

Large Spills

Containment: Dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways. Because copper is expensive, investigate recycling rather than disposal.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Minimize copper (II) oxide dust generation.

Storage Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from incompatibles (Sec. 10).

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Enclose processes where possible to prevent dust dispersion into the work area.

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source. (103)

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin, eyes, and respiratory tract.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator selections are for (1) copper dusts and mists and (2) copper fume. *Copper dusts and mists:* For $\leq 5 \text{ mg/m}^3$ use any dust or mist respirator. For $\leq 10 \text{ mg/m}^3$ use a supplied-air respirator (SAR) or SCBA. For $\leq 25 \text{ mg/m}^3$ use a powered air-purifying respirator with a dust mask or any SAR operated in continuous-flow mode. For $\leq 50 \text{ mg/m}^3$ use any air-purifying respirator with a full facepiece and a high efficiency particulate filter, any SAR or SCBA with a full facepiece, or any powered air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter. For $\leq 2000 \text{ mg/m}^3$ use any SAR operated in pressure demand or other positive-pressure mode. For emergency or planned entry into unknown areas or concentrations above 2000 mg/m^3 use any SCBA or SAR (with auxiliary SCBA) with a full facepiece and operated in pressure demand or positive-pressure mode. *Copper*

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101): Not listed

Section 15 - Regulatory Information**EPA Regulations:**

RCRA Hazardous Waste Number (40 CFR 261.33): Not listed

Listed (as copper compounds) as a CERCLA Hazardous Substance (40 CFR 302.4) per CWA, Sec. 307(a)

CERCLA Reportable Quantity (RQ): Not listed for the broad class

Listed (as copper compounds) as a SARA Toxic Chemical (40 CFR 372.65)

SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:

Listed (as copper fume and copper dusts and mists) as an Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)

Section 16 - Other Information

References: 1, 73, 100, 101, 103, 124, 126, 127, 132, 136, 148, 149, 159, 176, 187

Prepared By M Gannon, BA

Industrial Hygiene Review PA Roy, MPH, CIH

Medical Review T Thoburn, MD, MPH

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fume: For $\leq 1 \text{ mg/m}^3$ use any dust, mist, or fume respirator, any SAR, or SCBA. For $\leq 2.5 \text{ mg/m}^3$ use any powered air purifying respirator with a dust, mist, and fume filter or SAR operated in continuous-flow mode. For $\leq 5 \text{ mg/m}^3$ use any air-purifying, full facepiece respirator with a high-efficiency particulate filter, any SAR or SCBA with a full facepiece, or any SAR with a tight-fitting facepiece and operated in continuous-flow mode. For $\leq 200 \text{ mg/m}^3$ use any SAR with a full facepiece and operated in pressure-demand or positive pressure mode. For emergency entry into unknown concentrations use a SCBA or SAR (with auxiliary SCBA) with a full facepiece and operated in pressure-demand or other positive pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.** If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove copper (I) oxide from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using copper (I) oxide, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance and Odor: Odorless, black to brownish-black amorphous or crystalline powder or granules.

Formula Weight: 79.54

Density ($\text{H}_2\text{O}=1$, at 4 °C): 6.315 at 57.2°F (14 °C)

Water Solubility: Insoluble

Other Solubilities: Soluble in dilute acids, alkali cyanides, ammonium carbonate solution and ammonia. Insoluble in alcohol.

Melting Point: 1879 °F (1026 °C), decomposes

Refraction Index: 2.63 (beta)

Section 10 - Stability and Reactivity

Stability: Copper (II) oxide is stable at room temperature in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization does *not* occur.

Chemical Incompatibilities: Include powdered aluminum (explodes), boron, cesium acetylene carbide, hydrazine, magnesium, phospham, potassium, sodium, titanium, zirconium, rubidium acetylene carbide, barium acetate, yttrium oxide, hydrogen sulfide, anilinium perchlorate, hydrogen, phthalic anhydride, hydroxylamine, dichloromethylsilane (ignites on contact), sodium hypobromite solution. It forms explosive acetylides with acetylene in caustic solutions.

Conditions to Avoid: Exposure to incompatibles.

Hazardous Decomposition Products: Thermal oxidative decomposition of copper (II) oxide can produce toxic copper fume.

Section 11 - Toxicological Information

Toxicity Data:^{*}

Acute Effects:

Rat, intratracheal, LD_{50} : 278 mg/kg

^{*} See NIOSH, *RTECS* (GL7900000), for additional toxicity data.

Section 12 - Ecological Information

Environmental Transport: Copper (II) oxide will precipitate out copper in alkaline waters. Acidic waters promote solubility and may affect microorganisms and aquatic life (depending on copper concentration).

Section 13 - Disposal Considerations

Disposal: Because copper and its salts are so expensive, recycling should be investigated prior to landfill disposal. Copper (II) oxide waste can be concentrated through use of ion exchange, reverse osmosis, or evaporators to the point where copper can be removed electrolytically and sent to a reclamation operator. If recovery is not possible, copper can be precipitated via mixing with caustics and then deposited in a chemical waste landfill. **Note:** Copper oxide should not be deposited in landfills with acid leachate (pH < 6). Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Container Cleaning and Disposal: Triple rinse containers and treat wastewater as above.



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Material Safety Data Sheets Collection:

Sheet No. 514
p-Dichlorobenzene

Issued: 10/83

Revision: A, 11/90

Section 1. Material Identification

***p*-Dichlorobenzene (C₆H₄Cl₂)** Description: Derived by chlorinating monochlorobenzene. Used as a general insecticide; a moth repellent; a germicide; a chemical intermediate in the production of polyphenylene sulfide; a plastic used in the electrical and electronics industries; a space deodorant in products such as room deodorizers, urinal and toilet bowl blocks, and diaper pad deodorizers; and in producing 1,2,4 trichlorobenzene.
Other Designations: CAS No. 0106-46-7, 1,4-dichlorobenzene, dichlorocide, Evola,* NCI-c 54955, Paracide,* Paracrysol,* Paradi,* paradichlorobenzol, Paramoth,* *p*-chlorophenyl chloride, PDB,* Santochlor.*
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(TM) for a suppliers list.

| | |
|---|---|
| R | 1 |
| F | 3 |
| S | 1 |
| K | 2 |

NFP
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* See

Cautions: *p*-Dichlorobenzene vapor is an eye and upper respiratory tract irritant. It is toxic to the liver. Prolonged exposure to high concentrations may cause weakness, dizziness, and weight loss. Flammable when exposed to heat, flame, or oxidizers.

Section 2. Ingredients and Occupational Exposure Limits

p-Dichlorobenzene, ca 100%

1989 OSHA PELs

8-hr TWA: 75 ppm, 450 mg/m³

15-min STEL: 110 ppm, 675 mg/m³

1990-91 ACGIH TLVs

TWA: 75 ppm, 451 mg/m³

STEL: 110 ppm, 661 mg/m³

1988 NIOSH REL

None established

1985-86 Toxicity Data*

Human, oral, TD₀₁: 300 mg/kg produced sense organ and special senses (other eye effects); lungs, thorax or respiration (other changes); and gastrointestinal (hypermotility, diarrhea) effects
Human, eye: 80 ppm

1987 IDLH Level

1000 ppm

* See NIOSH, RTECS (CZ4550000), for additional irritative, mutative, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 343 °F (174 °C) at 760 mm Hg

Melting Point: 127.6 °F (53.1 °C)

Vapor Pressure: 10 mm Hg at 130.6 °F (54.8 °C)

Vapor Density (Air = 1): 5.08

Molecular Weight: 147.01

Specific Gravity: 1.248 at 131 °F (55 °C)

Water Solubility: Insoluble

Appearance and Odor: Volatile, white crystals with a distinctive mothball-like odor that becomes very strong at concentrations between 30 and 60 ppm. At concentrations of 80 to 160 ppm, vapors are painful to the eyes and nose. Odors and irritating effects are good warnings against overexposure to *p*-dichlorobenzene; however, individuals may develop tolerance to high concentrations.

Section 4. Fire and Explosion Data

Flash Point: 150 °F (66 °C), CC

Autoignition Temperature: None reported

LEL: 1.7% v/v

UEL: None reported

Extinguishing Media: Use dry chemical, carbon dioxide, alcohol foam, or water spray. Use water spray to cool fire-exposed container, to disperse vapors, or to blanket a pool fire.

Unusual Fire or Explosion Hazards: Explosive and toxic mixtures may form in air when this material is heated, such as in a fire.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective clothing. Thoroughly decontaminate firefighting equipment after use. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: *p*-Dichlorobenzene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: *p*-Dichlorobenzene is incompatible with strong oxidizers and oxidizing agents.

Conditions to Avoid: Avoid incompatibilities and heat or ignition sources.

Hazardous Products of Decomposition: Thermal oxidative decomposition of *p*-dichlorobenzene includes carbon monoxide, chlorides, and chlorine.

Section 6. Health Hazard Data

Carcinogenicity: p-Dichlorobenzene is an NTP anticipated human carcinogen and an IARC possible human carcinogen (Group 2B), with inadequate human evidence and sufficient animal evidence.

Summary of Risks: This material has a relatively low level of acute or chronic toxicity. It may be irritating to eyes, nose, upper airways, and intestinal tract upon inhalation or ingestion. Limited case reports link acute exposure to hemolytic anemia, jaundice, methemoglobinemia, granulomas of the lung, liver atrophy, toxic hepatitis, kidney injury, and allergic pigmentation and purpura (tiny hemorrhages) of the skin. Occupational studies of PDB-exposed workers reveal none of the blood abnormalities noted with similar substances. Vapors may produce painful irritation of the eyes at 50 to 80 ppm and severe discomfort at 160 ppm.

Medical Conditions Aggravated by Long-Term Exposure: Individuals with liver disease should not be exposed to p-dichlorobenzene.

Target Organs: Liver, respiratory system, eyes, kidneys, and skin.

Primary Entry Routes: Inhalation and dermal contact.

Acute Effects: Acute exposures to PDB vapor may be irritating to mucous membranes of the eyes and upper respiratory tract. Ingestion of the solid resulted in toxicity to a 3-year old child, with hemolytic anemia, jaundice, and methemoglobinemia. Nausea, vomiting, and diarrhea are seen in other cases. Prolonged skin exposure may cause skin irritation.

Chronic Effects: Limited case studies show chronic toxicity with exposure to PDB. Chronic ingestion is linked to anemia, leukemia, and kidney damage. In one case, chemical dependence was noted with signs of withdrawal when ingestion stopped. Chronic vapor exposure is suggested in cases of lung granulomatosis, liver abnormalities, kidney damage, anemia, other blood cell abnormalities, and cataract formation.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that conscious person drink 1 to 2 glasses of water, then induce vomiting. Consult a physician.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Urinary excretion of 2,5-dichlorophenol, a metabolite of p-dichlorobenzene, may be useful as an index of exposure.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, and remove or extinguish all heat and ignition sources. Cleanup personnel should protect against vapor inhalation and skin or eye contact. For liquid spills, take up spilled material with noncombustible absorbent material and place into clean metal containers for disposal. For large liquid spills, dike far ahead of spill to contain liquid. For dry spills, shovel spilled material into clean metal containers for disposal. Runoff to sewers or waterways may create health and explosion hazards. (96-hr LC₅₀ fathead minnow: 4.2 to 30 mg/l, moderately toxic.) Pesticide wastes are toxic. Follow applicable EPA and OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33), Hazardous Waste No. U072

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 100 lb (45.4 kg) [* per Clean Water Act, Sec. 311(b)(4), Sec. 307(a), and per RCRA, Sec. 3001]

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. A gas mask with organic vapor canister and dust filter is suitable to 1000 ppm. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Neoprene gloves are recommended.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below OSHA PELs and ACGIH TLVs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area; soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, dry, well-ventilated area away from all heat and ignition sources and oxidizing agents. p-Dichlorobenzene melts at 127 °F (53 °C). Protect containers against physical damage.

Engineering Controls: Avoid dust or vapor inhalation and eye and skin contact (especially when heated). Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures.

Other Precautions: Provide replacement and annual physical examinations that emphasize the liver (liver function tests), upper respiratory tract, and eyes.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Dichlorobenzene, para, solid

DOT Hazard Class: ORM-A

ID No.: UN1592

DOT Label: None

DOT Packaging Exceptions: 173.505

DOT Packaging Requirements: 173.510

IMO Shipping Name: p-Dichlorobenzene

IMO Hazard Class: 6.1

ID No.: UN1592

IMO Label: St. Andrews Cross

IMDG Packaging Group: III

MSDS Collection References: 1-7, 9, 10, 12, 14, 16, 23, 26, 31, 34, 38, 43, 48, 73, 84, 85, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138, 139, 140, 142, 143, 146, 148

Prepared by: MJ Allison, BS, Industrial Hygiene **Review:** DJ Wilson, CIH, Medical Review: W Silverman, MD, Edited by: JR Stuart, MS



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Material Safety Data Sheets Collection

Sheet No. 470
 Diesel Fuel Oil No. 2-D

Issued: 10/81 Revision: A 11/92

Section 1. Material Identification

Diesel Fuel Oil No. 2-D Description: Diesel fuel is obtained from the middle distillate in petroleum separation, a distillate of low sulfur content. It is composed chiefly of unbranched paraffins. Diesel fuel is available in various grades, one of which is synonymous with fuel oil No. 2-D. This diesel fuel oil requires a minimum Cetane No. (efficiency rating for diesel fuel comparable to octane number ratings for gasoline) of 40 (ASTM D613). Used as a fuel for trucks, ships, and other automotive engines; as mosquito control (coating on breeding waters); and for drilling muds.
Other Designations: CAS No. 68334-30-5, diesel fuel.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*TM for a suppliers list.

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Cautions: Diesel fuel oil No. 2-D is a skin irritant and central nervous depressant with high mist concentrations. It is an environmental hazard and moderate fire risk.

Section 2. Ingredients and Occupational Exposure Limits

| Diesel fuel oil No. 2-D* | | | |
|--------------------------|--|------------------|---|
| 1989 OSHA PEL | 1990-91 ACGIH TLV | 1988 NIOSH REL | 1985-86 Toxicity Data [†] |
| None established | Mistral Oil Mist TWA: 5 mg/m ³ STEL: 10 mg/m ³ | None established | Rat. oral LD ₅₀ : 9 g/kg produces gastrointestinal (hypermotility, diarrhea) effects |

* Diesel fuel No. 2-D tends to be low in aromatics and high in paraffins. This fuel oil is complex mixture of: 1) >95% paraffins, olefins, aliphatics, and aromatic hydrocarbons, 2) sulfur (<0.5%), and 3) benzene (<100 ppm). (A low benzene level reduces carcinogenic risk. Fuel oils can be exempted under the benzene standard (29 CFR 1910.1028)). Although low in the fuel itself, benzene concentrations are likely to be much higher in processing areas.

† As sampled by evaporator-collecting method.
 ‡ Monitor NIOSH, RTECS (HZ1800000), for future toxicity data.

Section 3. Physical Data

Boiling Point Range: 340 to 675 °F (171 to 358 °C)
Viscosity: 1.9 to 4.1 centistokes at 104 °F (40 °C)
Appearance and Odor: Brown, slightly viscous liquid.
Specific Gravity: <0.86
Water Solubility: Insoluble

Section 4. Fire and Explosion Data

Flash Point: 125 °F (52 °C) min. **Autoignition Temperature:** >500 °F (932 °C) **LEL:** 0.6% v/v **UEL:** 7.5% v/v

Extinguishing Media: Use dry chemical, carbon dioxide, or foam to fight fire. Use a water spray to cool fire exposed containers. Do not use forced water spray directly on burning oil since this will scatter the fire. Use a smothering technique for extinguishing fire.

Usual Fire or Explosion Hazard: Diesel fuel oil No. 2-D is a OSHA Class II combustible liquid. Its volatility is similar to that of gas oil. Vapor may travel to a source of ignition and flash back.

Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective clothing. If feasible, remove containers from fire. Be aware of runoff from fire control methods. Do not release to sewers or waterways due to pollution and fire explosion hazard.

Section 5. Reactivity Data

Stability/Polymerization: Diesel fuel oil No. 2-D is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: It is incompatible with strong oxidizing agents; heating greatly increases the fire hazard.

Conditions to Avoid: Avoid heat and ignition sources.

Hazardous Products of Decomposition: Thermal oxidative decomposition of diesel fuel oil No. 2-D can produce various hydrocarbons and hydrocarbon derivatives, and other partial oxidation products such as carbon dioxide, carbon monoxide, and sulfur dioxide.

Section 6. Health Hazard Data

Carcinogenicity: Although the IARC has not assigned an overall evaluation to diesel fuels as a group, it has evaluated occupational exposures to petroleum refining as an IARC probable human carcinogen (Group 2A). It has evaluated distillate (light) diesel oils as not classifiable as human carcinogens (Group 3).

Summary of Risks: Although diesel fuels' toxicologic effects should resemble kerosene's, they are somewhat more pronounced due to additives such as sulfonated esters. Excessive inhalation of aerosol or mist can cause respiratory tract irritation, headache, dizziness, nausea, vomiting, and loss of coordination, depending on concentration and exposure time. When removed from exposure area, affected persons usually recover completely. If vomiting occurs after ingestion and if oil is aspirated into the lungs, hemorrhaging and pulmonary edema, progressing to respiratory involvement and chemical pneumonitis, may result. A comparative ratio of oral to aspirated lethal doses may be 1 to vs. 3 ml. Aspiration may also result in transient CNS depression or excitement. Secondary effects may include hypoxia (insufficient oxygen in body cells), infection, pneumatocele formation, and chronic lung dysfunction. Inhalation may result in euphoria, cardiac dysrhythmias, respiratory arrest, and CNS toxicity. Prolonged or repeated skin contact may irritate hair follicles and block sebaceous glands, producing a rash of acne pimples and soots, usually on arms and legs.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Target Organs: Central nervous system, skin, and mucous membranes.

Primary Entry Routes: Inhalation, ingestion.

Acute Effects: Systemic effects from ingestion include gastrointestinal irritation, vomiting, diarrhea, and in severe cases central nervous system depression, progressing to coma or death. Inhalation of aerosols or mists may result in increased rate of respiration, tachycardia (excessively rapid heart beat), and cyanosis (dark purplish discoloration of the skin and mucous membranes caused by deficient blood oxygenation).

Chronic Effects: Repeated contact with the skin causes dermatitis.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. If large areas of the body have been exposed or if irritation persists, get medical help immediately. Wash affected area with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* due to aspiration hazard.

Contact: a physician immediately. Position to avoid aspiration.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Gastric lavage is contraindicated due to aspiration hazard. Preferred antidotes are charcoal and milk. In cases of severe aspiration pneumonitis, consider monitoring arterial blood gases to ensure adequate ventilation. Observe the patient for 6 hr. If vital signs become abnormal or symptoms develop, obtain a chest x-ray.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate area for large spills, remove all heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and liquid contact. Clean up spills promptly to reduce fire or vapor hazards. Use a noncombustible absorbent material to pick up small spills or residues. For large spills, duke far ahead to contain. Pick up liquid for reclamation or disposal. Do not release to sewers or waterways due to health and fire and/or explosion hazard. Follow applicable OSHA regulations (29 CFR 1910.120). Diesel fuel oil No. 2-D spills may be environmental hazards. Report large spills.

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.21): Ignitable waste

CERCLA Hazardous Substance (40 CFR 302.4): Not listed

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, use a NIOSH-approved respirator with a mist filter and organic vapor cartridge. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.**

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations that promote worker safety and productivity. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area; soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Use and storage conditions should be suitable for a OSHA Class II combustible liquid. Store in closed containers in a well-ventilated area away from heat and ignition sources and strong oxidizing agents. Protect containers from physical damage. To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations. Use nonsparking tools and explosion-proof electrical equipment. No smoking in storage or use areas.

Engineering Controls: Avoid vapor or mist inhalation and prolonged skin contact. Wear protective rubber gloves and chemical safety glasses where contact with liquid or high mist concentration may occur. Additional suitable protective clothing may be required depending on working conditions. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures. Do not wear oil contaminated clothing. At least weekly laundering of work clothes is recommended. Do not put oily rags in pockets. When working with this material, wear gloves or use barrier cream.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Fuel oil

DOT Hazard Class: Combustible liquid

ID No.: NA1993

DOT Label: None

DOT Packaging Exceptions: 173.118a

DOT Packaging Requirements: None



Section 1. Material Identification

Epoxy Resins (molecular formula varies for each compound) Description: The epoxies are a large chemical group made up of compounds containing one or more epoxide rings (rings consisting of one oxygen atom and two adjacent carbon atoms). Derived by many processes including the oxidation of olefins with peroxy acids, oxygen, and hydrogen peroxide and cyclo-dehydrohalogenation (chlorohydrin process). Epoxies fall into many subfamilies: bisphenol-A epoxies (90% of epoxies are produced by reacting epichlorohydrin with bisphenol-A), aliphatic epoxies, epoxy novolac resins, and multifunctional epoxies. Used in many applications and products including surface coatings for home appliances and gas storage vessels, adhesives, casting metal-forming tools and dies; encapsulation of electrical parts, filament-wound pipe and pressure vessels, neutron-shielding materials, cements and low temperature mortars, nonskid road surfacing, rigid foams, oil wells (to solidify sand), and stained glass windows matrix.

