HEALTH AND SAFETY PLAN
REMOVAL OF TANKS AND STRUCTURES

Commercial Oil Services
Oregon, Ohio

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CONESTOGA-ROVERS & ASSOCIATES

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1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been prepared for the Removal of Tanks and Structures at the Commercial Oil Services Site (Site) in Oregon, Ohio. This HASP has been prepared by Conestoga-Rovers and Associates (CRA) on behalf of the Commercial Oil Services Phase II Trust. The project involves the removal of above ground tanks, underground tanks and associated contaminated soils, and miscellaneous debris; and the demolition of structures.

During removal activities, personnel may come in contact with the chemicals listed in Table 1. Material Safety Data Sheets for these chemicals are provided in Appendix A. The Contaminants of Concern for the Site are listed in Table 2. The Contaminants of Concern were determined by an evaluation of the chemicals listed in Table 1. The evaluation was based on prevalent chemical concentrations and chemical characteristics.

The routes of entry causing primary concern with the chemicals listed in Table 1 are through skin adsorption, inhalation and ingestion. The possible ingestion of these compounds will be controlled through proper hygiene practices.

Work at the Site may involve contact with materials potentially containing toxic and/or flammable materials, explosion hazards presented by contained volatile substances, and physical hazards presented by heavy construction. Asbestos containing materials (ACM) will be inspected for and removed and disposed of as necessary. The activity specific risks associated with removal activities are listed in Table 3.

This Health and Safety Plan (HASP) is designed to ensure:

1) that personnel working on-Site are not exposed to hazardous materials which could adversely affect their health and safety;

2) that the health and safety of the general public and the environment is not compromised by off-Site migration of contaminated materials; and

TABLE 1

CONTAMINANT PROFILE FOR COMMERCIAL OIL SERVICES SITE

Compound	*Lagoon Sludge*	*Tank Contents*	*Maximum Concentration (ppm)*
VOCs			
acetone	X	X	300
benzene	–	X	4.1
butanone	X	--	3.8
2-butanone	--	X	8.8
chlorobenzene	X	X	92
1,1-dichloroethene	--	X	0.7
1,2-dichloroethane	--	X	0.3
ethylbenzene	X	X	15,000
trichloroethene	--	X	18,000
1,1,1-trichloroethane	X	--	95
tetrachloroethene	--	X	520,000
toluene	X	X	7,300
xylenes	X	X	84,000

TABLE 1

CONTAMINANT PROFILE FOR COMMERCIAL OIL SERVICES SITE

Compound	*Lagoon Sludge*	*Tank Contents*	*Maximum Concentration (ppm)*
SVOCs			
acenaphthene	X	X	1,800
acenaphthylene	X	X	1,200
anthracene	X	X	<1000
benzo(a)anthracene	X	X	740
benzo(b,k)fluoranthene	X	--	440
benzo(a)pyrene	X	--	590
benzo(g,h,i)perylene	X	--	32
bis(2-ethylhexyl)phthalate	X	X	2,000
butylbenzyl phthalate	X	X	3,000
4-chloro-3-methylphenol	--	X	500
chrysene	X	X	1,400
dibenz(a,h)anthracene	X	--	34
diethylphthalate	--	X	390
di-n-butylphthalate	X	X	120
di-n-octylphthalate	--	X	70
fluoranthene	X	X	3,400
fluorene	X	X	1,500
2-methylnapthalene	X	X	29,000
napthalene	X	X	6,900
phenanthrene	X	X	6,800
phenol	X	X	1,100
pyrene	X	X	2,800
pentachlorophenol	--	X	<315
PCBs	X	X	47

TABLE 1

CONTAMINANT PROFILE FOR COMMERCIAL OIL SERVICES SITE

Compound	*Lagoon Sludge*	*Tank Contents*	*Maximum Concentration (ppm)*
INORGANICS			
beryllium	X	X	11
cadmium	X	X	5
chromium	X	X	570
copper	X	X	1,910
lead	X	X	792
mercury	X	X	1
nickel	X	--	122
thallium	--	X	14
zinc	X	X	620
arsenic	X	X	15
sulfide	X	--	1,200
cyanide	X	X	166