Other Designations: There are numerous synonyms depending on the specific compound, the following are examples: CAS No. 57608-87-8, epoxy resin ERR-0100; CAS No. 25068-38-6, epoxy resin ERL-2795; CAS No. 25928-94-3, epoxy resin (epichlorohydrin + diethylene glycol).

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*⁽⁷³⁾ for a suppliers list.

Cautions: Epoxy resins, *uncured* generally pose little inhalation hazard due to low vapor pressures but they can cause eye and respiratory irritation if misted or as dust (solid epoxies). Epoxies have negligible systemic toxicity but do cause skin sensitization (dermatitis) in a large percent of exposed workers (11.4%). Epoxy resins, *cured* are considered inert and pose no health hazard unless traces of *uncured* resin remain.



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Section 2. Ingredients and Occupational Exposure Limits

Epoxy Resins, ca 100%

1992 OSHA PELs*†‡

Transitional Limits:

8-hr TWA, 5 ppm (19 mg/m³)

Final Rule Limits:

8-hr TWA: 2 ppm (8 mg/m³)†, skin

1992-93 ACGIH TLVs

TWA: 2 ppm (7.6 mg/m³)[§], skin

TWA: 10 mg/m³‡

1998 NIOSH REL*

Limit of Quantitation: 2.5 ppm

Ca., exposure to be minimized

1992 Toxicity Data ¶

Rabbit, skin, LD₅₀: 2000 mg/kg; toxic effects not yet reviewed

Rat, oral, LD₅₀: 1100 mg/kg; toxic effects not yet reviewed⁽¹⁾

Rat, inhalation, LC₅₀: 16 mg/m³/4 hr⁽²⁾

Rabbit, skin: 4500 mg/given intermittently for 3 days caused mild irritation.⁽³⁾

* These limits are for epichlorohydrin, used in 90% of epoxy resins

† Notice of intended change to 0.1 ppm (0.38 mg/m³)

‡ 8-hr TWA: 15 mg/m³ total dust, 5 mg/m³ respirable fraction.

§ These limits are for nuisance dusts and are a guideline to be used for cured epoxies when they undergo cutting and grinding and generate dusts.

¶ See NIOSH, RTECS (KD4380000, CAS # 25068-38-6)⁽¹⁾, (KD4200000, CAS # 25928-94-3)⁽²⁾, (KD4385000, CAS # 57608-87-8)⁽³⁾ for additional toxicity data.

Section 3. Physical Data

Boiling Point: Varies according to compound

Vapor Pressure: low

Molecular Weight: Varies according to compound

Density: Varies

Water Solubility: Varies from insoluble to miscible; glycidyl ethers range from <1% to 18%, glycidol is completely soluble.

Appearance and Odor: The lower molecular weight (MW) resins are liquids becoming more viscous and finally solids as MW increases.

Section 4. Fire and Explosion Data

Flash Point: generally, >200 °F (93.3 °C) | Autoignition Temperature: None reported | LEL: None reported | UEL: None reported

Extinguishing Media: Fight fire with carbon dioxide, dry chemical, water spray, fog, or regular foam.

Unusual Fire or Explosion Hazards: None reported.

Special Fire-fighting Procedures: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Do not release runoff from fire control methods to sewers or waterways; dike for proper disposal.

Section 5. Reactivity Data

Stability/Polymerization: Epoxy resins are stable at room temperature in closed containers and under normal storage and handling conditions. It will polymerize exothermically when in contact with curing agents such as organic amines, acid anhydrides, and polyamides. The rapidity of reaction varies from fast (~ one minute) to slow (> one hour); faster reactions generate more heat.

Chemical Incompatibilities: Oxidizing agents, strong acids, mercaptans, bases, and bulk contact with curing agents.

Conditions to Avoid: Exposure to heat, ignition sources, and incompatibles.

Hazardous Products of Decomposition: Thermal oxidative decomposition of epoxy resins can produce carbon oxides (CO₂) and various hydrocarbons, depending on pyrolysis temperature and original resin composition.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,⁽¹⁸⁾ NTP,⁽¹⁹⁾ and OSHA⁽¹⁸⁾ do not list epoxy resins as carcinogenic as a group although individual compounds are. There are 38 epoxy compounds shown to cause malignant tumors in animals (generally skin tumors at site of application). One of these, epichlorohydrin is listed by the IARC, Class 2A (probably carcinogenic, limited human and sufficient animal evidence), NIOSH, Class X (carcinogen definite without further explanation), NTP Class 2 (reasonably anticipated to be carcinogenic, limited human and sufficient animal evidence), ACGIH TLV A2 (suspected human carcinogen based on limited epidemiologic evidence or demonstration), and MAK A2 (unmistakably carcinogenic in animal experimentation). Check the composition of the resin you are working with to ascertain its carcinogenic potential.

Summary of Risks: Epoxy resins do not pose a health hazard in the cured state unless traces of uncured resin are present on the surface. Uncured resins generally have a low vapor pressure and pose little inhalation hazard unless heated or misted. However the reactive diluents (added to reduce viscosity), curing agents, fillers, and pigments present in epoxy systems may.

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Material Safety Data Sheets Collection

Fuel Oil No. 4

MSDS No. 886

Date of Preparation: 10/93

Section 1 - Chemical Product and Company Identification

42

Product/Chemical Name: Fuel Oil No. 4
Chemical Formula: Not given
CAS No.: 68476-31-3
Synonyms: heating oil
Derivation: A petroleum fraction consisting of heavier straight-run or cracked distillates.
General Use: Used in commercial or industrial burner installations not equipped with preheating facilities.
Vendors: Consult the latest *Chemical Week Buyers' Guide*. (73)

Section 2 - Composition / Information on Ingredients

Fuel Oil No. 4, ca 100 % vol
Trace Impurities: All petroleum fractions contain appreciable amounts of aromatics (toluene, xylene) and saturated rings (cycloparaffins, naphthenes).

OSHA PEL
None established

NIOSH REL
None established

DFG (Germany) MAK
None established

ACGIH TLV
None established

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Fuel oil no. 4 is a moderately dark, viscous liquid. It is flammable when exposed to heat or flame. Prolonged or repeated skin contact may cause dermatitis. It is a DOT flammable liquid.

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion.
Target Organs: Skin, CNS (severe exposure).

Acute Effects

Inhalation: Excessive inhalation of aerosol or mist can cause respiratory tract irritation, headache, dizziness, nausea, increased rate of respiration, tachycardia (excessively rapid heart beat), stupor, convulsions, cyanosis (dark purplish coloration of the skin and mucous membranes caused by deficient blood oxygenation), or unconsciousness, depending on concentration and length of exposure.

Eye: None reported.

Skin: Prolonged or repeated skin contact may cause irritation of the hair follicles and may block the sebaceous glands, producing a rash of acne pimples and spots, usually on arms and legs.

Ingestion: Ingestion may cause nausea, vomiting, diarrhea, and abdominal pain; occasionally, mild CNS depression or excitement occur after ingestion.

Carcinogenicity: IARC lists fuel oils, residual heavy as a possible carcinogen (2B; limited animal data). OSHA and NTP do not list fuel oil no. 4 as a carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: Dermatitis.

Chronic Effects: Repeated skin contact may cause defatting and dermatitis.

Comments: Fuel oil no. 4 may be a synergist to pesticides.

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Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of tepid water for at least 15 min. If pain and irritation persist, consult an ophthalmologist.

Skin Contact: Remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, do not induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Comments: Following ingestion of hydrocarbons, the primary concern is aspiration into the lungs. Hydrocarbons with the lowest viscosity and surface tension have the greatest risk for aspiration. Fuel oil no. 4 is a viscous liquid and therefore, has a lesser risk for aspiration. Risk for vapor inhalation of fuel oil no. 4 is less than other hydrocarbons such as gasoline or kerosene because fuel oil no. 4 is less volatile. In general, fuel oil no. 4 is more viscous and less toxic than kerosene.

Section 5 - Fire-Fighting Measures

Flash Point: 142-240 °F (61-116 °C); reported by NFPA:
129 °F (54 °C)



Autoignition Temperature: 505 °F (263 °C)

LEL: None reported.

UEL: None reported.

Flammability Classification: Depending on the flash point, fuel oil no. 4 is classified as an OSHA Class II, Class IIIA or IIIB Combustible Liquid.*

Extinguishing Media: For small fires, use dry chemical, CO₂, water spray, or regular foam. For large fires, use water spray, fog, or regular foam.

Unusual Fire or Explosion Hazards: Containers may explode in the heat of fire.

Hazardous Combustion Products: Acrid smoke and irritating fumes.

Fire-Fighting Instructions: If feasible and without undue risk, move containers from fire hazard area. Otherwise, apply cooling water to containers until well after fire is extinguished. Withdraw immediately in case of any tank discoloration or rising sound from venting safety device due to fire. For massive fires, use monitor nozzles or unmanned hose holders. Do not release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing will provide limited protection.

* You will notice that there is a difference in classifications of a flammable and combustible liquid between OSHA and the DOT. The DOT classifies fuel oil (no. 1, 2, 4, 5, 6) as flammable liquids (See Sec. 14).

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel of large spills, remove all heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against vapor inhalation and skin or eye contact. Clean up spills promptly to reduce fire hazards. Use nonsparking tools.

Small Spills: Use an inert, noncombustible, absorbent material to pick up small spills or residues.

Large Spills

Containment: For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways.

Cleanup: Consider using straw, polyurethane foam, activated carbon, or peat to soak up oil. There is a wide variety of sorbents, dispersants, sinking agents, combustion promoters, and mechanical systems to treat oil spills.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor or mist inhalation or prolonged skin contact.

Storage Requirements: Store in closed containers in a well-ventilated area away from heat and ignition sources. No smoking in storage or use areas.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations.

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source. (103)

Administrative Controls: Practice good personal hygiene and housekeeping procedures. Do not wear oil contaminated clothing.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Barrier creams may be helpful. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
 Appearance and Odor: Moderately dark, viscous.
 Medium Odor Threshold: 0.5 ppm

Water Solubility: Insoluble
 Melting Point: -51 °F (-46 °C)

Section 10 - Stability and Reactivity

Stability: Fuel oil no. 4 is stable at room temperature in closed containers under normal storage and handling conditions.
 Polymerization: Hazardous polymerization cannot occur.
 Chemical Incompatibilities: Oxidizing materials.
 Conditions to Avoid: Heat and ignition sources.
 Hazardous Decomposition Products: Thermal oxidative decomposition of fuel oil no. 4 can produce various hydrocarbons and hydrocarbon derivatives and partial oxidation products including carbon oxides.

Section 11 - Toxicological Information

Toxicity Data: None reported*

* Monitor NIOSH, RTECS (LS8965000), for future toxicity data.

Section 12 - Ecological Information**Aquatic Toxicity:**

Striped bass, LC₅₀, 96 hr: 25.1 ppm (static test environment)
 Carp, LC₅₀, 24 hr: 50 ppm (static test environment)
 Striped bass, LC₅₀, 96 hr: 0.62 ppm (static test environment with 1.5 mg/L LAS)
 Carp, LC₅₀, 24 hr: 5.1 ppm (static with 1.5 mg/L LAS)

Section 13 - Disposal Considerations

Disposal: Consider incineration (permit-approved facilities only). Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information**DOT Transportation Data (49 CFR 172.101):**

Shipping Name: Fuel oil (No. 1, 2, 4, 5, or 6)
 Shipping Symbols: D
 Hazard Class: 3
 ID No.: NA1993
 Packing Group: III
 Label: Flammable Liquid*
 Special Provisions (172.102): B1

Packaging Authorizations
 a) Exceptions: 173.150
 b) Non-bulk Packaging: 173.203
 c) Bulk Packaging: 173.241

Quantity Limitations
 a) Passenger, Aircraft, or
 Railcar: 60 L
 b) Cargo Aircraft Only: 220 L

Vessel Stowage Requirements
 a) Vessel Stowage: A
 b) Other: —

* DOT defines a flammable liquid as a liquid having a flash point at or above 100 °F (37.8 °C) and not more than 141 °F (60.5 °C). OSHA defines a flammable liquid as any liquid having a flash point below 100 °F.

Section 15 - Regulatory Information**EPA Regulations:**

RCRA Hazardous Waste (40 CFR 261.33): Not listed
 Classified as a RCRA Hazardous Waste (40 CFR 261.21): Characteristic of Ignitability (if flash point <140 °F (60 °C))
 CERCLA Hazardous Substance (40 CFR 302.4): Listed if classified as a RCRA Hazardous Waste, Characteristic of Ignitability
 CERCLA Reportable Quantity (RQ), 100 lb (45.4 kg)
 SARA Toxic Chemical (40 CFR 372.65): Not listed
 SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed
 OSHA Regulations:
 Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A): Not listed

Section 16 - Other Information

References: 73, 101, 103, 126, 132, 136, 164

Prepared by MJ Wirth, BS
Industrial Hygiene Review DJ Wilson, CIH
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Revision Notes:

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Section 6. Health Hazard Data, continued

Respiratory tract and eye irritation can occur from inhalation of mists, and vapors. Uncured epoxy resins cause skin irritation and sensitization (allergic dermatitis) in a significant percent of the population. One study showed 11.4 % of exposed workers to suffer from epoxy-related dermatitis. The latency period from exposure to onset of symptoms varies widely with an average of 10 months. One man developed skin eruptions after one day on the job, another worked with epoxy resins for 10 years before showing symptoms. In general, symptoms disappear shortly after removal from exposure. Some individuals may build up an immunity and become symptom free during exposure.

Medical Conditions Aggravated by Long-Term Exposure: Dermatitis and possibly asthma.

Target Organs: Skin, eyes, and respiratory tract.

Primary Entry Routes: Skin contact.

Acute Effects: Dermatitis is characterized by redness, blistering, and scaly, fissured skin. In severe cases; edema (swelling), deep-seated pain, lesions, and secondary infections (from penetration of the resin and microorganisms through breaks in the skin) may also occur. Dermatitis generally affects the back of the hands, between the fingers, forearms, neck, and face (particularly the upper eyelids and around the mouth). There is little evidence of systemic symptoms but a Japanese study showed that after an outbreak of dermatitis, workers had significantly elevated white blood cell counts, fatigue, runny nose, heartburn, and susceptibility to colds. Animals show blood changes and liver and kidney damage.

Chronic Effects: Some epoxy compounds may cause malignant tumors in animals but are not proven to be carcinogenic in humans.

FIRST AID **Eyes:** Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: Quickly remove contaminated clothing. Do not use solvents to remove resin because they will facilitate penetration of the resin through the skin. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless otherwise advised, have that conscious and alert person drink 1 to 2 glasses of water to dilute. If large amounts are ingested, induce vomiting.

Note to Physicians: Treatment is symptomatic and supportive.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources. Clean up personnel should protect against inhalation and skin/eye contact. Take up small liquid spills with earth, sand, vermiculite or other absorbent, noncombustible material and place in suitable containers. Scoop solid epoxy resins with non-sparking tools into suitable containers. Dike far ahead of large liquid spill for later disposal or reclamation. Prevent entry into sewers, drains, and waterways. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations*

Listed as a RCRA Hazardous Waste (40 CFR 261.33): U041

Listed as a SARA Toxic Chemical (40 CFR 372.65)

Listed as a CERCLA Hazardous Substance† (40 CFR 302.4): Final Reportable Quantity (RQ), 100 lb (45.4 kg) [† per RCRA, Sec. 3001]

Listed as a SARA Extremely Hazardous Substance (40 CFR 355), TPO: 1000 lb

OSHA Designations*

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

*Epoxy resins are not regulated by the EPA or OSHA as a group. Some specific compounds may, including epichlorohydrin (in 90% of resins) which is listed here.

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen.

For emergency or nonroutine operations (clearing spills, reactor vessels, or storage tanks), wear an SCBA. **Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.** If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, and aprons made of nitrile or nitrile-butadiene rubber to prevent skin contact. Do not use cotton or leather (absorbs and concentrates resin) or polyvinyl chloride, rubber, or polyethylene which absorb epoxy resins over time.

Barrier creams which do not contain emulsified fats or oils such as Kerodex or Dermotect are useful in preventing skin contact (symptoms may still occur in workers already sensitized). **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰³⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drunch showers, and washing facilities.

Contaminated Equipment: Separate contaminated work clothes from street clothes and launder before reuse. Remove this material from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage/Handling Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from heat, ignition sources, and incompatibles (Sec. 5). **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers which emphasize the skin. Patch tests (specific for type of epoxy resins being used--commercial kits are unreliable) may indicate individuals susceptible to sensitization. The very nature that makes epoxy resins desirable (durability, strength and adhesion) also makes them difficult to control even with the most stringent hygiene plan. They stick on everything and can be carried throughout buildings. Do not share tools between departments.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Combustible liquid, n.o.s.

DOT Hazard Class: Combustible liquid

ID No.: NA1993

DOT Packing Group: III

DOT Label: None

Special Provisions (172.102): T1

Packaging Authorizations

a) Exceptions: 173.150

b) Non-bulk Packaging: 173.203

c) Bulk Packaging: 173.241

Quantity Limitations

a) Passenger Aircraft or Railcar: 60 L

b) Cargo Aircraft Only: 220 L

Vessel Storage Requirements

a) Vessel Storage: A

b) Other: -

MSDS Collection References: 1, 73, 100, 101, 103, 126, 127, 132, 133, 139, 148, 164, 182, 183

Prepared by: M Gannon, BA; **Industrial Hygiene Review:** PA Roy, MPH, CIH; **Medical Review:** J Brax, Ph. D. MD

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Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 1000 ppm, use any powered, air-purifying respirator with organic vapor cartridges or any chemical cartridge respirator with a full facepiece and organic vapor cartridges. For < 10,000 ppm, use any supplied-air respirator (SAR) operated in continuous-flow mode. For < 12,000 ppm, use any air-purifying, full facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister or any SCBA or SAR with a full facepiece. For emergency or entrance into unknown concentrations, use any SCBA or SAR (with auxiliary SCBA) with a full facepiece and operated in pressure-demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning!** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove isopropyl alcohol from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using isopropyl alcohol, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance and Odor: Colorless with a slight odor and bitter taste.

Odor Threshold: 22 ppm*

Vapor Pressure: 44 mm Hg at 25 °F (77 °C)

Saturated Vapor Density (Air = 1.2 kg/m³, 0.075 lb/ft³):
1.274 kg/m³ or 0.080 lb/ft³

Formula Weight: 60.09

Density (H₂O=1, at 4 °C): 0.78505 at 68 °F (20 °C)

Water Solubility: > 10 %

Ionization Potential: 10.10 eV

Other Solubilities: Soluble in alcohol, ether, chloroform, and benzene. Insoluble in salt solutions.

Boiling Point: 180.5 °F (82.5 °C)

Freezing Point: -129.1 °F (-89.5 °C)

Viscosity: 2.1 cP at 77 °F (25 °C)

Refraction Index: 1.375 at 68 °F (20 °C)

Surface Tension: 20.8 dyne/cm at 77 °F (25 °C)

Critical Temperature: 455 °F (235 °C)

Critical Pressure: 47 atm

Octanol/Water Partition Coefficient: log Kow = 0.05

* References range from 1 to as high as 610 ppm.

Section 10 - Stability and Reactivity

Stability: Isopropyl alcohol is stable at room temperature in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization does not occur.

Chemical Incompatibilities: Include acetaldehyde, chlorine, ethylene oxide, acids and isocyanates, hydrogen + palladium, nitroform, oleum, phosgene, potassium t-butoxide, oxygen (forms unstable peroxides), trinitromethane, barium perchlorate, tetrafluoroborate, chromium trioxide, sodium dichromate + sulfuric acid, aluminum, aluminum triisopropoxide, and oxidizers. Will attack some forms of plastic, rubber, and coatings.

Conditions to Avoid: Exposure to heat, ignition sources, and incompatibles.

Hazardous Decomposition Products: Thermal oxidative decomposition of isopropyl alcohol can produce carbon oxides and acid smoke.

Section 11 - Toxicological Information

Toxicity Data:

Eye Effects:

Rabbit, eye: 100 mg caused severe irritation.

Skin Effects:

Rabbit, skin: 500 mg caused mild irritation.

Reproductive:

Rat, inhalation: 3500 ppm/7 hr given from 1 to 19 days of pregnancy caused fetotoxicity.

Acute Oral Effects:

Human, oral, TD_{Lo}: 223 mg/kg caused hallucinations, distorted perceptions, lowered blood pressure, and a change in pulse rate.
Human, oral, LD_{Lo}: 3570 mg/kg caused coma, respiratory depression, nausea, and vomiting.
Rat, oral, LD₅₀: 5045 mg/kg caused a change in righting reflex, and somnolence (general depressed activity).

* See NIOSH, RTECS (NT8050000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: Guppies (*Poecilia reticulata*) LC₅₀ = 7,060 ppm/7 days; fathead minnow (*Pimephales promelas*) LC₅₀ = 11,830 mg/L/1 hr. BOD = 133 %/5 days.

Environmental Degradation: On soil, IPA will volatilize or leach into groundwater. Biodegradation is possible but rates are not found in available literature. It will volatilize (est. half-life = 5.4 days) or biodegrade in water. It is not expected to bioconcentrate in fish. In the air, it reacts with photochemically produced hydroxyl radicals with a half-life of one to several days. Because it is soluble, removal by rain, snow or other precipitation is possible.

Section 13 - Disposal Considerations

Disposal: Microbial degradation is possible by oxidizing isopropyl alcohol to acetone by members of the genus *Desulfovibrio*. Spray waste into incinerator (permit-approved facilities only) equipped with an afterburner and scrubber. Isopropyl alcohol can be settled out of water spills by salting with sodium chloride. Note: Salt may harm aquatic life, so weigh the benefits against possible harm before application. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Container Cleaning and Disposal: Triple rinse containers.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Isopropanol or isopropyl alcohol

Shipping Symbols: -

Hazard Class: 3

ID No.: UN1219

Packing Group: II

Label: Flammable Liquid

Special Provisions (172.102): T1

Packaging Authorizations

a) Exceptions: 173.150

b) Non-bulk Packaging: 173.202

c) Bulk Packaging: 173.242

Quantity Limitations

a) Passenger, Aircraft, or Railcar: 5 L

b) Cargo Aircraft Only: 60 L

Vessel Stowage Requirements

a) Vessel Stowage: B

b) Other: -

Section 15 - Regulatory Information

EPA Regulations:

Listed as a RCRA Hazardous Waste Number (40 CFR 261.21)

RCRA Hazardous Waste Classification (40 CFR 261.21): Characteristic of Ignitability

Listed (Unlisted Hazardous Waste, Characteristic of Ignitability) as a CERCLA Hazardous Substance (40 CFR 302.4) per RCRA, Sec. 3001

CERCLA Reportable Quantity (RQ), 100 lb (45.4 kg)

SARA 311/312 Codes: 1, 2, 3

Listed as a SARA Toxic Chemical (40 CFR 372.65); *only persons who manufacture by the strong acid process are subject: no supplier notification.*

SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)

Section 16 - Other Information

References: 73, 103, 124, 126, 127, 132, 136, 139, 148, 153, 159, 164, 167, 168, 176, 187

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Material Safety Data Sheets Collection:

Sheet No. 298
Jet Fuels

Issued: 8/90

Section 1. Material Identification

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Jet Fuel Description: A petroleum distillate similar to kerosene composed of C₁₀ to C₂₈ aliphatics, monocycloparaffins, aromatics, and olefins (for turbine engines only). Aromatics are a lower percentage for jet fuels, but there are a number of jet fuel types with somewhat different compositions and properties.
Other Designations: Jet A, Jet A-1, Jet B, Jet fuel HEP-3, JP-1, JP-4, JP-5, JP-6.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*^(TM) for a suppliers list.
Cautions: Jet fuel is volatile, combustible, and thus, a dangerous fire hazard. It is a skin, eye, and respiratory tract irritant. Ingestion can be harmful, even fatal.

| | | |
|------------------------|----------|----------|
| R 1 | (8) NFPA | (6) |
| I - | 2 | 3 |
| S 2 | 0 | 0 |
| K 2-4* | 0 | 0 |
| * Varying flash points | | |
| HMIS | HMIS | |
| H 1 | H 1 | |
| F 2 | F 3 | |
| R 0 | R 0 | |
| PPG† | PPG† | |
| | | † Sec. 8 |

- (a) Jet A and Jet A-1 (combustible) and JP-5 (flammable to combustible).
- (b) Jet B (dangerous fire hazard) and JP-4 (dangerous fire hazard and moderate explosion hazard in the form of vapor).

Section 2. Ingredients and Occupational Exposure Limits

Jet fuel, ca 100%

1989 OSHA PEL
None established

1989-90 ACGIH TLV
None established

1988 NIOSH REL
None established

1985-86 Toxicity Data*
Rat. oral, LD₅₀: 40 mg/kg
Rat. inhalation, LC₅₀: 23 ppm/4 hr
Rat. skin, LD₅₀: 317 mg/kg

* These toxicity data pertain to jet fuel HEP-3. See NIOSH, *RTCS* (MHS-425100), for additional toxicity data.

Section 3. Physical Data*

Boiling Point: 300 to 550 °F (149 to 288 °C)
Vapor Pressure: 0.1 mm Hg at 20 °C
Viscosity: 1.0 to 2.0 cSt at 72 °F (40 °C)

Relative Density (15 °C/4 °C): 0.79 to 0.84
Water Solubility: Negligible

Appearance and Odor: A clear liquid with a hydrocarbon odor.

* Physical data vary with fuel type. These data pertain to kerosene jet fuels in general.

Section 4. Fire and Explosion Data

Flash Point: 100 °F (37.8 °C), OC*

Autoignition Temperature: 446 °F (230.2 °C)*

LEL: 0.6% v/v

UEL: 3.7% v/v

Jet A and Jet A-1: 110 to 150 °F (43.4 to 65.6 °C)
Jet B: -16 to -30 °F (-26.7 to -34.5 °C)
JP-1: 95 to 145 °F (35.0 to 62.8 °C)
JP-4†: -10 to 30 °F (-23.4 to -1.1 °C)
JP-5: 95 to 145 °F (35.0 to 62.8 °C)

JP-1: 442 °F (228 °C)
JP-4: 468 °F (242 °C)
JP-5: 475 °F (246 °C)

JP-4: 1.3% v/v

JP-4: 8.0% v/v

Extinguishing Media: For large fire, use water spray, fog, or foam. For small fire, use dry chemical or CO₂. Water may be ineffective in fighting fires involving materials with low flash points. Apply in the form of a spray.

Unusual Fire or Explosion Hazards: Jet fuel is volatile and combustible.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

* A higher becomes out than JP-4 with lower impurities.
† 65% gasoline and 35% light petroleum distillate.

Section 5. Reactivity Data

Stability/Polymerization: Jet fuels are stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: A violent reaction occurs with fluorine (F₂). Jet fuels are also incompatible with halogens, strong acids, alkalines, and oxidizers.

Conditions to Avoid: Avoid heat, sparks, flames, and build up of static electricity.

Hazardous Products of Decomposition: Thermal oxidative decomposition of jet fuel can produce carbon monoxide from incomplete combustion.

Section 6. Health Hazard Data

Carcinogenicity: The NTP, IARC, and OSHA do not list jet fuels as a carcinogen.

Summary of Risks: Jet fuel is a moderate skin, eye, and respiratory irritant. Ingestion may be harmful or fatal. The most serious toxic effect following ingestion is aspiration pneumonia.

Medical Conditions Aggravated by Long-Term Exposure: Individuals with chronic pulmonary disease should not be exposed to jet fuel vapor.

Target Organs: Central nervous system, respiratory tract.

Primary Entry Routes: Inhalation, ingestion.

Acute Effects: Systemic exposure through the respiratory or gastrointestinal (GI) tract may result in increasing levels of central nervous system depression, manifest by a staggering gait, slurred speech, or mental confusion. These symptoms could progress to unconsciousness, coma, and death from respiratory failure. Exposure of lung tissues through aspiration of liquid jet fuel causes an immediate irritant and destructive reaction. The inflammatory lung changes cause a chemical pneumonitis, pulmonary edema (fluid in the lungs), and/or bleeding in the lung tissue. Secondary infection as a result of the injury, and scarring may occur with resultant permanent lung damage. The immediate clinical effects are increasing shortness of breath, coughing, bloody sputum, and chest pain. These symptoms may worsen over the following hours to days. Ingestion causes irritation to the GI tract characterized by vomiting, abdominal pain, and diarrhea. Other organs possibly injured through systemic exposure include parenchyma of the liver, kidney, pancreas, and spleen. Exposure to high mist concentrations may irritate the mucous membrane.

Chronic Effects: Chronic lung dysfunction may result from aspiration into the lungs. Prolonged or repeated skin contact can cause dermatitis.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, do not induce vomiting. If the victim is unassisted, position head lower than knees to prevent aspiration. Administer vegetable oil and call a physician immediately.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Design and practice a jet fuel spill control and countermeasure program (SCCP). Notify safety personnel, isolate hazard area and deny entry, remove all heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and direct contact with skin or eyes. Immediately absorb spilled jet fuel with noncombustible, inert material such as fire-retardant treated sawdust or diatomaceous earth. Using nonsparking tools, immediately shovel spilled material in appropriate containers for disposal. After completing material pickup, ventilate area and wash spill site. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed

CERCLA Hazardous Substance (40 CFR 302.4): Not listed

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear nonsparking shoes (rubber, cord, or sewn leather soles).

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations that promote worker safety and productivity. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area; soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, dry, well-ventilated area away from all heat and ignition sources and incompatible materials (Sec. 5). Outside or detached storage is preferred.

Engineering Controls: Avoid vapor inhalation and skin or eye contact. Use with appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Jet fuel's greatest hazard is its fire potential. Train all employees to use fire-extinguishing equipment. Perform fire drill exercises periodically. Take all measures to prevent static electricity: electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas. Maintain and test grounding and bonding connections. Do not use drag chains or cables on fueling vehicles. After filling jet fuel storage tanks, wait 30 min before opening hatches to permit the relaxation of any static charges generated during filling or heating. Empty containers or drums retaining residue (liquid and/or vapor) can be dangerous. Do not expose to heat or ignition sources. All drums should be completely drained, properly bunged, and promptly disposed of per local regulations. Practice good personal hygiene and housekeeping procedures. Take care in handling hoses, cans, and funnels wet with jet fuel. Before touching with bare hands, carefully wipe jet fuel containers. Properly dispose of wet rags per EPA hazardous waste requirements. Avoid contamination of jet fuel with water, rust, scale, dirt, and other petroleum products. Use commercial kits (Hydrokit, Aqua-Glo, or "Clear and Bright") to detect water and dirt, respectively.

Transportation Data (49 CFR 172.101, .102): Not listed

MSDS Cross-Reference: 1, 73, 84, 103, 126, 132, 133, 136

Prepared by: MJ Allison, BS, Industrial Hygiene Review: DJ Wilson, CIH, Material Review: W Silverman, MD; Edited by: JR Stuetz, MS



Section 1. Material Identification

Lead (Inorganic) (Pb) Description: Exists widely throughout the world in a number of ores. Its main commercial source is galena (lead sulphide). Lead mineral is separated from crude ores by blast-furnace smelting, dressing, or electrolytic refining. Lead is used mostly in manufacturing storage batteries. Other uses are in manufacturing tetraethyllead and both organic and inorganic lead compounds in ceramics, plastics, and electronic devices; in producing ammunition, solder, cable covering, sheet lead, and other metal products (brass, pipes, caulking); in metallurgy; in weights and as ballast; as a chemical intermediate for lead alkyls and pigments; as a construction material for the tank linings, piping, and equipment used to handle the corrosive gases and liquids used in sulfuric acid manufacturing, petroleum refining, halogenation, sulfonation, extraction, and condensation; and for x-ray and atomic radiation protection.

Other Designations: CAS No. 7439-92-1, lead oxide; lead salts, inorganic; metallic lead; plumbum.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*^(TM) for a suppliers list.

Cautions: *Inorganic lead is a potent systemic poison.* Organic lead (for example, tetraethyl lead) has severe, but different, health effects. Occupational lead poisoning is due to inhalation of dust and fumes. Major affected organ systems are the nervous, blood, and reproductive systems, and kidneys. Health impairment or disease may result from a severe acute short- or long-term exposure.

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Genium

| | |
|---|---|
| R | 0 |
| I | 4 |
| S | - |
| K | 0 |

HMIS
H 3
F 1
R 0
PPG*

* See 8

Section 2. Ingredients and Occupational Exposure Limits

Lead (inorganic) fumes and dusts, as Pb, ca 100%

1989 OSHA PELs (Lead, inorganic compounds)
8-hr TWA: 50 µg/m³
Action Level TWA*: 30 µg/m³

1989-90 ACGIH TLV (Lead, inorganic, fumes and dusts)
TLV-TWA: 150 µg/m³

1985-86 Toxicity Data†
Human, inhalation, TC₅₀: 10 µg/m³ affects gastrointestinal tract and liver
Human, oral, TD₅₀: 450 mg/kg ingested over 6 yr affects peripheral and central nervous systems
Rat, oral, TD₅₀: 790 mg/kg affects multigeneration reproduction

29 CFR 1910.1025 Lead Standard
Blood Lead Level: 40 µg/100 g

1988 NIOSH REL
10-hr TWA: <100 µg/m³

* Action level applies to employee exposure without regard to respirator use.
† See NIOSH, *ATSDS (OP7525000)*, for additional mutagenic, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 3164 °F (1740 °C)
Melting Point: 621.3 °F (327.4 °C)
Vapor Pressure: 1.77 mm Hg at 1832 °F (1000 °C)
Viscosity: 3.2 cp at 621.3 °F (327.4 °C)

Molecular Weight: 207.20
Specific Gravity (20 °C/4 °C): 11.34
Water Solubility: Relatively insoluble in hot or cold water*

Appearance and Odor: Bluish-white, silvery, gray, very soft metal.

* Lead dissolves more easily at a low pH.

Section 4. Fire and Explosion Data

Flash Point: None reported **Autoignition Temperature:** None reported **LEL:** None reported **UEL:** None reported

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, or foam to extinguish fire.
Unusual Fire or Explosion Hazards: Flammable and moderately explosive in the form of dust when exposed to heat or flame.
Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Lead is stable at room temperature in closed containers under normal storage and handling conditions. It tarnishes on exposure to air. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Mixtures of hydrogen peroxide + trioxane explode on contact with lead. Lead is incompatible with sodium azide, zirconium, diiodine acetylides, and oxidants. A violent reaction on ignition may occur with concentrated hydrogen peroxide, chlorine trifluoride, sodium acetylides (with powdered lead), ammonium nitrate (below 200 °C with powdered lead). Lead is attacked by pure water and weak organic acids in the presence of oxygen. Lead is resistant to tap water, hydrofluoric acid, brine, and solvents.
Conditions to Avoid: Rubber gloves containing lead may ignite in nitric acid.
Hazardous Products of Decomposition: Thermal oxidative decomposition of lead can produce highly toxic fumes of lead.

Section 6. Health Hazard Data

Carcinogenicity: Although the NTP and OSHA do not list lead as a carcinogen, the IARC lists it as probably carcinogenic to humans, but having (usually) no human evidence. However, the literature reports instances of lead-induced neoplasms, both benign and malignant, of the kidney and other organs in laboratory rodents. Excessive exposure to lead has resulted in neurologic disorders in infants. Experimental studies show lead has reproductive and teratogenic effects in laboratory animals. Human male and female reproductive effects are also documented.
Summary of Risks: Lead is a potent, systemic poison that affects a variety of organ systems, including the nervous system, kidneys, reproductive system, blood formation, and gastrointestinal (GI) system. The most important way lead enters the body is through inhalation, but it can also be ingested when lead dust or unwashed hands contaminate food, drink, or cigarettes. Much of ingested lead passes through feces without absorption into the body. Adults may absorb only 5 to 15% of ingested lead; children may absorb a much larger fraction. Once in the body, lead enters the bloodstream and circulates to various organs. Lead concentrates and remains in bone for many years. The amount of lead the body stores increases as exposure continues, with possibly cumulative effects. Depending on the dose entering the body, lead can be deadly within several days or affect health after many years. Very high doses can cause brain damage (encephalopathy).
Medical Conditions Aggravated by Exposure: Lead may aggravate nervous system disorders (e.g., epilepsy, neuropathies), kidney diseases, high blood pressure (hypertension), infertility, and anemia. Lead-induced anemia and its effect on blood pressure can aggravate cardiovascular disease.

Continues on next page

Section 6. Health Hazard Data, continued

Target Organs: Blood, central and peripheral nervous systems, kidneys, and gastrointestinal (GI) tract.

Primary Entry Routes: Inhalation, ingestion.

Acute Effects: An acute, short-term dose of lead could cause acute encephalopathy with seizures, coma, and death. However, short-term exposures of this magnitude are rare. Reversible kidney damage can occur from acute exposure, as well as anemia.

Chronic Effects: Symptoms of chronic long-term overexposure include appetite loss, nausea, metallic taste in the mouth, lead line on gingival (gum) tissue, constipation, anxiety, anemia, pallor of the face and the eye grounds, excessive tiredness, weakness, insomnia, headache, nervous irritability, fine tremors, numbness, muscle and joint pain, and colic accompanied by severe abdominal pain. Paralysis of wrist and, less often, ankle extensor muscles may occur after years of increased lead absorption. Kidney disease may also result from chronic overexposure, but few, if any, symptoms appear until severe kidney damage has occurred. Reproductive damage is characterized by decreased sex drive, impotence, and sterility in men; and decreased fertility, abnormal menstrual cycles, and miscarriages in women. Unborn children may suffer neurologic damage or developmental problems due to excessive lead exposure in pregnant women. Lead poisoning's severest result is encephalopathy manifested by severe headache, convulsions, coma, delirium, and possibly death.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Consult a physician if any health complaints develop.

Inhalation: Remove exposed person to fresh air and support breathing as needed. Consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If large amounts of lead were ingested, induce vomiting with Ipecac syrup. Consult a physician immediately.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Physician's Note: For diagnosis, obtain blood pressure, blood lead level (PbB), zinc protoporphyrin (ZPP), complete blood count for microcytic anemia and basophilic stippling, urinalysis, and blood urea nitrogen (BUN) of creatinine. Examine peripheral motor neuropathy, pallor, and gingival lead line. Use Ca-EDTA to treat poison, but never chelate prophylactically. Consult an occupational physician or toxicologist.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel and evacuate all unnecessary personnel immediately. Cleanup personnel should protect against inhalation of dust or fume and contact with skin or eyes. Avoid creating dusty conditions. Water sprays may be used in large quantities to prevent the formation of dust. Cleanup methods such as vacuuming (with an appropriate filter) or wet mopping minimizes dust dispersion. Scoop the spilled material into closed containers for disposal or reclamation. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33, Appendix II—EP Toxicity Test Procedures)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) (* per Clean Water Act, Sec. 307(a))

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning!** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Other: Wear impervious gloves, boots, aprons, and gaskets to prevent skin contact. Protective clothing made of man-made fibers and lacking turn-ups, pleats, or pockets retain less dust from lead.

Ventilation: Provide general and local ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰⁰⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area; soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially washing hands before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, dry, well-ventilated area away from all incompatible materials, direct sunlight, and heat and ignition sources.

Engineering Controls: Inform workers about lead's hazards. Follow and inform employees of the lead standard (29 CFR 1910.1025). Avoid inhalation of lead dust and fumes and ingestion of lead. Use only with appropriate personal protective gear and adequate ventilation. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Avoid creating dusty conditions. Segregate and launder contaminated clothing. Take precautions to protect laundry personnel. Practice good personal hygiene and housekeeping procedures. For a variety of reasons, the lead concentration in workroom air may not correlate with the blood lead levels in individuals.

Other Precautions: Provide supplementation and periodic medical examinations which emphasize blood, nervous system, gastrointestinal tract, and kidneys, including a complete blood count and urinalysis. Receive a complete history including previous surgeries and hospitalizations, allergies, smoking history, alcohol consumption, proprietary drug intake, and occupational and nonoccupational lead exposure. Maintain records for medical surveillance, airborne exposure monitoring, employee complaints, and physician's written opinions for at least 40 years or duration of employment plus 20 years. Measurement of blood lead level (PbB) and zinc protoporphyrin (ZPP) are useful indicators of your body's lead absorption level. Maintain worker PbBs at or below 40 µg/100 g of whole blood. To minimize adverse reproductive health effects to parents and developing fetus, maintain the PbBs of workers intending to have children below 30 µg/100 g. Elevated PbBs increase your risk of disease, and the longer you have elevated PbBs, the greater your chance of substantial permanent damage.

Transportation Data (49 CFR 172.102)

IMO Shipping Name: Lead compounds, soluble, n.o.s.