TABLE 2

CONTAMINANTS OF CONCERN
COMMERCIAL OIL SERVICES SITE

Compound	*TLV(ppm)*	*PEL (ppm)*	*IDLH (ppm)*
Acetone	750	1000	20,000
Ethylbenzene	100	100	2,000
Trichloroethene	50	100	1,000
Tetrachloroethene	25	100	500
Toluene	50	200	2,000
Xylenes	100	100	1,000
Asbestos			
Amosite	0.5f/cc	0.1f/cc	---
Chrysotile	2f/cc	0.1f/cc	---
Crocidolite	0.2f/cc	0.1f/cc	---

Note:

SVOCs are also present on this site, however, monitoring and regulating for VOCs will adequately protect workers from exposure to SVOCs.

TABLE 3

HAZARD ANALYSIS

Task	*Chemical Hazards*	*Physical Hazards*	*Prevention*
Reconnaissance			
	Low potential for skin and inhalation exposure to contaminated materials	Slip/trip/fall	Wear proper PPE, use buddy system
Removal Oversight			
	Low potential for skin exposure to contaminated materials and inhalation exposure to dust and vapor	Heavy equipment operations Slip/trip/fall	Wear proper PPE, stand clear of operating equipment
Removal Activities			
	Potential for skin exposure to concentrated waste/sludge and inhalation exposure to contaminated waste/sludge vapor	Noise Levels Utility lines Slip/trip/fall Heavy equipment operations	Wear proper PPE, position equipment away from overhead lines, locate underground utility lines, use buddy system, maintain eye contact with equipment operator, inspect equipment daily

3) compliance with applicable governmental and nongovernmental (American Conference of Governmental Industrial Hygienists (ACGIH)) regulations and guidelines.

All Site removal activities will be conducted in accordance with the provisions of this HASP. Cost and scheduling considerations will not be considered as justification for modifying this plan.

2.0 BASIS

The Occupational Safety and Health Administration (OSHA) Standards and Regulations contained in Title 29, Code of Federal Regulations, Parts 1910 and 1926 (29 CFR 1910 and 1926) provides the basis for this Health and Safety Plan. The plan also reflects the position of the United States Environmental Protection Agency (USEPA) and National Institute for Occupational Safety and Health (NIOSH) regarding procedures required to ensure safe operations at sites containing hazardous or toxic materials.