IMO Hazard Class: 6.1

ID No.: UN2291

IMO Label: St. Andrew's Cross (X. Slow away from foodstuffs)

IMDG Packaging Group: III

MSDS Collection Reference: 26, 38, 73, 84, 85, 88, 89, 90, 100, 101, 103, 109, 124, 126, 132, 133, 134, 136, 138, 139, 142, 143

Prepared by: MJ Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: MJ Uptal, MD, MPH; Edited by: JR Smart, MS



SECTION 1. MATERIAL IDENTIFICATION 19

MATERIAL NAME: LEAD MONOXIDE

OTHER DESIGNATIONS: Lead (II) Oxide, Plumbous Oxide, Litharge, Massicot, PbO, CAS # 1317-36-8

MANUFACTURER/SUPPLIERS: Available from several suppliers, including:
 NL Barond, Inc., PO Box 1675, Houston, TX 77251; Telephone: (713) 527-1100
 Eagle-Picher Industries, Inc., Chemicals Division, 580 Walnut Street, Cincinnati, OH 45202;
 Telephone: (513) 721-7010

| | | |
|--|---------------|------------------|
| | HMSI | Not Found |
| | H: 2 | |
| | F: 0 | R 0 |
| | R: 0 | I 4 |
| | PPE: * | S 0 |
| | * See Sect. 8 | K 0 |



SECTION 2. INGREDIENTS AND HAZARDS **HAZARD DATA**

| INGREDIENTS | % | HAZARD DATA |
|--|-----|--|
| LEAD MONOXIDE, PbO | >99 | ACGIH TLV*: 8-hr TWA: 0.15 mg/m ³ <hr/> OSHA PEL**: 8-hr TWA: 0.05 mg/m ³ <hr/> Rat, Intraperitoneal, LDLo: 430 mg/kg <hr/> Dog, Oral, LDLo: 1400 mg/kg |
| * Current (1985-86) ACGIH TLV, as Pb ** Current OSHA PEL (as Pb) with an action level of 0.03 mg/m ³ (29 CFR 1910.1025) | | |

SECTION 3. PHYSICAL DATA

Melting Point - 1646.6°F(897°C) (Begins to Sublime before Melting)
 Boiling Point - 2681.6°F(1472°C) (Decomposes)
 Molecular Weight - 223.2

| | | |
|------------------------------|-----------------|-----------------|
| | <u>Litharge</u> | <u>Massicot</u> |
| Density | 9.53 g/cc | 9.4 g/cc |
| Solubility in Water (@ 25°C) | 0.0504 g/L | 0.1065 g/L |

Appearance and color: Lead monoxide exists in two crystalline forms: litharge and massicot. The reddish litharge transforms to yellow massicot at 912.7°F(489°C). Lead monoxide is odorless.

SECTION 4. FIRE AND EXPLOSION DATA **LOWER** | **UPPER**

| Flash Point and Method | Autoignition Temp. | Flammability Limits in Air | LOWER | UPPER |
|------------------------|--------------------|----------------------------|-------|-------|
| NA | NA | NA | | |

This material is nonflammable. Use whatever extinguishing agents are appropriate for the surrounding fire.

When hot, lead monoxide can act as an oxidizing agent and may intensify combustion.

Toxic dust and fumes may be generated in a fire situation. Fire fighters should wear self-contained breathing apparatus and full protective gear.

SECTION 5. REACTIVITY DATA

Lead monoxide is stable at room temperature. It does not polymerize. When heated and cooled in air it can undergo transitions between crystalline and oxide forms.

Mixtures of lead oxide and chlorinated rubber may react violently when heated. A lead oxide-glycol mixture (used as cements/jointing compound) can ignite when exposed to fluorine gas and may explode after exposure to perchloric acid fumes. Violent reactions can occur when lead monoxide is heated with aluminum, sodium, zirconium, titanium, boron, or silicon. Other incompatibles include hydrogen sulfide, metal acrylates, and peroxyformic acid.

Toxic lead fumes can form at high temperatures.

SECTION 6. HEALTH HAZARD INFORMATION | TLV

Lead compounds are toxic when inhaled or ingested. Lead is a cumulative poison. The chief effects of excessive lead intake are anemia, neurological disorders, and kidney damage. Symptoms of the neurological effects may include irritability, headaches, insomnia, delirium, convulsions, muscular tremors, and palsy of the extremities. Excessive lead exposure may also have adverse effects on human reproduction. Symptoms of acute lead poisoning by ingestion include headache; abdominal pain; nausea; vomiting; diarrhea; and, in severe cases, coma and death. The IARC concludes that the evidence for carcinogenicity of lead and lead compounds to humans is inadequate. The NTP does not list lead monoxide in its third annual report on carcinogens.

FIRST AID: Any worker who experiences symptoms of lead poisoning should be removed from exposure and receive prompt medical care. **EYE CONTACT:** Flush eyes (including under the eyelids) with running water for at least 15 minutes. Obtain medical attention. **SKIN CONTACT:** Flush affected area with plenty of water. If irritation persists, seek medical attention. **INHALATION:** Remove victim from exposure. Get medical attention for treatment of symptoms. **INGESTION:** If person is conscious, give him/her plenty of milk or water to drink. Induce vomiting. Keep victim warm and at rest. Get medical assistance immediately.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety/environmental personnel of large spills. Ventilate spill area. Cleanup personnel should wear respiratory protection, gloves, and protective clothing. Carefully vacuum up spilled material. Place collected material in a suitable container that can be tightly sealed for reclaim or disposal. Avoid dusting conditions at all stages of handling.

DISPOSAL: Salvage material when possible. PbO requires disposal as a hazardous waste. Contact supplier or a licensed chemical waste disposal contractor for treatment, packaging, and disposal requirements. Follow Federal, state, and local regulations.

EPA Hazardous Waste No.: D008 (EP TOXIC; 40 CFR 261.24)

SECTION 8. SPECIAL PROTECTION INFORMATION

Provide local exhaust ventilation and/or other engineering controls to meet the PEL requirement. NIOSH-approved respirators should be worn where engineering controls and work practices do not reduce exposures to or below the PEL. Half-mask air-purifying respirators with high-efficiency filters are acceptable for concentrations up to 0.5 mg/m³ (2.5 mg/m³ with full facepiece). Protective clothing and equipment such as coveralls, gloves, hats, and shoes should be worn when exposures exceed the PEL or where the possibility of skin and eye contact exist. Provide clean body-covering work clothing weekly to workers exposed to above the PEL (daily if exposed above 0.2 mg/m³) and arrange for special handling and laundering of contaminated clothing. Changing rooms (with separate storage facilities for street and work clothing) and showers are required for employees exposed to above the PEL. Prevent dust from being transported to lunchroom by way of the ventilation system or contaminated clothing. Consult the OSHA lead standard (29 CFR 1910.1025) for detailed requirements.

Contact lenses pose a special hazard; soft lenses may absorb and all lenses concentrate irritants.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store in tightly closed containers away from incompatibles. Protect containers from physical damage. Keep away from food or feed. Use good housekeeping procedures (vacuuming and/or wet cleanup) to prevent accumulation of dust. DO NOT use compressed air for cleaning surfaces or clothing (use vacuum). Follow good personal hygiene practice. Wash face and hands thoroughly after handling and before eating, drinking, or smoking. Do not eat, drink, or use tobacco in areas where this material is used.

Exposure monitoring, biological monitoring, and medical surveillance should be provided in accordance with the OSHA Lead Standard (29 CFR 1910.1025). Prevent dust generation. Use with adequate ventilation. Avoid inhalation and contact. Do not ingest!

DOT Classification: Not listed in Hazardous Materials Table, 49 CFR 172.101.

Data Source(s) Code: 2, 4, 5, 12, 14, 25, 55, 57, 58, 61, 62, 82, 84, CV

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Approvals *JC Acciogio*

Indust. Hygiene/Safety *JW 6/86*

Medical Review *[Signature]*

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Material Safety Data Sheet

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GENIUM PUBLISHING CORP.

No. 373

METHYL CHLORIDE

(Revision A)

Issued: May 1981

Revised: November 1987

SECTION 1. MATERIAL IDENTIFICATION

Material Name: METHYL CHLORIDE

Description (Origin/Uses): Used as a refrigerant.

Other Designations: Chloromethane; CH₃Cl; NIOSH *RTECS* No. PA6300000; CAS No. 0074-87-3

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers Guide* (Genium ref. 73) for a list of suppliers.



HMS
 H 2
 F 4 R 1
 R 1 I 3
 PPG* S 1
 *See sect. 8 K 4

SECTION 2. INGREDIENTS AND HAZARDS

| Ingredients | % | EXPOSURE LIMITS |
|--|--------|---|
| Methyl Chloride, CAS No. 0074-87-3 H ₃ CCl | ca 100 | ACGIH TLVs (Skin*), 1987-88 TLV-TWA: 50 ppm, 105 mg/m ³ TLV-STEL: 100 ppm, 205 mg/m ³ OSHA PELs (Skin*) 8-Hr TWA: 100 ppm Ceiling: 200 ppm (30 Min) MAC**: 300 ppm for 5 Min in any 3-Hr period NIOSH REL: Ca*** Toxicity Data**** Rat, Inhalation, LC ₅₀ : 15,200 mg/m ³ (30 Min) Mouse, Inhalation, LC ₅₀ : 3146 ppm (7 Hrs) |

*This material can be absorbed through intact skin, which contributes to overall exposure.
 **Maximum allowable concentration
 ***NIOSH views methyl chloride as an occupational carcinogen and suggests that all exposures to it be reduced to the lowest feasible level.
 ****See NIOSH, *RTECS*, for additional data with references to reproductive and mutagenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: -10.7°F (-23.7°C) **Melting Point:** -143°F (-97°C)

Vapor Density (Air = 1): 1.8 **Molecular Weight:** 50.49 Grams/Mole

Water Solubility: 100 (complete) **% Volatile by Volume:** 100%

Appearance and Odor: A colorless, odorless gas that compresses under pressure to a cryogenic liquid with poor warning properties (see sect. 6).

SECTION 4. FIRE AND EXPLOSION DATA

| | | | LOWER | UPPER |
|------------------------|--------------------------|----------------------------|-------|-------|
| Flash Point and Method | Autoignition Temperature | Flammability Limits in Air | 8.1 | 17.2 |
| | | % by Volume | | |

Extinguishing Media: *Methyl chloride is an extremely explosive and flammable gas. If it is burning, try to stop the flow of gas; use a water spray to protect men effecting the shutoff and to cool fire-exposed containers.

Unusual Fire or Explosion Hazards: Methyl chloride is denser than air and will collect in enclosed or low-lying areas like sumps, so eliminate ignition sources there.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Methyl chloride is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

Chemical Incompatibilities: This material is incompatible with strong oxidizing agents; amines; amides; and metals like Zn, Al, Mg, Na, and K.

Conditions to Avoid: Do not allow ignition sources like open flame, unprotected heaters, lighted tobacco products, electric sparks, and excessive heat in work areas because of the extreme flammability of this material.

Hazardous Products of Decomposition: Extremely toxic gases like phosgene and HCl are produced during fire conditions.

SECTION 6. HEALTH HAZARD INFORMATION

Methyl chloride is listed as an occupational carcinogen by NIOSH.

Summary of Risks: "Inhalation of high concentrations of methyl chloride causes serious central nervous system (CNS) damage, lingering illness, and sometimes death. Because methyl chloride has so little odor and (often) a slowly progressive or a mild narcotic action, a person may be exposed to considerable concentrations without being aware of the danger. The onset of symptoms of poisoning such as dizziness, headache, optical difficulties, nausea, and vomiting may be delayed for many hours" (Genium ref. 84, pp. 49-62). "Severe exposures require hospitalization, monitoring, and treatment for acidosis. ... Recovery may be prolonged and permanent neurologic impairment has been reported" (Genium ref. 100, p. 354).

Medical Conditions Aggravated by Long-Term Exposure: CNS disorders. **Target Organs:** CNS, liver, kidneys, eyes, and skin. **Primary Entry:** Inhalation, skin absorption/contact. **Acute Effects:** Neurologic effects like mental confusion, dizziness, staggering gait, slurred speech, and drowsiness. **Chronic Effects:** Anorexia, nervousness, insomnia, incoordination, diminished vision, and emotional instability.

FIRST AID

Eye Contact: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. **Skin Contact:** Immediately wash the affected area with soap and water because of the increased hazard from absorption. Carefully monitor the exposed skin area for frostbite damage (cryogenic injuries) and treat it accordingly. **Inhalation:** Remove victim to fresh air; restore and/or support his breathing as needed. **Ingestion:** This type of exposure to methyl chloride is extremely unlikely because it appears as a pressurized cryogenic (extremely low-temperature) liquid.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and eliminate all ignition sources immediately. Cleanup personnel need protection against contact and inhalation of vapor (see sect. 8). Try to shut off the flow of methyl chloride gas.

Waste Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000 Subpart Z)

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, No. U045

CERCLA Hazardous Substance, Reportable Quantity: 1 lb (0.454 kg)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Follow the eye- and face-protection guidelines of 29 CFR 1910.133. **Respirator:** Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* (Genium ref. 88) for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow the respirator guidelines in 29 CFR 1910.134. For emergency or nonroutine use (e.g., cleaning reactor vessels or storage tanks) use an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Other Equipment:** Wear neoprene or polyvinyl alcohol-impregnated gloves, boots, aprons, and clean, impervious, body-covering clothing to prevent any possibility of skin contact. **Ventilation:** Install and operate general and local maximum explosion-proof ventilation systems of sufficient power to control airborne levels of methyl chloride below the OSHA PELs cited in section 2. **Safety Stations:** Make eyewash stations, washing facilities, and safety showers available in areas of use and handling. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do not wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from shoes and equipment.

Comments: Practice good personal hygiene; always wash thoroughly after using this material. Avoid transferring it from hands to mouth while eating, drinking, or smoking. Do not smoke, eat, or drink in any work area. Avoid inhalation of vapor!

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage Segregation: Store methyl chloride in a cool, dry, well-ventilated area away from oxidizing agents, ignition sources, and chemical incompatibilities (see sect. 5). Outside or detached storage is advised for this highly flammable gas. **Special Handling/Storage:** Methyl chloride is shipped or stored as a pressurized liquid in cylinders or tank cars. Protect these containers against physical damage and regularly inspect them for leaks, cracks, or faulty valves. All containers used in shipping/transferral operations must be electrically grounded to prevent static sparks. **Engineering Controls:** Preplan handling and emergency response procedures prior to use. All engineering systems (ventilation, production, etc.) must be of maximum explosion-proof design. Methyl chloride must be used in closed engineering systems because of its flammability/explosivity hazards (see sect. 4). This prevents dispersion of this highly flammable gas into work areas. **Warning:** Methyl chloride gas has extremely poor warning properties. An automatic air-monitoring system is needed if this gas is used in large amounts because even highly toxic concentrations of this material will be colorless and odorless.

Comments: All operations with methyl chloride must be done carefully to prevent accidental ignition of this highly flammable liquid. Do not smoke in any use or storage area! Follow recommended standard operating procedures for using liquefied cryogenic gases.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Methyl Chloride

DOT Hazard Class: Flammable Gas

IMO Class: 2.3

References: 1, 2, 12, 73, 84-94, 100, 103, P11

DOT ID No. UN1063

IMO Label: Poison Gas and Flammable Gas

DOT Label: Flammable Gas

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Medical Review *[Signature]*



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Material Safety Data Sheets Collection:

Sheet No. 303
Methyl Ethyl Ketone

Issued: 9/79 Revision: D, 5/93

Section 1. Material Identification

41

Methyl Ethyl Ketone (CH₃CH₂COCH₃) Description: Derived by dehydrogenation or selective oxidation of *sec*-butyl alcohol; from mixed *n*-butylenes and sulfuric acid, followed by distillation to separate *sec*-butyl alcohol and then dehydrogenation; or by controlled oxidation of butane. Used as a solvent for printing inks and cellulose compounds (nitrocellulose in particular), constituent of dewaxing compositions; in the manufacture of acrylic and vinyl surface coatings, paint removers, cements and adhesives, artificial leather, cosmetics, lubricating oils, pharmaceuticals, smokeless powder and explosives, and cleaning fluids.

| | | | |
|-------------------|----|--|----------|
| R | 1 | | NFPA |
| I | 2 | | |
| S | 2* | | |
| K | 4 | | |
| * Skin absorption | | | HMS |
| | | | H 2 |
| | | | F 3 |
| | | | R 0 |
| | | | PPE† |
| | | | † Sec. 8 |

Other Designations: CAS No. 78-93-3, 2-butanone, ethyl methyl ketone, methylacetone, 2-oxobutane.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*⁽⁷⁾ for a suppliers list.

Cautions: Methyl ethyl ketone is a flammable liquid. Vapors are irritating to the eyes and respiratory tract. It potentiates the neurotoxic potential of other chemicals and some findings suggest it may be neurotoxic itself.

Section 2. Ingredients and Occupational Exposure Limits

Methyl ethyl ketone, ca 100%

1992 OSHA PELs

Transitional Limit

8-hr TWA: 200 ppm (590 mg/m³)

Final Rule Limits

8-hr TWA: 200 ppm (590 mg/m³)

15-min STEL: 300 ppm (885 mg/m³)

1992 NIOSH RELs

TWA: 200 ppm (590 mg/m³)

STEL: 300 ppm (885 mg/m³)

1993-94 ACGIH TLVs

TWA: 200 ppm (590 mg/m³)

STEL: 300 ppm (885 mg/m³)

1991 DFG (Germany) MAK

TWA: 200 ppm (590 mg/m³)

Half-Life: < 2 hr

Category II: Substances with systemic effects

Peak Exposure Limit: 400 ppm, 30 min.

average value, 4/shift

1992 Toxicity Data*

Rabbit, skin: 300 mg/24 hr caused severe irritation.

Rat, oral, LD₅₀: 2737 mg/kg

Rat, inhalation, TC_{LD}: 3000 ppm/7 hr from 6 to 15 days of pregnancy caused craniofacial abnormalities (including nose and tongue) as well as developmental abnormalities of the urogenital system and homeostasis.

Human, inhalation, TC_{LD}: 100 ppm/5 min caused eye irritation and respiratory changes.

1990 IDLH Level

3000 ppm

* See NIOSH, RTECS (EL6475000), for additional irritation, mutation, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 176 °F (80 °C)

Melting Point: -122.6 °F (-85.9 °C)

Vapor Pressure: 71.2 mm Hg at 68 °F (20 °C)

Saturated Vapor Density (Air = 0.075 lb/ft³ or 1.2 kg/m³): 0.085 lb/ft³ or 1.368 kg/m³

Bulk Density: 6.71 lb/gal

Refraction Index: 1.379 at 68 °F (20 °C)

Critical Temperature: 504 °F (262 °C)

Critical Pressure: 41 atm

Molecular Weight: 72.1

Density: 0.8045 g/mL at 68 °F (20 °C)

Water Solubility: MEK in water = 28%; water in MEK = 12.5%

Other Solubilities: Soluble in alcohol, benzene, ether, and fixed oils.

Surface Tension: 24.6 dyna/cm at 68 °F (20 °C)

Ionization Potential: 9.54 eV

Viscosity: 0.4 cP at 77 °F (25 °C)

Relative Evaporation Rate (ether = 1): 2.7

Octanol/Water Partition Coefficient: log Kow = 0.26 to 0.29

Appearance and Odor: Colorless, volatile, liquid with a sweet mint or acetone-like odor. The odor threshold is 25 ppm.

Section 4. Fire and Explosion Data

Flash Point: 16 °F (-9 °C)

Autoignition Temperature: 759 °F (404 °C)

LEL: 1.4% at 200 °F (93 °C) | UEL: 11.4% at 200 °F (93 °C)

Extinguishing Media: A Class 1B flammable liquid. For small fires, use dry chemical, carbon dioxide, water spray, or alcohol-resistant foam. For large fires, use water spray, fog, or alcohol-resistant foam.

Unusual Fire/Explosion Hazards: Vapors may travel to ignition source and flash back. Container may explode in fire. Burning rate = 4.1 mm/min.

Special Fire-fighting Procedures: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighters' protective clothing provides only limited protection. If possible without risk, move container from fire area. Apply cooling water to container sides until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw and let fire burn. Withdraw immediately if you hear a rising sound from venting safety device or notice any tank discoloration due to fire. Do not release runoff from fire control methods to sewers or waterways; dike for proper disposal.

Section 5. Reactivity Data

Stability/Polymerization: Methyl ethyl ketone is stable at room temperature in closed containers under normal storage and handling conditions.

Hazardous polymerization cannot occur.

Chemical Incompatibilities: Include chlorosulfonic acid, oleum (fuming sulfuric acid), potassium-*t*-butoxide, hydrogen peroxide + nitric acid, propenol (forms explosive peroxides), chloroform + alkali, amines, ammonia, inorganic acids, caustics, copper, isocyanates, pyridines, and strong oxidizers. MEK will soften or dissolve some plastics.

Conditions to Avoid: Exposure to heat, ignition sources, and incompatibles.

Hazardous Products of Decomposition: Thermal oxidative decomposition of MEK can produce carbon dioxide gas and acid smoke.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,⁽¹²⁾ NTP,⁽¹⁰⁾ and OSHA⁽¹²⁾ do not list methyl ethyl ketone as a carcinogen.

Summary of Risks: MEK vapors are irritating to the eyes and respiratory tract. Inhalation causes varying degrees of central nervous system depression. Approximately 75% of inhaled MEK is absorbed in humans. It is absorbed readily through the skin...

Continued on next page

Section 6. Health Hazard Data, continued

and prolonged contact may cause dermatitis. Because of its low odor threshold, MEK's irritating properties should be sufficient to prevent overexposure. MEK appears to potentiate the neurotoxic effects of some chemicals including *n*-butyl ketone and *n*-hexane, and some studies suggest that MEK may even produce neurotoxicity itself (possibly because it is partially metabolized to methanol⁽¹³⁹⁾). **Medical Conditions Aggravated by Long-Term Exposure:** Dermatitis. **Target Organs:** Respiratory tract, central nervous system, skin, and eyes. **Primary Entry Routes:** Inhalation, eyes, and skin contact/absorption. **Acute Effects:** Inhalation may cause headache, dizziness, nausea, vomiting, weakness, and unconsciousness. High concentration can cause smarting in addition to irritation of the eyes and respiratory tract. In one study, exposure to 100 ppm caused slight nose and throat irritation, 200 ppm caused mild eye irritation, and 300 ppm was "objectionable" with headache and throat irritation. In another study, short exposure to 500 ppm caused nausea and vomiting. Also, workers exposed to 300 to 600 ppm for an unspecified time period experienced numbness of the fingers and arms; one worker experienced leg numbness with a tendency to "give way under him". Direct eye contact can cause painful irritation and corneal injury. **Chronic Effects:** Repeated skin contact can cause defatting and dermatitis, apparently without irritation.

FIRST AID **Eyes:** Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water.

Inhalation: Remove exposed person to fresh air, administer 100% humidified supplemental oxygen and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless otherwise advised, have that conscious and alert person drink 1 to 2 glasses of water to dilute. Do not induce vomiting because of possible aspiration into the lungs.

Note to Physicians: MEK is detectable in expired air and urine. There is good correlation between urinary MEK and workplace air concentration.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources. Cleanup personnel should protect against exposure. Take up small spills with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers. Dike far ahead of large spill for reclamation or disposal. For spills in water, use natural barriers or spill control booms to limit spill travel. Prevent entry into sewers, drains, and waterways. Follow applicable OSHA regulations (29 CFR 1910.120). **Ecotoxicity Values:** *Pimephales promelas* (fathead minnow) LC₅₀ = 3,220 mg/L/96 hr; *Lepomis macrochirus* (bluegill), TLM = 5,640 to 1,690 mg/L/24 to 96 hr. **Environmental Degradation:** In water MEK will evaporate with an expected half-life of 3 to 12 days in rivers and lakes, respectively. It slowly biodegrades in both fresh and salt water. It may degrade in ground water after a long acclimation period. It is not expected to bioconcentrate in aquatic organisms. On land, MEK will either evaporate or leach into the ground. In air, MEK will degrade by photochemical reaction with hydroxyl radicals (half-life = 2.3 days). Under smog conditions, degradation may be slightly faster. **Disposal:** Incineration is possible in permit-approved facilities. Steam stripping can be used to remove MEK from aqueous waste. Concentrations up to several wt % solvent in water can be handled with better than 99% removal expected. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33): U159

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 5000 lb (2270 kg) [* per RCRA, Sec. 3001]

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 1000 ppm, use any powdered air-purifying respirator with organic vapor cartridges (OVCs) or any chemical cartridge respirator with a full facepiece and OVCs. For < 3000 ppm, use any air-purifying, full facepiece respirator (gas mask) with a chin-style, front-or-back mounted organic vapor canister. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning!** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Butyl rubber and Teflon with breakthrough times (BT) of > 8 hr and polyethylene/ethylene vinyl alcohol with a BT of > 4 hr are suitable PPE materials. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰³⁾ **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work and street clothes and launder before reuse. Remove MEK from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using MEK, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage/Handling Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from heat, incompatibles (Sec. 5). Periodically check containers for leaks.

Engineering Controls: To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. To prevent static sparks, electrically ground and bond all equipment used with MEK.

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin and respiratory system. Inform workers that MEK is absorbed through the skin and stress the importance of wearing appropriate gloves.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Methyl ethyl ketone

DOT Hazard Class: 3

ID No.: UN1193

DOT Packing Group: II

DOT Label: Flammable liquid

Special Provisions (172.102): T8

Packaging Authorizations

a) Exceptions: 173.150

b) Non-bulk Packaging: 173.202

c) Bulk Packaging: 173.242

Quantity Limitations

a) Passenger Aircraft or Railcar: 5L

b) Cargo Aircraft Only: 60L

Vessel Stowage Requirements

a) Vessel Stowage: B

b) Other: —

MSDS Collection References: 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 148, 149, 153, 199, 168, 171, 183, 186

Prepared by: M Gannon, BA; Industrial Hygiene Review: RE Langford, Ph.D., CIH; Medical Review: T Thornum, MD, MPH

SECTION 6. HEALTH HAZARD INFORMATION

Naphthalene is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: Renal shutdown (kidney failure), hemolytic effects (breakdown of red blood cells), hematuria (blood in the urine), oliguria (low volume of urine), jaundice, eye damage, and depression of the central nervous system (CNS) are the primary health concerns associated with exposure to naphthalene. The ACGIH TLVs in section 2 are set to prevent eye damage. These recommended exposure limits may not be low enough to prevent blood changes in genetically hypersensitive individuals.

Medical Conditions Aggravated by Long-Term Exposure: Diseases of the blood, liver, and kidneys. Administer medical exams emphasizing these organs. **Target Organs:** Eyes, skin, kidneys, liver, blood (red blood cell effects), and CNS.

Primary Entry: Inhalation, skin contact. **Acute Effects:** Inhalation of naphthalene vapor causes excitement, confusion, headache, nausea, and loss of appetite. **Chronic Effects:** Increased incidence of cataracts.

FIRST AID

Eye Contact: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes to remove particles.

Skin Contact: Immediately wash the affected area with soap and water.

Inhalation: Remove victim to fresh air; restore and/or support his breathing as needed.

Ingestion: Call a poison control center. Never give anything by mouth to someone who is unconscious or convulsing. Administer a gastric lavage followed by saline catharsis. Monitor blood and electrolytic balance. Other sources recommend giving the victim several glasses of water to drink.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and eliminate all ignition sources immediately. Cleanup personnel need protection against contact and inhalation of vapor (see sect. 8). Contain large spills and collect waste. Use nonsparking tools to place naphthalene into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways.

Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z)

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste, No. U165

CERCLA Hazardous Substance, Reportable Quantity: 100 lbs (45.4 kg)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Follow the eye- and face-protection guidelines of 29 CFR 1910.133. **Respirator:** Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* (Genium ref. 88) for the maximum-use concentrations and/or the exposure limits cited in section 2. Respirator usage must be in accordance with the OSHA regulations of 29 CFR 1910.134. IDLH or unknown concentrations require an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres.

Other Equipment: Wear impervious gloves, boots, aprons, gauntlets, etc., as required by the specific work environment to prevent skin contact. **Ventilation:** Install and operate general and local maximum explosion-proof ventilation systems of sufficient power to maintain airborne levels of naphthalene below the OSHA PEL standard cited in section 2. **Safety Stations:** Make eyewash stations, washing facilities, and safety showers available in areas of use and handling. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove and launder contaminated clothing before wearing it again; clean this material from shoes and equipment.

Comments: Practice good personal hygiene; always wash thoroughly after using this material. Keep this material off of your clothing and equipment. Avoid transferring this material from hands to mouth while eating, drinking, or smoking. Do *not* smoke, eat, or drink in any immediate work area. Avoid inhalation of vapor!

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage Segregation: Store naphthalene in a cool, dry, well-ventilated area away from chemical incompatibles (see sect. 5).

Special Handling/Storage: Protect containers from physical damage. All bulk storage facilities must be built with an explosion-proof design. All containers used in shipping/transferring operations must be electrically grounded to prevent static sparks. Use monitoring equipment to measure the extent of vapor present in any storage facility containing naphthalene because of potential fire and explosion hazards.

Comments: All operations with naphthalene must be done carefully to prevent accidental ignition of its flammable/explosive vapor. If the weather is warm, more naphthalene vapor forms and the potential for explosion increases. Do *not* smoke in any use or storage area!

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Naphthalene

DOT Hazard Class: ORM-A

IMO Class: 4.1

DOT ID No. UN1334

IMO Label: Flammable Solid

DOT Label: None

References: 1, 2, 12, 73, 84-94, 103, PJI

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Approvals *[Signature]*

Indust. Hygiene/Safety *[Signature]*

Medical Review *[Signature]*

Material Safety Data Sheet

from Genium's Reference Collection
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No. 683

POLYCHLORINATED BIPHENYLS
(PCBs)

Issued: November 1988

SECTION 1. MATERIAL IDENTIFICATION

27

Material Name: POLYCHLORINATED BIPHENYLS (PCBs)

Description (Origin/Uses): Commercial PCBs are mixtures that were once widely manufactured by combining chlorine gas, iron filings, and biphenyls. Their high stability contributes to their intended commercial applications and their accidental, long-term adverse environmental and health effects. PCBs are useful as insulators in electrical equipment because they are electrically nonconductive. Their distribution has been limited since 1976. The Aroclor PCB codes identify PCBs by type. The first two digits of a code indicate whether the PCB contains chlorinated biphenyls (12), chlorinated terphenyls, (54), or both (25, 44); the last two digits indicate the approximate percentage of chlorine. Found in insulating liquid, synthetic rubber, plasticizers, flame retardants, floor tile, printer's ink, paper and fabric coatings, brake linings, paints, automobile body sealants, asphalt, adhesives, electrical capacitors, electrical transformers, vacuum pumps, gas-transmission turbines, heat-transfer fluids, hydraulic fluids, lubricating and cutting oil, copying paper, carbonless copying paper, and fluorescent light ballasts.

Synonyms: Chlorodiphenyls

Other Designations (Producer, Trade Name, Nation): Monsanto, Aroclor® (USA, Great Britain); Bayer, Clophen® (German Democratic Republic); Prodelco, Phenoclor®, Pyralene® (France); Kanechlor®, Mitsubishi, Santochlor® (Japan); Caffaro, Feoclor® (Italy).

| Trade Name | CAS No. | RTECS No. | Trade Name | CAS No. | RTECS No. |
|--------------|------------|-----------|--------------|------------|-----------|
| Aroclors | 01336-36-3 | TQ1350000 | Aroclor 1242 | 53469-21-9 | TQ1356000 |
| Aroclor 1016 | 12674-11-2 | TQ1351000 | Aroclor 1248 | 12672-29-6 | TQ1358000 |
| Aroclor 1221 | 11104-28-2 | TQ1352000 | Aroclor 1254 | 11097-69-1 | TQ1360000 |
| Aroclor 1232 | 11141-16-5 | TQ1354000 | Aroclor 1260 | 11096-82-5 | TQ1362000 |

| HMIS | |
|------|-------|
| H | 1 R 1 |
| F | 1 I 3 |
| R | 0 S 1 |
| PPG* | K 1 |



Genium

SECTION 2. INGREDIENTS AND HAZARDS/EXPOSURE LIMITS

PCB-42% Chlorine/Aroclor 1242
CAS No. 53469-21-9
OSHA PEL (Skin*)
8-Hr TWA: 1 mg/m³
ACGIH TLV (Skin*), 1988-89
TLV-TWA: 1 mg/m³

PCB-54% Chlorine/Aroclor 1254
CAS No. 11097-69-1
OSHA PEL (Skin*)
8-Hr TWA: 0.5 mg/m³
ACGIH TLV (Skin*), 1988-89
TLV-TWA: 0.5 mg/m³

All PCBs/Aroclors
CAS No. 1336-36-3
NIOSH REL 1977
10-Hour TWA: 0.001 mg/m³
Toxicity Data**
Moose, Oral, LD₅₀: 1900 mg/kg

*This material can be absorbed through intact skin, which contributes to overall exposure.

**See NIOSH, RTECS (Genium ref. 90), at the locations specified in section 1 for additional data with references to tumorigenic, reproductive, mutagenic, and irritative effects.

SECTION 3. PHYSICAL DATA

Boiling Point: Ranges from 527°F (275°C) to 725°F (385°C)
Solubility in Water (%): Insoluble
Pour Point: Ranges from -31°F (-35°C) to 87.8°F (31°C)

% Volatile by Volume: Ranges from 1.2 to 1.6
Molecular Weight (Average): Aroclor 1242: 258 Grams/Mole
Aroclor 1254: 326 Grams/Mole

Appearance and Odor: Clear to light yellow mobile oil to a sticky resin; a sweet "aromatic" odor. As the percentage of chlorine increases, the PCB becomes thicker and heavier; e.g., Aroclor 1254 is more viscous than Aroclor 1242.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point*
Autoignition Temperature: Not Found

LEL: Not Found
UEL: Not Found

Extinguishing Media: Use water spray/fog, carbon dioxide (CO₂), dry chemical, or "alcohol" foam to extinguish fires that involve polychlorinated biphenyls. Although it is very difficult to ignite PCBs, they are often mixed with more flammable materials (oils, solvents, etc.)
Unusual Fire or Explosion Hazards: If a transformer containing PCBs is involved in a fire, its owner may be required to report the incident to appropriate authorities. Consult and follow all pertinent Federal, state, and local regulations. Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode; fire fighters must also wear a complete set of protective clothing. Comments: The hazards of PCB fires are associated with the possibility of their being released into the environment where they and their products of degeneration can pose serious long-term health risks. These potential problems are heightened by the PCBs' resistance to biological and chemical degradation and by the possibility that they will contaminate underground water systems (see sect. 5)

*Ranges from 284°F (140°C) to 392°F (200°C).

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Polychlorinated biphenyls are very stable materials. Hazardous polymerization cannot occur.
Chemical Incompatibilities: PCBs can react dangerously with sodium or potassium. These reactions are part of an industrial process used to destroy PCBs; however, people have been killed by explosions at PCB treatment, storage, and disposal sites. Conditions to Avoid: Limit human exposure to PCBs to the lowest possible level; especially avoid contact with skin. Hazardous Products of Decomposition: Thermal-oxidative degradation of PCBs can produce toxic gases such as carbon monoxide, chlorine, chlorinated aromatic fragments, phenolics, aldehydes, and hydrogen chloride. Incomplete combustion of PCBs produces toxic compounds such as polychlorinated dibenzofuran (PCDF, the major product of combustion), and polychlorinated dibenzo-p-dioxin (PCDD or dioxin).

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: The EPA lists PCBs as carcinogens, and the IARC classifies them as probable human carcinogens (group 2B).
Summary of Risks: Effects of accidental exposure to PCBs include acneiform eruptions; eye discharge; swelling of the upper eyelids and hyperemia of the conjunctiva; hyperpigmentation of skin, nails, and mucous membrane; chloroacne; distinctive hair follicles; fever; hearing difficulties; limb spasms; headache; vomiting; and diarrhea. PCBs are potent liver toxins that can be absorbed through unbroken skin in hazardous amounts without immediately discernible pain or discomfort. Severe health effects can develop later. In experimental animals, prolonged or repeated exposure to PCBs by any route results in liver damage at levels that are less than those reported to have caused cancer in rodents. **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** Skin, eyes, eyelids, blood, liver.
Primary Entry: Inhalation, skin contact/absorption. **Acute Effects:** Skin and eye irritation, acneiform dermatitis, nausea, vomiting, abdominal pain, jaundice, liver damage. **Chronic Effects:** Possible cancer (evidence of this is inconclusive); reproductive effects (jaundice, excessive secretion of tears, dermal chromopexy); and hepatitis. **FIRST AID:** Eyes: Immediately flush eyes, including under the eyelids, gently but thoroughly with flooding amounts of running water for 15 minutes. Skin: Rinse exposed skin with flooding amounts of water; wash with soap and water. Inhalation: Remove the exposed person to fresh air; restore and/or support breathing as needed. Have qualified medical personnel administer oxygen as required. Ingestion: Induce vomiting by sticking your finger to the back of the exposed person's throat. Have him or her drink 1 to 2 glasses of milk or water. Get medical help (in plant, paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid. **Note to Physicians:** PCBs are poorly metabolized, soluble in lipids, and they accumulate in tissues or organs rich in lipids. Liver function tests can help to determine the extent of body damage in exposed persons. If electrical equipment containing PCBs arcs over, the PCBs or other hydrocarbon dielectric fluids may decompose and give off hydrochloric acid (HCl), a potent respiratory irritant.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Treat any accidental release of PCBs as an emergency. An SPCCP (spill-prevention control and countermeasure plan) must be formulated before spills or leaks occur. PCBs are resistant to biodegradation, soluble in lipids, and chemically stable; as such they have become significant contaminants of global ecosystems. Releases of PCBs require immediate, competent, professional response from trained personnel. Each release situation is unique and requires a specifically designed cleanup response. General recommendations include adhering to Federal regulations (40 CFR Part 761). Notify safety personnel, evacuate nonessential personnel, ventilate the spill area, and contain the PCBs. All wastes, residues, and contaminated cleanup equipment from the incident are subject to EPA requirements (40 CFR 761). Consult your attorney or appropriate regulatory officials for information about reporting requirements and disposal procedures. **Waste Disposal:** Contact your hazardous waste disposal firm or a licensed contractor for detailed recommendations, especially when PCBs are unexpectedly discovered. Follow Federal, state, and local regulations. PCBs are biomagnified in the food chain; i.e., their concentration increases at each link. The disposal of PCBs or of PCB-contaminated materials is strictly regulated; violations of applicable laws can result in fines, lawsuits, and negative publicity. **Warning:** Accidental spills of PCBs that may affect water supplies must be reported to Coast Guard personnel at the National Response Center, telephone (202) 426-2675.

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z).

EPA Designations (40 CFR 302.4)

CERCLA Hazardous Substance, Reportable Quantity: 10 lbs (4.54 kg), per the Clean Water Act (CWA), §§ 311 (b) (4) and 307 (a).

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing of PCBs is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Wear a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (leaks or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators will not protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, and gauntlets, etc., to prevent any contact of PCBs with your skin. **Ventilation:** Install and operate general and local maximum, explosion-proof ventilation systems powerful enough to maintain airborne levels of this material below the OSHA PEL standards cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contamination into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do not wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from your shoes and equipment. Heavily soiled clothing must be properly discarded in a manner consistent with applicable regulations. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do not eat, drink, or smoke in work areas.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage Segregation: Store PCBs in closed containers in a cool, dry, well-ventilated area. Protect containers from physical damage. **Special Handling/Storage:** All storage facilities must have adequate containment systems (dikes; elevated, nonporous holding platforms; retaining walls) to prevent any major release of PCBs into the environment. Carefully design and implement these extra precautions now; do not wait until you have to respond to an accidental release of this material.

Transportation Data (49 CFR 172.101-2; PCBs were the first materials to be directly regulated by Congress by way of TSCA in 1976.)

DOT Shipping Name: Polychlorinated Biphenyls

DOT Hazard Class: ORM-E

ID No. UN 2315

DOT Packaging Requirements: 49 CFR 173.510

IMO Shipping Name: Polychlorinated Biphenyls

IMO Hazard Class: 9

IMDG Packaging Group: II

References: 1, 6, 26, 38, 84-94, 100, 101, 116, 117, 120, 122.

Prepared by PJ IgOE, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: W Silverman, MD

Technical Review: Northeast Analytical, Inc. (PCB and VOC Specialists), Schenectady, New York, Telephone: (518) 346-4592



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Material Safety Data Sheets Collection:

Sheet No. 720
Petroleum (Crude)

Issued: 8/90

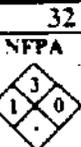
Section 1. Material Identification

Petroleum (Crude) Description: A highly complex mixture of paraffinic, cycloparaffinic (naphthenic), and aromatic hydrocarbons with molecular weights ranging from the very lightest to over 6000; also containing small amounts of benzene hydrocarbons, sulfur, and oxygenated compounds. Used as a source of gasoline, petroleum ether, fuel and lubricating oils, liquid and solid petroleum, butane, isopropyl alcohol, and many other products.

Other Designations: CAS No. 8002-05-9, base oil, coal liquid, coal oil, crude oil, petroleum crude, petroleum oil, rock oil, and seneca oil.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*TM for a suppliers list.

R 1
I -
S 2
K 4



HMIS
H 1
F 3
R 0
PPG*
* Sec. 8

Cautions: Petroleum (crude) is toxic by ingestion and is irritating by skin contact. It is a dangerous fire hazard when exposed to heat, flame, or powerful oxidizers. Its fumes are flammable, asphyxiating, and potentially toxic.

Section 2. Ingredients and Occupational Exposure Limits

Petroleum (crude), ca 100%

1989 OSHA PEL
None established

1989-90 ACGIH TLV
None established

1988 NIOSH REL
None established

1985-86 Toxicity Data*

Mouse, skin, TD₀₁: 3744 mg/kg administered intermittently over a 2-yr period in a number of separate, discrete doses produces tumorigenic effects; skin and appendages (tumors)

Comment: Crude petroleum is a complex mixture of volatile hydrocarbons and gases. So-called "sour crude" contains toxic and dangerous hydrogen sulfide gas (MSDS Collection, No. 52).

* See NIOSH, RTECS (SE1175000), for additional mutative and tumorigenic data.

Section 3. Physical Data

Melting Point: -51 °F (-46 °C)

Density: 0.780 to 0.970

Water Solubility: Insoluble

Appearance and Odor: A viscous, dark yellow to brown or greenish-black, oily liquid with an unpleasant odor. Petroleum's (crude light's) upper and lower odor thresholds are 0.5 and 0.1 ppm, respectively.

Section 4. Fire and Explosion Data

Flash Point: 20 to 90 °F (-6.7 to 32.2 °C) | **Autoignition Temperature:** None reported | **LEL:** None reported | **UEL:** None reported

Extinguishing Media: To fight fire, use dry chemical, foam, or carbon dioxide.

Unusual Fire or Explosion Hazard: Liquid petroleum contains and gives off considerable amounts of dissolved, possibly explosive gases that are a dangerous fire hazard when exposed to heat, flame, or powerful oxidizers.

Special Fire-fighting Procedures: Isolate hazard entry and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and fully encapsulating suit. If feasible, move containers from fire area. Otherwise, use a water spray to cool fire-exposed containers. Never apply water directly to a petroleum fire. Water fog or mist will act as a blanket to reduce vapors and cut off the air supply. Stay out of low areas. Vapors may travel to an ignition source and flash back. Be aware of runoff from fire control methods. Do not release to sewers or waterways where it could cause a fire/explosion hazard or pollution.

Section 5. Reactivity Data

Stability/Polymerization: Petroleum is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Petroleum (crude light) may act as a synergist (a substance that induces a greater effect when added to another substance) to pesticides. Incompatible with oxidizing agents.

Conditions to Avoid: Avoid exposure to heat and ignition sources.

Hazardous Products of Decomposition: Thermal oxidative decomposition of petroleum can emit acrid smoke and fumes.

Section 6. Health Hazard Data

Carcinogenicity: The IARC does not classify petroleum (crude) as a human carcinogen (Group 3) since human and animal evidence are inadequate.

Summary of Risks: Petroleum is toxic by ingestion and is a skin irritant. Aspiration pneumonia (pulmonary toxicity due to aspiration into the lungs) is the most serious toxic effect following ingestion. Cardiovascular and neurologic toxicity are the major concerns following inhalation.

Medical Conditions Aggravated by Long-Term Exposure: Chronic skin disease.

Target Organs: Skin, eyes, respiratory system, central nervous system.

Primary Entry Routes: Inhalation, accidental ingestion, skin contact.

Acute Effects: Ingestion causes nausea, vomiting, diarrhea, and abdominal pain. Liver and renal injury may occur following ingestion. Symptoms of aspiration include coughing, choking, shortness of breath, increased respiration, and pulmonary edema. Inhalation of petroleum or its dissolved gases may result in respiratory arrest, euphoria, cardiac dysrhythmia, and central nervous system toxicity.

Chronic Effects: Prolonged and repeated contact with petroleum can cause skin disorders such as dermatitis.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, do not induce vomiting since this increases the aspiration risk. Keep victim's head between knees. Consult a physician immediately.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Physician's Note: Unless a large amount of petroleum is ingested, gastric emptying is not suggested. Consider administering activated charcoal, but administer it with caution because it may also cause vomiting and increase the risk of aspiration.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove all heat and ignition sources, and provide maximum explosion-proof ventilation. For small spills, take up with sand or other noncombustible absorbent material and place into appropriate containers for disposal. For large spills, dike far ahead of spill. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed

CERCLA Hazardous Substance (40 CFR 302.4): Not listed

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations that protect worker safety and productivity. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁰⁹⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area; soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed drums or tanks in a cool, dry, well-ventilated area away from heat and ignition sources (naked lights, sparks, welding equipment). Protect containers from physical damage. To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas. In addition, conductive tires can further protect vehicles.

Engineering Controls: Use only with adequate ventilation. Workers should be educated about petroleum's hazards and potential dangers.

Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. To prevent dermatitis use appropriate protective gear and practice good personal hygiene procedures. Monitor storage facilities for gas buildup.

Other Precautions: Provide annual examinations with emphasis on the skin and respiratory system.

Transportation Data (49 CFR 172.103)

IMO Shipping Name: Petroleum crude oil

IMO Hazard Class: 3.1, 3.2, 3.3

ID No.: UN1267

IMO Label: Flammable liquid

IMDG Packaging Group: II

**Section 1. Material Identification**

Phenol (C₆H₅OH) Description: One of many aromatic compounds in coal tar. Made by alkylating benzene with propylene then oxidizing the resulting cumene to produce phenol and acetone. Used as a feedstock in manufacturing various phenolic resins, caprolactam, bis-phenol-A, and other chemicals and drugs; a disinfectant; a fuel-oil sludge inhibitor; a reagent in chemical analysis; in producing or manufacturing a large variety of aromatic compounds including fertilizers, illuminating gas, coke, explosives, lampblack, paints, paint removers, asbestos goods, wood preservatives, textiles, perfumes, bakelite, rubber, and other plastics; in medical and industrial organic compounds and dyes; and in germicidal paints and fumigants. Phenol has been identified in cigarette smoke and automobile exhaust.

Other Designations: CAS No. 0108-95-2, carbolic acid, hydroxybenzene, monohydroxy benzene, oxybenzene, phenic acid, phenyl alcohol, phenyl hydroxide.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*TM for a suppliers list.

Cautions: Phenol has a marked corrosive effect on any tissue. Eye contact may cause severe damage and blindness. Its primary entry route is through *skin absorption*. Systemic absorption may cause *liver and kidney damage, convulsions (seizures), or death*.

R 1
I 4
S 3*
K 2
* Skin absorption



HMIS
H 3
F 2
R 0
PPG
- Sec 3

Section 2. Ingredients and Occupational Exposure Limits

Phenol, ca 100%

1989 OSHA PEL (Skin)
8-hr TWA: 5 ppm, 19 mg/m³

1990-91 ACGIH TLV (Skin)
TWA: 5 ppm, 19 mg/m³

1988 NIOSH REL
TWA: 5 ppm, 19 mg/m³
Ceiling: 15.6 ppm, 60 mg/m³

1985-86 Toxicity Data*
Mammal, inhalation, LC₅₀: 74 mg/m³
Rat, oral, LD₅₀: 317 mg/kg; toxic effects include behavioral changes (convulsions or effect on seizure threshold)
Rabbit, eye, TC₅₀: 5 mg produces severe irritation

1987 IDLH Level
250 ppm

* See NIOSH, *RTECS* (SI3325000), for additional irritative, mutative, reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 359.15 °F (181.75 °C) at 760 mm Hg
Melting Point: 109.4 °F (43 °C)
Vapor Pressure: 0.3513 mm Hg at 77 °F (25 °C)

Vapor Density (Air = 1): 3.24
pH: 6 (aqueous solution)
Molecular Weight: 94.11

Specific Gravity (20 °C/4 °C): 1.0576
Water Solubility: 1 g dissolves in about 15 ml H₂O
Viscosity: 12.7 centipoise at 64.9 °F (18.3 °C)

Appearance and Odor: White crystalline solid with a characteristic sharp medicinal sweet, tangy odor detectable above 0.05 ppm. Phenol turns pink or red if it contains impurities or is exposed to heat or light.

Section 4. Fire and Explosion Data

Flash Point: 175 °F (79 °C); CC

Autoignition Temperature: 1319 °F (715 °C)

LEL: 1.7% v/v

UEL: 8.6% v/v

Extinguishing Media: Use water spray, carbon dioxide, dry chemical, or alcohol-type foam to extinguish fires involving phenol. Do not use a solid stream of water since the stream scatters and spreads fire. Use water spray to cool fire-exposed tanks/containers.

Unusual Fire or Explosion Hazards: Phenol presents a moderate fire hazard when exposed to heat, flame, or oxidizers. When heated, it emits toxic fumes and vapors that form explosive mixtures with air. Air mixtures containing 3 to 10% phenol are explosive. Solid phenol burns with difficulty, giving off heavy smoke.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective clothing. Be aware of runoff from fire control methods. Water containing phenol can cause severe chemical burns. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Phenol is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: In general, phenol is incompatible with strong oxidizing agents and halogens. It coagulates colloid and proteins. A potentially explosive reaction occurs with formaldehyde, peroxydisulfuric acid, peroxymonosulfuric acid, sodium nitrite + heat, and aluminum chloride + nitromethane (at 110 °C/100 bar). A violent reaction occurs with butadiene, sodium nitrite + trifluoroacetic acid, and aluminum chloride + nitrobenzene at 248 °F (120 °C). Combining phenol with mineral oxidizing acids results in fire; with acetaldehyde results in violent condensation; with isocyanates results in heat generation and violent polymerization, with calcium hypochlorite results in an exothermic reaction producing toxic fumes which may ignite; and with nitrides results in heat and flammable gas generation. Hot phenol is corrosive to many metals, including aluminum, lead, magnesium, and zinc. Reaction with these materials causes phenol to discolor.

Conditions to Avoid: Avoid heating phenol above 122 °F (90 °C).

Hazardous Products of Decomposition: Thermal oxidative decomposition of phenol can produce oxides of carbon and water.

Section 6. Health Hazard Data

Carcinogenicity: The NTP, IARC, and OSHA do not list phenol as a carcinogen. Although no specific evidence of human cancer exists, its carcinogenicity to mice emphasizes the need for precaution when handling this material. Phenol also causes human mutations (genetic changes).

Summary of Risks: Phenol is a general protoplasmic poison that is corrosive to any living tissue it contacts. Toxicity most likely results from dermal (skin) contact or ingestion. Skin absorption occurs readily with a rapid onset of symptoms or death (within 30 min to several hours). Contact with eyes may cause severe damage and blindness. Ingestion of 1 g may be fatal. Although phenol is irritating to the respiratory tract due to its low volatility and good warning properties, inhalation is typically less of a concern. Chronic toxic effects are uncommon, but may include digestive disturbances, neurological disorders, skin rash (dermatitis), and liver and kidney damage.

Medical Conditions Aggravated by Long-Term Exposure: Individuals with chronic respiratory disorders, pre-existing skin disorders, convulsive disorders, or kidney or liver abnormalities may be at increased risk from phenol exposure.

Target Organs: Liver, kidneys, nervous system, and skin.

Primary Entry Routes: Skin absorption, eye contact, ingestion, and inhalation.

Acute Effects: Skin contact results in white, wrinkled discoloration, followed by a severe burn or systemic poisoning if removed improperly.

Continue on next page

Section 6. Health Hazard Data, continued

Phenol ingestion can cause gangrene and corrosion of lips, mouth, throat, esophagus, and stomach if not properly decontaminated (see First Aid). Although not immediately painful, skin contact can cause serious burns and systemic toxicity. In addition to skin burns and respiratory tract irritation, systemic absorption may cause pallor, anorexia (appetite loss), nausea, vomiting, diarrhea, weakness, muscle aches, darkened urine, headache, tinnitus (ringing in ears), sweating, convulsions, cyanosis (bluish coloration of lips and/or fingertips), shock, unconsciousness, respiratory failure, and death. After ingestion, major percutaneous (skin), or inhalation exposures, collapse and death can be rapid. Ingestion can cause severe tissue corrosion or gangrene affecting lips, mouth, throat, esophagus, and stomach. Eye contact can cause severe corrosive damage to the eye (conjunctival edema, corneal opacification, and hypesthesia) and possible blindness.

Chronic Effects: Chronic phenol poisoning is rarely reported. Symptoms include vomiting, difficulty swallowing, diarrhea, appetite loss, headache, fainting, dizziness, darkened urine, and mental disturbances. Chronic exposure can cause death from liver and kidney damage. Repeated skin contact with phenol or phenol-bearing products can result in dermatitis with dark pigmentation (ochronosis) of skin and whites of eyes (sclerae).

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician immediately.

Skin: Speedy action is critical. Flood exposed area with water and quickly remove contaminated clothing. As soon as possible, repeatedly spray or swab with the decontaminating agent polyethyleneglycol-300 (PEG). Immerse extremities in PEG. Rescue personnel should protect themselves from skin contact with phenol. Do not use greases, powders, or ointments to treat phenol burns. Never delay phenol removal if PEG is not readily available. Use soap and water instead.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: *Speed is essential in the treatment of oral poisoning.* Immediately consult a physician and poison center. Never give anything by mouth to an unconscious or convulsing person. Administer to that conscious person 15 to 30 cc castor oil or another vegetable oil, and be prepared to induce vomiting upon a physician's advice. Vegetable oils slow phenol absorption and reduce local damage.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat ingestion with gastric lavage using 40% aqueous Bacto-Peptone, milk, or water until phenolic odor is eliminated. Then give 15 to 30 cc castor or vegetable oil. Debride necrotic skin. Monitor vital signs, fluid status, electrolytes, BUN, renal and hepatic function, and electrocardiogram. Manage sedation, seizures, renal failure, and fluid electrolyte imbalances symptomatically as indicated.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove all heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and skin and eye contact with a self-contained breathing apparatus and full personal protective clothing and equipment. Absorb small spills with some noncombustible inert material and place in a closed metal container for disposal. Dike large spills and allow material to cool and solidify. Using nonsparking tools, shovel solid into steel containers for disposal. Thoroughly flush spill area with water, use caustic soda solution for neutralization, and collect flushings and wash water for disposal. Do not allow phenol to enter sewers, watersheds, or waterways. Follow applicable OSHA regulations (29 CFR 1910.120). Notify proper authorities including the National Response Center (800-424-8802).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Reportable Quantity (RQ), 1000 lb (454 kg) [* per Clean Water Act, Sec. 311(b)(4), Sec. 307(a), and per RCRA, Sec. 3001]

Listed as a SARA Extremely Hazardous Substance (40 CFR 355): RQ, 1000 lb; Threshold Planning Quantity (TPQ), 500/10,000 lb

Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. Where potential exists for exposures near or over 19 mg/m³, use a MSHA/NIOSH-approved full facepiece respirator with an organic vapor cartridge/canister and dust/mist prefilter. Increased protection is obtained from full facepiece powered-air purifying respirators. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact. ACGIH recommends neoprene or butyl rubber as good-to-excellent protective materials.

Ventilation: Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL and ACGIH TLV (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁶⁾

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area; soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed containers in a cool, dry, well-ventilated area away from heated surfaces, open flame, and ignition sources. Outside or detached storage is preferred. Protect containers from physical damage.

Engineering Controls: Enclose all operations, eliminating all possible phenol exposure routes. Educate workers about phenol's hazards and potential dangers. Use only with appropriate personal protective gear and adequate ventilation. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Provide local exhaust ventilation at the site of chemical release. Practice good personal hygiene and housekeeping procedures.

Medical Surveillance: Provide preplacement or periodic medical examinations that emphasize central nervous system (CNS), hepatic, renal, and skin. Tests should include BUN, creatinine, LFTs, and urinalysis. Phenol can be detected in urine in free or conjugated forms. The ACGIH biological exposure index (BEI) is 250 mg total phenol/g creatinine or 15 mg/hr.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Phenol

DOT Hazard Class: Poison B

ID No.: UN1671

DOT Label: Poison

DOT Packaging Exceptions: 173.364

DOT Packaging Requirements: 173.369

IMO Shipping Name: Phenol

IMO Hazard Class: 6.1

ID No.: UN1671

IMO Label: Poison

IMDG Packaging Group: II

MSDS Collection References: 1, 2, 12, 15, 19, 23, 24, 26, 31, 34, 37, 38, 59, 73, 79, 84, 85, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138-140, 143, 146, 148, 149

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Material Safety Data Sheet

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No. 317
TOLUENE
(Revision D)

Issued: August 1979
Revised: April 1986

SECTION 1. MATERIAL IDENTIFICATION

20

MATERIAL NAME: TOLUENE

OTHER DESIGNATIONS: Methyl Benzene, Methyl Benzol, Phenylmethane, Toluol, C₇H₈, CAS #0108-88-3

MANUFACTURER/SUPPLIER: Available from many suppliers, including:
Allied Corp., PO Box 2064R, Morristown, NJ 07960; Telephone: (201) 455-4400
Ashland Chemical Co., Industrial Chemicals & Solvents Div., PO Box 2219,
Columbus, OH; Telephone: (614) 889-3844

HMS

H: 2

F: 3

R: 0

PPE*

*See sect. 8



R 1

I 3

S 2

K 4

SECTION 2. INGREDIENTS AND HAZARDS

%

HAZARD DATA

Toluene



- Current (1985-86) ACGIH TLV. The OSHA PEL is 200 ppm with an acceptable ceiling concentration of 300 ppm and an acceptable maximum peak of 300 ppm/10 minutes.
- Skin designation indicates that toluene can be absorbed through intact skin and contribute to overall exposure.
- Affects the mind.

ca 100

8-hr TLV: 100 ppm, or
375 mg/m³ (Skin)**

Max. Inhalation, TClO:
100 ppm: Psychoactive***

Rat. Oral, LD₅₀: 5000 mg/kg

Rat. Inhalation, LCLo:
4000 ppm/4 hrs.

Rabbit, Skin, LD₅₀: 14 gm/kg

Human, Eye: 300 ppm

SECTION 3. PHYSICAL DATA

Boiling Point ... 231°F (111°C)

Vapor Pressure @ 20°C, mm Hg ... 22

Water Solubility @ 20°C, wt. % ... 0.05

Vapor Density (Air = 1) ... 3.14

Evaporation Rate (BuAc = 1) ... 2.24

Specific Gravity (H₂O = 1) ... 0.866

Melting Point ... -139°F (-95°C)

Percut Volatile by Volume ... ca 100

Molecular Weight ... 92.15

Appearance and odor: Clear, colorless liquid with a characteristic aromatic odor. The odor is detectable to most individuals in the range of 10 to 15 ppm. Because olfactory fatigue occurs rapidly upon exposure to toluene, odor is not a good warning property.

SECTION 4. FIRE AND EXPLOSION DATA

LOWER UPPER

Flash Point and Method

Autoignition Temp.

Flammability Limits in Air

40°F (4°C) CC

896°F (480°C)

% by Volume

1.27

7.1

EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, alcohol foam. Do not use a solid stream of water because the stream will scatter and spread the fire. Use water spray to cool tanks/containers that are exposed to fire and to disperse vapors.

UNUSUAL FIRE/EXPLOSION HAZARDS: This OSHA class IB flammable liquid is a dangerous fire hazard. It is a moderate fire hazard when exposed to oxidizers, heat, sparks, or open flame. Vapors are heavier than air and may travel a considerable distance to an ignition source and flash back.

SPECIAL FIRE-FIGHTING PROCEDURES: Fire fighters should wear self-contained breathing apparatus with full facepiece operated in a positive-pressure mode when fighting fires involving toluene.

SECTION 5. REACTIVITY DATA

CHEMICAL INCOMPATIBILITIES: Toluene is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization. This material is incompatible with strong oxidizing agents, dinitrogen tetroxide, silver perchlorate, tetramethane, and uranium hexafluoride. Contact with these materials may cause fire or explosion. Nitric acid and toluene, especially in the presence of sulfuric acid, will produce nitroaromatic compounds that are dangerously explosive.

CONDITIONS TO AVOID: Avoid exposure to sparks, open flame, hot surfaces, and all sources of heat and ignition. Toluene will attack some forms of plastics, rubber, and coatings. Thermal decomposition or burning produces carbon dioxide and/or carbon monoxide.

SECTION 6. HEALTH HAZARD INFORMATION | TLV

Toluene is not considered a carcinogen by the NTP, IARC, or OSHA. **SUMMARY OF RISKS:** Vapors of toluene may cause irritation of the eyes, nose, upper respiratory tract, and skin. Exposure to 200 ppm for 8 hours causes mild fatigue, weakness, confusion, lacrimation (tearing) and paresthesia (a sensation of prickling, tingling, or creeping on the skin that has no objective cause). Exposure to higher concentrations may cause headache, nausea, dizziness, dilated pupils, and euphoria, and, in severe cases, may cause unconsciousness and death. The liquid is irritating to the eyes and skin. Contact with the eyes may cause transient corneal damage, conjunctival irritation, and burns if not promptly removed. Repeated and/or prolonged contact with the skin may cause drying and cracking. It may be absorbed through the skin in toxic amounts. Ingestion causes irritation of the gastrointestinal tract and may cause effects resembling those from inhalation of the vapor. Chronic overexposure to toluene may cause reversible kidney and liver injury. **FIRST AID: EYE CONTACT:** Immediately flush eyes, including under eyelids, with running water for at least 15 minutes. Get medical attention if irritation persists. * **SKIN CONTACT:** Immediately flush skin (for at least 15 minutes) while removing contaminated shoes and clothing. Wash exposed area with soap and water. Get medical attention if irritation persists or if a large area has been exposed. * **INHALATION:** Remove victim to fresh air. Restore and/or support breathing as required. Keep victim warm and quiet. Get medical help. * **INGESTION:** Give victim 1 to 2 glasses of water or milk. Contact a poison control center. Do not induce vomiting unless directed to do so. Transport victim to a medical facility. Never give anything by mouth to a person who is unconscious or convulsing. * **GET MEDICAL ASSISTANCE** - In plant, paramedic, community. Get medical help for further treatment, observation, and support after first aid, if indicated.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

SPILL/LEAK: Notify safety personnel of large spills or leaks. Remove all sources of heat and ignition. Provide maximum explosion-proof ventilation. Limit access to spill area to necessary personnel only. Remove leaking containers to safe place if feasible. Cleanup personnel need protection against contact with liquid and inhalation of vapor (see sect. 6). **WASTE DISPOSAL:** Absorb small spills with paper towel or vermiculite. Contain large spills and collect if feasible, or absorb with vermiculite or sand. Place waste solvent or absorbent into closed containers for disposal using nonsparking tools. Liquid can be flushed with water to an open holding area for handling. Do not flush to sewer, watershed, or waterway. **COMMENTS:** Place in suitable container for disposal by a licensed contractor or burn in an approved incinerator. Consider reclaiming by distillation. Contaminated absorbent can be buried in a sanitary landfill. Follow all Federal, state, and local regulations. TLm 96: 100-10 ppm. Toluene is designated as a hazardous waste by the EPA. The EPA (RCRA) HW No. is U220 (40 CFR 261). The reportable quantity (RQ) is 1000 lbs/454 kg (40 CFR 117).

SECTION 8. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation to meet TLV requirements. Ventilation fans and other electrical service must be nonsparking and have an explosion-proof design. Exhaust hoods should have a face velocity of at least 100 fpm (linear feet per minute) and be designed to capture heavy vapor. For emergency or nonroutine exposures where the TLV may be exceeded, use an organic chemical cartridge respirator if concentration is less than 200 ppm and an approved canister gas mask or self-contained breathing apparatus with full facepiece if concentration is greater than 200 ppm. Safety glasses or splash goggles should be worn in all work areas. Neoprene gloves, apron, face shield, boots, and other appropriate protective clothing and equipment should be available and worn as necessary to prevent skin and eye contact. Remove contaminated clothing immediately and do not wear it until it has been properly laundered.

Eyewash stations and safety showers should be readily available in use and handling areas.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

STORAGE SEGREGATION: Store in a cool, dry, well-ventilated area away from oxidizing agents, heat, sparks, or open flame. Storage areas must meet OSHA requirements for class IB flammable liquids. Use metal safety cans for handling small amounts. Protect containers from physical damage. Use only with adequate ventilation. Avoid contact with eyes, skin, or clothing. Do not inhale or ingest. Use caution when handling this compound because it can be absorbed through intact skin in toxic amounts. **SPECIAL HANDLING/STORAGE:** Ground and bond metal containers and equipment to prevent static sparks when making transfers. Do not smoke in use or storage areas. Use nonsparking tools. **ENGINEERING CONTROLS:** Frequent and periodic medical exams emphasizing the liver, kidneys, nervous system, lungs, heart, and blood should be provided. Workers exposed to concentrations greater than the action level (50 ppm) should be examined at least once a year. Use of alcohol can aggravate the toxic effects of toluene.

COMMENTS: Emptied containers contain product residues. Handle accordingly!

Toluene is designated as a hazardous substance by the EPA (40 CFR 116). DOT Classification: Flammable liquid. UN1294. Data Source(s) Code: 1-9, 12, 16, 20, 21, 24, 26, 34, 81, 82. CR

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Approvals *J.O. Resbaco, 11/86.*

Indust. Hygiene/Safety *JW 11-86*

Medical Review *[Signature]*



Section 1. Material Identification

Trichloroethylene (C₂HCl₃) Description: Derived by treating tetrachloroethane with lime or other alkali in the presence of water, or by thermal decomposition of tetrachloroethane followed by steam distillation. Stabilizers such as epichlorohydrin, isobutanol, carbon tetrachloride, chloroform, benzene, or pentanol-2-triethanolamine are then added. Used as a degreasing solvent in electronics and dry cleaning, a chemical intermediate, a refrigerant and heat-exchange liquid, and a diluent in paints and adhesives; in oil, fat, and wax extraction and in aerospace operations (flushing liquid oxygen). Formerly used as a fumigant (food) and anesthetic (replaced due to its hazardous decomposition in closed-circuit apparatus).
Other Designations: CAS No. 79-01-6; acrylene trichloride; Algylex; Anamenth; Benzinol; Cocolene; Chlorlyen; Dow-Tri; ethylene trichloride; Germalgene; Narcogen; Triasol; trichloroethene; TCE; 1,1,3-trichloroethylene.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*⁽⁷⁾ for a suppliers list.

R 1
I 2
S 2*
K 3
* Skin absorption

NFPA



HMS
H 2†
F 2
R 0
PPE†
† Chronic Effects
† Sec. 8

Cautions: TCE is irritating and toxic to the central nervous system (CNS). Inhalation of high concentrations have lead to death due to ventricular fibrillation. Chronic exposure may lead to heart, liver, and kidney damage. The liquid is absorbed through the skin. Although it has a relatively low flash point, TCE burns with difficulty.

Section 2. Ingredients and Occupational Exposure Limits

Trichloroethylene, < 100% (contains stabilizers (Sec. 1)).

1991 OSHA PELs

8-hr TWA: 50 ppm (270 mg/m³)
15-min STEL: 200 ppm (1080 mg/m³)

1990 IDLH Level
1000 ppm

1990 NIOSH REL

10-hr TWA: 25 ppm (-135 mg/m³)

1992-93 ACGIH TLVs

TWA: 50 ppm (269 mg/m³)
STEL: 200 ppm (1070 mg/m³)

1990 DFG (Germany) MAK
Ceiling: 50 ppm (270 mg/m³)

Category II: Substances with systemic effects
Half-life: 2 hr to shift length
Peak Exposure Limit: 250 ppm, 30 min average value; 2 peaks/shift

1965-86 Toxicity Data*

Human, inhalation, TC₅₀: 160 ppm/83 min caused hallucinations and distorted perceptions.
Human, lymphocyte: 5 mL/L caused DNA inhibition.
Rabbit, skin: 500 mg/24 hr caused severe irritation.
Rabbit, eye: 20 mg/24 hr caused moderate irritation.
Mouse, oral, TD₅₀: 455 mg/kg administered intermittently for 78 weeks produced liver tumors.

* See NIOSH, RTECS (KX4550000), for additional irritation, mutation, reproductive, tumorigenic and toxicity data.

Section 3. Physical Data

Boiling Point: 189 °F (87 °C)
Freezing Point: -121 °F (-85 °C)
Viscosity: 0.0055 Poise at 77 °F (25 °C)
Molecular Weight: 131.38
Density: 1.4649 at 20/4 °C
Refraction Index: 1.477 at 68 °F (20 °C/D)
Odor Threshold: 82 to 108 ppm (not an effective warning)

Vapor Pressure: 58 mm Hg at 68 °F (20 °C); 100 mm Hg at 32 °F (0 °C)
Saturated Vapor Density (Air = 0.075 lb/ft³; 1.2 kg/m³): 0.0956 lb/ft³; 1.53 kg/m³
Water Solubility: Very slightly soluble; 0.1% at 77 °F (25 °C)
Other Solubilities: Highly soluble in organic solvents (alcohol, acetone, ether, carbon tetrachloride, & chloroform) and lipids.
Surface Tension: 29.3 dyne/cm

Appearance and Odor: Clear, colorless (sometimes dyed blue), mobile liquid with a sweet chloroform odor.

Section 4. Fire and Explosion Data

Flash Point: 90 °F (32 °C) CC | Autoignition Temperature: 788 °F (420 °C) | LEL: 8% (25 °C); 12.5% (100 °C) | UEL: 10% (25 °C); 90% (100 °C)

Extinguishing Media: A Class 1C Flammable Liquid. Although it has a flash point of 90 °F, TCE burns with difficulty. For small fires, use dry chemical, carbon dioxide, water spray, or regular foam. For large fires, use water spray, fog, or regular foam. **Unusual Fire or Explosion Hazards:** Vapor/air mixtures may explode when ignited. Container may explode in heat of fire. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighters' protective clothing provides only limited protection against TCE. Apply cooling water to sides of container until well after fire is out. Stay away from ends of tanks. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: TCE slowly decomposes in the presence of light and moisture to form corrosive hydrochloric acid. Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Include alkalis (sodium hydroxide), chemically active metals (aluminum, beryllium, lithium, magnesium, sodium, potassium, and titanium), epoxides, and oxidants (nitrogen tetroxide, perchloric acid). Contact with 1-chloro-2,3-epoxy prop or the mono and di 2,3-epoxypropyl ethers of 1,4-butanediol + 2,2-bis-(4(2,3'-epoxypropoxy)-phenyl)propane can, in the presence of catalytic quantities of halide ions, cause dehydrochlorination of TCE to explosive dichloroacetylene. **Conditions to Avoid:** Exposure to light, moisture, ignition sources, and incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of TCE (above 300 °C) or exposure to ultraviolet light can produce carbon dioxide (CO₂) and toxic dichloro acetylene (explosive), chlorine, hydrogen chloride, and phosgene gas.

Section 6. Health Hazard Data

Carcinogenicity: The following agencies have rated TCE's carcinogenicity: IARC (Class 3, limited animal evidence & insufficient human data), Germany MAK (Class B, justifiably suspected of having carcinogenic potential), & NIOSH (Class X, carcinogen defined with no further categorization). **Summary of Risks:** TCE vapor is irritating to the eyes, nose, and respiratory tract and inhalation of high concentrations can lead to severe CNS effects such as unconsciousness, ventricular arrhythmias, and death due to cardiac arrest. Mild liver dysfunction was also seen at levels high enough to produce CNS effects. Contact with the liquid is irritating to the skin and can lead to dermatitis by defatting the skin. Chronic toxicity is observed in the victims increasing intolerance to alcohol characterized by 'degreasers' flush', a transient redness of the face, trunk, and arms. The euphoric effect of TCE has led to craving, and habitual snuffing of its vapors.

Continue on next p.

Section 6. Health Hazard Data, Continued

TCE crosses the placental barrier and thus exposes the fetus (any effects are yet unknown). There are increased reports of menstrual disorders in women workers and decreased libido in males at exposures high enough to cause CNS effects. TCE is eliminated unchanged in expired air and as metabolites (trichloroacetic acid & trichloroethanol) in blood and urine. **Medical Conditions Aggravated by Long-Term Exposure:** Disorders of the nervous system, skin, heart, liver, and kidney. **Target Organs:** Respiratory, central & peripheral nervous, and cardiovascular (heart) systems, liver, kidney, and skin. **Primary Entry Routes:** Inhalation, skin and eye contact, and ingestion (rarely). **Acute Effects:** Vapor inhalation can cause eye, nose, and throat irritation, nausea, blurred vision, overexcitement, headache, drunkenness, memory loss, irregular heartbeat (resulting in sudden death), unconsciousness, and death due to cardiac failure. Skin contact with the liquid can cause dryness and cracking and prolonged exposure (generally if the victim is unconscious) can cause blistering. Eye contact can cause irritation and watering, with corneal epithelium injury (possibly blood-stained), drowsiness, and risk of pulmonary edema (fluid in lungs). **Chronic Effects:** Effects may persist for several weeks or months after repeated exposure. Symptoms include giddiness, irritability, headache, digestive disturbances, mental confusion, intolerance to alcohol (degreasers flush), altered color perception, loss or impairment of sense of smell, double vision, and peripheral nervous system function impairment including persistent neuritis, temporary loss of sense of touch, and paralysis of the fingers from direct contact with TCE liquid.

FIRST AID **Eyes:** Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, have that conscious and alert person drink 1 to 2 glasses of water, then induce vomiting. Do not give milk, as its fat content (TCE is lipid soluble) may enhance gastrointestinal absorption of TCE. **Note to Physicians:** TCE elimination seems to be triphasic with half lives at 20 min, 3 hr, and 30 hr. Some success is seen in treating patients with propranolol, atropine, and disulfiram. Monitor urine and blood (lethal level = 3 to 110 µg/mL) metabolites. BEI = 100 mg/g creatinine (trichloroacetic acid) in urine, sample at end of workweek. BEI = 4 mg/L (trichloroethanol) in blood, sample at end of shift at end of the workweek. These tests are not 100% accurate indicators of exposure; monitor TCE in expired air as a confirmatory test.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Immediately notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off all ignition sources. For small spills, take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable container for later disposal. For large spills, flush to containment area where density stratification will form a bottom TCE layer which can be pumped and contained. Report any release in excess of 1000 lbs. Follow applicable OSHA regulations (29 CFR 1910.120). **Ecotoxicity Values:** Bluegill sunfish, LC₅₀ = 44,700 µg/L/96 hr; fathead minnow (*Pimephales promelas*), LC₅₀ = 40.7 mg/L/96 hr. **Environmental Degradation:** In air, TCE is photooxidized with a half-life of 5 days and reported to form phosgene, dichloroacetyl chloride, and formyl chloride. In water it evaporates rapidly in minutes to hours. TCE rapidly evaporates and may leach since it does not absorb to sediment. **Soil Absorption/Mobility:** TCE has a Log K_{oc} of 2, indicating high soil mobility. **Disposal:** Waste TCE can be poured on dry sand and allowed to vaporize in isolated location, purified by distillation, or returned to supplier. A potential candidate for rotary kiln incineration at 1508 to 2912 °F (820 to 1600 °C) with an acid scrubber to remove halo acids. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

Listed as a RCRA Hazardous Waste (40 CFR 261.33 & 261.31): No. U228 & P002 (spent solvents)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 100 lb (45.4 kg) [* per RCRA, Sec. 3001, CWA Sec. 311 (b)(4), & CWA Sec. 307 (a)]

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear chemical safety goggles (cup-type or rubber framed, equipped with impact-resistant glass), per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. At any detectable concentration, wear a SCBA with a full facemask operated in pressure demand or other positive pressure mode. For emergency or nonroutine operations (clearing spills, reactor vessels, or storage tanks), wear an SCBA. **Warning!** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. If respirators are used, OSHA requires a respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets made from Viton or Neoprene to prevent skin contact. Do not use natural rubber or polyvinyl chloride (PVC). **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.⁽¹⁹⁾ **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Remove this material from your shoes and clean personal protective equipment. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Store in steel drums, in a cool, dry, well-ventilated area away from sunlight, heat, ignition sources, and incompatibles (Sec. 5). Store large quantities in galvanized iron, black iron, or steel containers; small amounts in dark (amber) colored glass bottles. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. Design processes so that the operator is not directly exposed to the solvent or its vapor. Do not use open electric heaters, high-temperature processes, arc-welding or open flames in TCE atmospheres. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers with emphasis on skin, respiratory, cardiac, central and peripheral nervous systems, and liver and kidney function. Employ air and biological monitoring (BEIs). Instruct employees on safe handling of TCE.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Trichloroethylene

DOT Hazard Class: 6.1

ID No.: UN1710

DOT Packing Group: III

DOT Label: Keep Away From Food

DOT Special Provisions (172.102): N36, T1

Packaging Authorizations

a) Exceptions: 173.153

b) Non-bulk Packaging: 173.203

c) Bulk Packaging: 173.241

Quantity Limitations

a) Passenger Aircraft or Railcar: 60L

b) Cargo Aircraft Only: 220L

Vessel Stowage Requirements

a) Vessel Stowage: A

b) Other: 40

MSDS Collection References: 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 149, 153, 159, 163, 164, 167, 168, 171, 174, 175, 176, 180.
Prepared by: M Gannon, BA; Industrial Hygiene Review: D Wilson, CIH; Medical Review: AC Darlington, MD

Material Safety Data Sheet

from Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
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No. 679

1,1,2-TRICHLOROETHANE

Issued: November 1988

SECTION 1. MATERIAL IDENTIFICATION

27

Material Name: 1,1,2-TRICHLOROETHANE

Description (Origin/Uses): Prepared by the catalytic chlorination of ethane or ethylene. Used as a solvent for fats, waxes, natural resins, and alkaloids.

Other Designations: B-Trichloroethane; Ethane Trichloride; Vinyl Trichloride; $\text{CH}_2\text{ClCHCl}_2$;
CAS No. 0079-00-5

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek*
Buyers' Guide (Genium ref. 73) for a list of suppliers.



Genium

HMIS
H 1 R 1
F 0 I 4
R 0 S 2
PPG*
*See sect. 8 K 0

SECTION 2. INGREDIENTS AND HAZARDS

1,1,2-Trichloroethane, CAS No. 0079-00-5

%

Ca 100

EXPOSURE LIMITS

*This material can be absorbed through intact skin, which contributes to overall exposure.
**See NIOSH, RTECS (KJ3150000), for additional data with references to irritative, tumorigenic, and mutagenic effects.

OSHA PEL (Skin*)
8-Hr TWA: 10 ppm, 45 mg/m³
ACGIH TLV (Skin*), 1988-89
TLV-TWA: 10 ppm, 45 mg/m³
NIOSH REL
Lowest Feasible Level
Toxicity Data**
Rat. Oral, LD₅₀: 580 mg/kg
Rat. Inhalation, LC₅₀: 500 ppm (8 Hrs)

SECTION 3. PHYSICAL DATA

Boiling Point: 237°F (114°C)
Melting Point: -33°F (-36°C)
% Volatile by Volume: 100
Vapor Pressure: 19 Torrs at 68°F (20°C)

Molecular Weight: 133 Grams/Mole
Solubility in Water (%): Insoluble
Specific Gravity (H₂O = 1): 1.4416 at 68°F (20°C)

Appearance and Odor: A colorless, nonflammable liquid; sweet, pleasant odor resembling chloroform.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point* **Autoignition Temperature*** **LEL*** **UEL***

Extinguishing Media: *1,1,2-Trichloroethane does not burn. Use an extinguishing agent such as "alcohol" foam, water spray, carbon dioxide, or dry chemical to put out the surrounding fire.

Unusual Fire or Explosion Hazards: None reported.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode to protect against the harmful effects of the surrounding fire.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: 1,1,2-Trichloroethane is stable in closed containers during routine operations at room temperature. Hazardous polymerization cannot occur.

Chemical Incompatibilities: 1,1,2-Trichloroethane can react dangerously with strong caustics such as sodium hydroxide and chemically active metals such as sodium, potassium, powdered magnesium, aluminum, and sodium-potassium alloys.

Conditions to Avoid: Prevent exposure to these incompatible materials.

Hazardous Products of Decomposition: Thermal-oxidative degradation of this liquid can produce toxic gases such as carbon monoxide (CO) and oxides of chlorine (ClO₂).

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: 1,1,2-Trichloroethane is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: Inhaling 1,1,2-trichloroethane vapor or absorbing the liquid through the skin depresses the central nervous system (CNS), which can progress to narcosis. Administration of this liquid to experimental animals has produced liver damage (fatty degeneration) and has induced cancer of the liver in mice. 1,1,2-Trichloroethane is 10 to 20 times more toxic than the trichloroethylene congener. **Medical Conditions Aggravated by Long-Term Exposure:** Persons with a history of chronic respiratory, liver, or kidney disease may be at increased risk from exposure to this liquid. Preplacement questionnaires are recommended. **Target Organs:** Skin, eyes, CNS, respiratory system, liver, and kidneys. **Primary Entry:** Inhalation, skin contact/absorption. **Acute Effects:** Irritation of skin, eyes, nose, throat, and mucous membranes; and anesthesia manifested by CNS effects such as headache, dizziness, drowsiness, and incoordination. **Chronic Effects:** Liver and kidney damage and eventually coma and death may occur. Removal from exposure will reverse this progression. **FIRST AID:** **Eyes.** Immediately flush eyes, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 minutes. **Skin.** Rinse the affected area with flooding amounts of water, then wash it with soap and water. **Inhalation.** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. Keep the exposed person warm and at rest until medical help is available. **Ingestion.** Unlikely. Get medical help (in plant, paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, evacuate unnecessary personnel, and provide adequate ventilation. Cleanup personnel should wear protective clothing and equipment (see sect. 8). Soak up the spilled 1,1,2-trichloroethane onto a suitable absorbent such as vermiculite or sawdust and place it into containers suitable for disposal. **Waste Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z).

EPA Designations (40 CFR 302.4)

RCRA Waste, No. U227

CERCLA Hazardous Substance, Reportable Quantity: 1 lb (0.454 kg), per the Clean Water Act (CWA), § 307 (a); and the Resource Conservation and Recovery Act (RCRA), § 3001.

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Use a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, and gauntlets, etc., to prevent skin contact with 1,1,2-trichloroethane. **Ventilation:** Install and operate general and local ventilation systems powerful enough to maintain airborne levels of this material below the OSHA PEL standard cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from your shoes and equipment. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Do not inhale 1,1,2-trichloroethane vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store 1,1,2-trichloroethane in closed containers in a cool, dry, well-ventilated area away from incompatible chemicals (see sect. 5). **Special Handling/Storage:** Storage facilities must have adequate ventilation because this volatile liquid can evaporate and build up hazardous concentrations in these areas.

Transportation Data (49 CFR 172.101-2): Not Listed

References: 1, 38, 84-94, 100, 116, 117, 120, 122.

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Industrial Hygiene Review: DJ Wilson, CIH

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Material Safety Data Sheet

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No. 197

ZINC CHLORIDE,
SOLID

Issue: June 1986

SECTION 1. MATERIAL IDENTIFICATION

MATERIAL NAME: ZINC CHLORIDE, SOLID

DESCRIPTION: Inorganic salt

OTHER DESIGNATIONS: CAS #7646-85-7, ZnCl₂, Zinc Butter

MANUFACTURER/SUPPLIER: Available from several suppliers, including:
Mallinckrodt, Inc., PO Box M, Paris, KY 40361; Telephone: (606) 987-7000

| | |
|--------------|-----------|
| | |
| HMIS | Not Found |
| H: 1 | |
| F: 0 | R - |
| R: 0 | I 3 |
| PPE* | S 3 |
| *See Sect. 8 | K 0 |

SECTION 2. INGREDIENTS AND HAZARDS

Zinc Chloride, Solid, CAS #7646-85-7

%

HAZARD DATA

100

8-hr. TWA:
1 mg/m³*

* Current OSHA PEL and ACGIH (1985-86) TLV for zinc chloride fumes.

Rat, Oral, LD₅₀:
350 mg/kg

Man, Inhalation, TCLo:
4800 mg/m³/30 min.

Mouse, Intraperitoneal, TDLo:
12500 µg/kg (110 Days Pregnant)

SECTION 3. PHYSICAL DATA

Boiling Point ... 1349.6°F (732°C)
Vapor Pressure, mm Hg @ 428°C ... 1.0
Water Solubility @ 25°C, g/100g H₂O ... 423
Vapor Density (Air=1) ... Not Found
Evaporation Rate ... Not Found

Specific Gravity (H₂O = 1) ... 2.91
Melting Point ... 554°F (290°C)
Percent Volatile by Volume ... Not Found
Molecular Weight ... 136.3
pH (Aqueous Solution) ... 4.0

Appearance and odor: White crystalline granules. Odorless.

SECTION 4. FIRE AND EXPLOSION DATA

| | | | LOWER | UPPER |
|------------------------|--------------------|----------------------------|-----------|-----------|
| Flash Point and Method | Autoignition Temp. | Flammability Limits in Air | Not Found | Not Found |
| Noncombustible | Not Found | Not Found | Found | Found |

EXTINGUISHING MEDIA: Zinc chloride is a noncombustible solid. Use suitable extinguishing media for surrounding fire.

UNUSUAL FIRE/EXPLOSION HAZARDS: This material is not considered to be an explosion hazard.

SPECIAL FIRE-FIGHTING PROCEDURES: Use water spray to cool fire-exposed containers and surrounding combustibles. Fire fighters should use self-contained breathing apparatus and wear fully protective clothing.

SECTION 5. REACTIVITY DATA

Zinc chloride is stable. Hazardous polymerization cannot occur.

This material is incompatible with cyanides and sulfides. An explosion on impact is possible when it has been mixed with potassium.

Thermal decomposition products of zinc chloride may include toxic fumes of chlorine and zinc oxide.

SECTION 6. HEALTH HAZARD INFORMATION

Zinc chloride is not listed as a carcinogen by the IARC, NTP, or OSHA.

SUMMARY OF RISKS: Inhalation of zinc chloride dust may be corrosive to the respiratory tract. Zinc chloride is deliquescent. Contact with skin and mucous membranes can be corrosive. Sensitization may occur in the form of eczematoid dermatitis. Eye contact may cause redness and pain. Ingestion may cause corrosive effects to the esophagus and stomach. Delayed complications can involve esophageal and/or pyloric strictures. **TARGET ORGANS:** Respiratory tract, skin, eyes, and gastrointestinal tract. **PRIMARY ENTRY:** Inhalation, ingestion. **ACUTE EFFECTS:** Inhalation may cause sore throat and coughing. Ingestion may cause abdominal pain and vomiting. Eye or skin contact may cause severe irritation or burns. **CHRONIC EFFECTS:** Not found.

FIRST AID: **EYE CONTACT:** Flush eyes thoroughly with running water, including under the eyelids, for at least 15 minutes. Get medical help.* **SKIN CONTACT:** Remove contaminated clothing. Flush affected area with water, wash with soap and water. Get medical help.* **INHALATION:** Remove victim to fresh air. Restore and/or support his breathing as required. Get medical help.* **INGESTION:** Rinse victim's mouth with water. Give him 2 to 3 glasses of water to drink to dilute material. Do not induce vomiting. Vomiting may occur spontaneously. Never give anything by mouth to someone who is unconscious or convulsing. Get medical help.*

* GET MEDICAL ASSISTANCE = In plant, paramedic, community. Get medical help for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Notify safety personnel of zinc chloride spills. Provide adequate ventilation. Cleanup personnel need protection against inhalation of zinc chloride dust or mist. Sweep up or vacuum waste (avoid generating dust) and place it in an appropriate container for reclamation or disposal. Absorb liquid spills on vermiculite or dry sand. Neutralize the material with slaked lime or sodium bicarbonate. Flush residue with a lot of water.

DISPOSAL: Bury scrap in an approved landfill. Follow Federal, state, and local regulations.

EPA, Clean Water Act, Reportable Spill Quantity: 5,000 lbs.

SECTION 8. SPECIAL PROTECTION INFORMATION

Wear chemical safety goggles for dusty conditions and rubber gloves.

Where dusty conditions occur, use a NIOSH-approved respirator.

Where dusty conditions prevail, provide local exhaust.

Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them.

Wear body-protective clothing appropriate to the work situation to minimize skin contact with this material. Prevent eye contact by wearing chemical safety goggles and/or a full face shield where splashing of solutions is possible. Soiled clothing must be laundered before it is worn again. Eyewash stations and washing facilities should be available to areas of use and handling.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Store zinc chloride in tightly closed containers in a cool, dry, well-ventilated area. Protect containers from physical damage.

Practice good housekeeping to prevent accumulation of dust.

Avoid breathing zinc chloride dust. Minimize skin contact by wearing proper gloves and suitable work clothing appropriate to the work situation. Practice good personal hygiene. Wash thoroughly after handling. **DO NOT INGEST THIS MATERIAL!**

Zinc chloride is designated as a hazardous substance by EPA (40 CFR 116).

DOT Classification: ORM-E

DOT No. UN2331

Label: None

Data Source(s) Code: 1, 2, 4-7, 9, 10, 12, 25, 26, 43, 58, 63, 75, 81, 82, 84. CK

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Approvals *J.O. Ambrose, 1/87.*

Indust. Hygiene/Safety *JW 1/87*

Medical Review *[Signature]*

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Material Safety Data Sheets Collection:

Sheet No. 318
Xylene (Mixed Isomers)

Issued: 11/80 Revision: E, 9/92

Section 1. Material Identification

Xylene (Mixed Isomers) (C₈H₁₀) Description: The commercial product is a blend of the three isomers (*ortho*-(*o*-), *meta*-(*m*-), *para*-(*p*-)) with the largest proportion being *m*-xylene. Xylene is obtained from coal tar, toluene by transalkylation, and pseudocumene. Used in the manufacture of dyes, resins, paints, varnishes, and other organics; as a general solvent for adhesives, a cleaning agent in microscope technique; as a solvent for Canada balsam microscopy; as a fuel component; in aviation gasoline, protective coatings, sterilizing catgut, hydrogen peroxide, perfumes, insect repellents, pharmaceuticals, and the leather industry; in the production of phthalic anhydride, isophthalic, and terephthalic acids and their dimethyl esters which are used in the manufacture of polyester fibers; and as an indirect food additive as a component of adhesives. Around the home, xylene is found as vehicles in paints, paint removers, degreasing cleaners, lacquers, glues and cements and as solvent/vehicles for pesticides.

Other Designations: CAS No. 1330-20-7 [95-47-6; 108-38-3; 106-42-3 (*o*-, *m*-, *p*-isomers)], dimethylbenzene, methyltoluene, NCI-C55232, Violet 3, xylol

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*^(TM) for a suppliers list.

| | | |
|----------------------------|----|--|
| R | 1 | |
| I | 2 | |
| S | 2 | |
| K | 3 | |
| NFPA | | |
| HMIS | | |
| H | 2+ | |
| F | 3 | |
| R | 0 | |
| PPE ‡ | | |
| ‡ Chroma: Effects ‡ Sec. 8 | | |

Cautions: Xylene is an eye, skin, and mucous membrane irritant and may be narcotic in high concentrations. It is a dangerous fire hazard.

Section 2. Ingredients and Occupational Exposure Limits

Xylene (mixed isomers): the commercial product generally contains ~ 40% *m*-xylene; 20% each of *o*-xylene, *p*-xylene, and ethylbenzene; and small quantities of toluene. Unpurified xylene may contain pseudocumene.

1991 OSHA PELs
8-hr TWA: 100 ppm (435 mg/m³)
15-min STEL: 150 ppm (655 mg/m³)

1990 IDLH Level
1000 ppm

1990 NIOSH RELs
TWA: 100 ppm (435 mg/m³)
STEL: 150 ppm (655 mg/m³)

1992-93 ACGIH TLVs
TWA: 100 ppm (434 mg/m³)
STEL: 150 ppm (631 mg/m³)
BEI (Biological Exposure Index): Methylhippuric acids in urine at end of shift: 1.5 g/g creatinine

1990 DFG (Germany) MAK
TWA: 100 ppm (440 mg/m³)
Category II: Substances with systemic effects
Half-life: < 2 hr
Peak Exposure: 200 ppm, 30 min, average value, 4 peaks per shift

1985-86 Toxicity Data*
Human, inhalation, TC₁₀: 200 ppm produced olfaction effects, conjunctive irritation, and other changes involving the lungs, thorax, or respiration. Man, inhalation, LC₅₀: 10000 ppm/6 hr; toxic effects not yet reviewed.
Human, oral, LD₅₀: 50 mg/kg; no toxic effect noted.
Rat, oral, LD₅₀: 4300 mg/kg; toxic effect not yet reviewed.
Rat, inhalation, LC₅₀: 5000 ppm/4 hr; toxic effects not yet reviewed.

* See NIOSH, RTECS (XE2100000), for additional toxicity data.

Section 3. Physical Data

Boiling Point Range: 279 to 284 °F (137 to 140 °C)
Boiling Point: *ortho*: 291 °F (144 °C); *meta*: 281.8 °F (138.8 °C); *para*: 281.3 °F (138.5 °C)
Freezing Point/Melting Point: *ortho*: -13 °F (-25 °C); *meta*: -53.3 °F (-47.4 °C); *para*: 55 to 57 °F (13 to 14 °C)
Vapor Pressure: 6.72 mm Hg at 70 °F (21 °C)
Saturated Vapor Density (Air = 1.2 kg/m³): 1.23 kg/m³, 0.077 lb/ft³

Appearance and Odor: Clear, sweet-smelling liquid.

* Materials with wider and narrower boiling ranges are commercially available.

Molecular Weight: 106.16
Specific Gravity: 0.864 at 20 °C/4 °C
Water Solubility: Practically insoluble
Other Solubilities: Miscible with absolute alcohol, ether, and many other organic liquids.
Octanol/Water Partition Coefficient: logKow = 3.12-3.20
Odor Threshold: 1 ppm
Viscosity: <32.6 SUS

Section 4. Fire and Explosion Data

Flash Point: 63 to 77 °F (17 to 25 °C) CC | Autoignition Temperature: 982 °F (527 °C) (*m*-) | LEL: 1.1 (*m*-, *p*-); 0.9 (*o*-) | UEL: 7.0 (*m*-, *p*-); 6.7 (*o*-)

Extinguishing Media: For small fires, use dry chemical, carbon dioxide (CO₂), water spray or regular foam. For large fires, use water spray, fog or regular foam. Water may be ineffective. Use water spray to cool fire-exposed containers. Unusual Fire or Explosion Hazards: Xylene vapors or liquid (which floats on water) may travel to an ignition source and flash back. The heat of fire may cause containers to explode and/or produce irritating or poisonous decomposition products. Xylene may present a vapor explosion hazard indoors, outdoors, or in sewers. Accumulated static electricity may occur from vapor or liquid flow sufficient to cause ignition. Special Fire-fighting Procedures: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facemask operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing will provide limited protection. If feasible and without risk, move containers from fire area. Otherwise, cool fire-exposed containers until well after fire is extinguished. Stay clear of tank ends. Use unmanned hose holder or monitor nozzles if massive cargo fires. If impossible, withdraw from area and let fire burn. Withdraw immediately in case of any tank discoloration or rising sound from venting safety device. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Xylene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Xylene is easily chlorinated, sulfonated, or nitrated. Chemical Incompatibilities: Incompatibilities include strong acids and oxidizers and 1,3-dichloro-5,5-dimethyl-2,4-imidazolidindione (dichlorohydrantoin). Xylene attacks some forms of plastics, rubber, and coatings. Conditions to Avoid: Avoid heat and ignition sources and incompatibles. Hazardous Products of Decomposition: Thermal oxidative decomposition of xylene can produce carbon dioxide, carbon monoxide, and various hydrocarbon products.

Section 6. Health Hazard Data

Carcinogenicity: The IARC⁽¹⁴⁴⁾ NTP⁽¹⁴⁶⁾ and OSHA⁽¹⁴⁴⁾ do not list xylene as a carcinogen. Summary of Risks: Xylene is an eye, mucous membrane, and respiratory tract irritant. Irritation starts at 200 ppm; severe breathing difficulties which may be delayed in onset can occur at high concentrations. It is a central nervous system (CNS) depressant and at high concentrations can cause coma. Kidney and liver damage can occur with xylene exposure. With prolonged or repeated cutaneous exposure, xylene produces a defatting dermatitis. Chronic toxicity is not well defined, but is less toxic than benzene. Prior to the 1950s, benzene was often found as a contaminant of xylene and the effects attributed to xylene such as blood dyscrasias are questionable. Since the late 1950s, xylenes have been virtually benzene-free and blood dyscrasias have not been associated with xylenes. Chronic exposure to high concentrations of xylene in animal studies have demonstrated milk reversible decrease in red and white cell counts as well as increases in platelet counts.

Continued on next page

Section 6. Health Hazard Data, continued

irregularly was reported in association with workplace exposure to xylene perhaps due to effects on liver metabolism. Xylene crosses the human placenta, but does not appear to be teratogenic under conditions tested to date. **Medical Conditions Aggravated by Long-Term Exposure:** CNS, respiratory, eye, skin, gastrointestinal (GI), liver and kidney disorders. **Target Organs:** CNS, eyes, GI tract, liver, kidneys, and skin. **Primary Entry Routes:** Inhalation, skin absorption (slight), eye contact, ingestion. **Acute Effects:** Inhalation of high xylene concentrations may cause dizziness; nausea, vomiting, and abdominal pain; eye, nose, and throat irritation; respiratory tract irritation leading to pulmonary edema (fluid in lung); drowsiness; and unconsciousness. Direct eye contact can result in conjunctivitis and corneal burns. Ingestion may cause a burning sensation in the oropharynx and stomach and transient CNS depression. **Chronic Effects:** Repeated or prolonged skin contact may cause drying and defatting of the skin leading to dermatitis. Repeated eye exposure to high vapor concentrations may cause reversible eye damage, peripheral and central neuropathy, and liver damage. Other symptoms of chronic exposure include headache, fatigue, irritability, chronic bronchitis, and GI disturbances such as nausea, loss of appetite, and gas.

FIRST AID *Emergency personnel should protect against exposure.* **Eyes:** Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. Carefully dispose of contaminated clothing as it may pose a fire hazard. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. Monitor exposed person for respiratory distress. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, do not induce vomiting! If spontaneous vomiting should occur, keep exposed person's head below the hips to prevent aspiration (breathing liquid xylene into the lungs). **Aspiration of a few millimeters of xylene can cause chemical pneumonitis, pulmonary edema, and hemorrhage.** Note to Physicians: Hippuric acid or the ether glucuronide of ortho-toluic acid may be useful in diagnosis of meta-, para- and ortho-xylene exposure, respectively. Consider gastric lavage if a large quantity of xylene was ingested. Proceed gastric lavage with protection of the airway from aspiration; consider endotracheal intubation with inflated cuff.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove all heat and ignition sources, and ventilate spill area. Cleanup personnel should protect against vapor inhalation and skin or eye contact. If feasible and without undue risk, stop leak. Use appropriate foam to blanket, release and suppress vapors. Water spray may reduce vapor, but does not prevent ignition in closed spaces. For small spills, absorb on paper and evaporate in appropriate exhaust hood or absorb with sand or some non-combustible absorbent and place in containers for later disposal. For large spills, dike far ahead of liquid to contain. Do not allow xylene to enter a confined space such as sewers or drains. On land, dike to contain or divert to impermeable holding area. Apply water spray to control flammable vapor and remove material with pumps or vacuum equipment. On water, contain material with natural barriers, booms, or weirs; apply universal gelling agent; and use suction hoses to remove spilled material. Report any release in excess of 1000 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** Little bioconcentration is expected. Biological oxygen demand 5 (after 5 days at 20 °C): 0.64 (no stated isomer). **Ecotoxicity values:** LD₅₀ Goldfish, 13 mg/L/24 hr, conditions of bioassay not specified, no specific isomer. **Environmental Degradation:** In the atmosphere, xylenes degrade by reacting with photochemically produced hydroxyl radicals with a half-life ranging from 1-1.7 hr. in the summer to 10-18 hr. in winter or a typical loss of 67-86% per day. Xylenes are resistant to hydrolysis. **Soil Absorption/Mobility:** Xylenes have low to moderate adsorption to soil and when spilled on land, will volatilize and leach into groundwater. **Disposal:** As a hydrocarbon, xylene is a good candidate for controlled incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

SARA Extremely Hazardous Substance (40 CFR 355): Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U239, F003 (spent solvent)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per Clean Water Act, Sec. 311(b)(4), per RCRA, Sec. 3001]

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For concentrations >1000 ppm, use any chemical cartridge respirator with organic vapor cartridges; any powered, air-purifying respirator with organic vapor cartridges; any supplied-air respirator; or any self-contained breathing apparatus. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning!** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. If respirators are used, Other: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent all skin contact. With breakthrough times > 8 hr, consider polyvinyl alcohol and fluorocarbon rubber (Viton) as materials for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source. **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing. Remove this material from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in clearly labelled, tightly closed, containers in a cool, well-ventilated place, away from strong oxidizing materials and heat and ignition sources. During transferring operations, electrically ground and bond metal containers. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. Use hermetically sealed equipment, transfer xylene in enclosed systems, avoid processes associated with open evaporating surfaces, and provide sources of gas release with enclosures and local exhaust ventilation. Use Class I, Group D electrical equipment. **Administrative Controls:** Establish air and biological monitoring programs and evaluate regularly. Consider preplacement and periodic medical examinations including a complete blood count, a routine urinalysis, and liver function tests. Consider hematologic studies if there is any significant contamination of the solvent with benzene. If feasible, consider the replacement of xylene by less toxic solvents such as petrol (motor fuel) or white spirit. Before carrying out maintenance and repair work, steam and flush all equipment to remove any xylene residues.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Xylenes

DOT Hazard Class: 3

ID No.: UN1307

DOT Packing Group: II

DOT Label: Flammable Liquid

Special Provisions (172.102): T1

Packaging Authorizations

a) Exceptions: 173.150

b) Nonbulk Packaging: 173.202

c) Bulk Packaging: 173.242

Quantity Limitations

a) Passenger, Aircraft, or Railcar: 5L

b) Cargo Aircraft Only: 60L

Vessel Stowage Requirements

a) Vessel Stowage: B

b) Other: -

MSDS Collection References: 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 149, 153, 159, 163, 164, 167, 171, 174, 176, 180

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