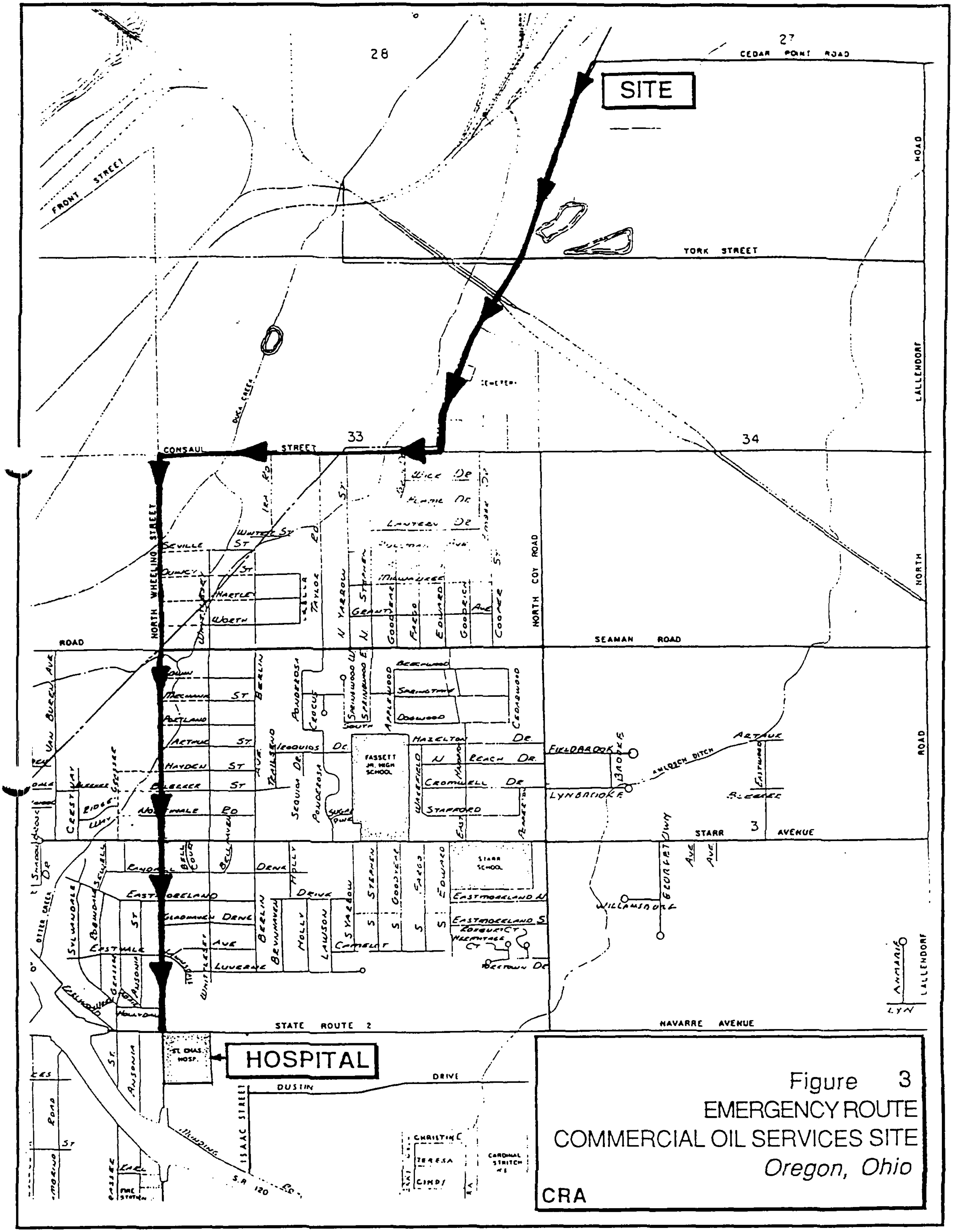


Figure 3
EMERGENCY ROUTE
COMMERCIAL OIL SERVICES SITE
Oregon, Ohio

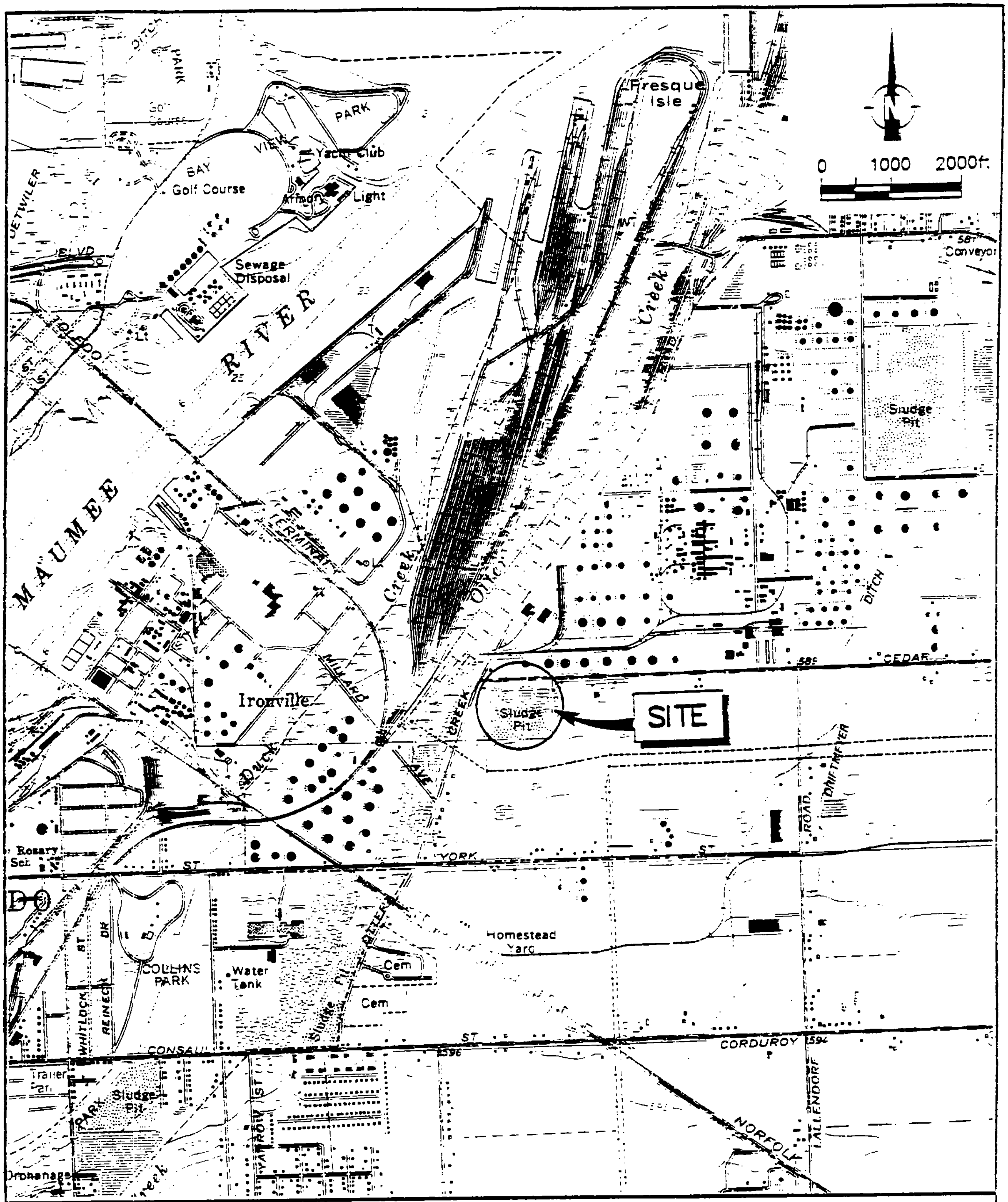
CRA

3.0 SITE CHARACTERIZATION

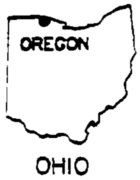
The Site is located on the southeast corner of Otter Creek Road and Cedar Point Road, at 3600 Cedar Point Road in Oregon, Ohio. Figure 1 presents the location of the Site. The Site is located approximately one mile southeast from the nearest point of the Maumee River.

The Site is bounded by Cedar Point Road to the north, by Otter Creek Road to the west, by an industrial gas plant to the east and by a closed solid waste landfill and an operating RCRA permitted hazardous waste landfill to the south.

A Site Plan is presented as Figure 2. Seven (7) surface impoundments (lagoons) occupy a significant portion of the Site area. Approximately sixty-six (66) aboveground tanks are located at the Site. Twenty-five (25) of the aboveground tanks are located in a tank farm in the northeast corner of the Site. A boiler house, process building, radio tower, and loading rack also exist in the tank farm area. Three (3) underground storage tanks and a septic tank are located near the garage building in the northwest corner of the Site. The Site also contains the remaining aboveground tanks and miscellaneous debris scattered throughout the Site. A drainage swale runs south to north on the east side of the Site, a gravel roadway runs along the north end of the Site and a radio tower exists in the northeast corner of the Site.



SOURCE: USGS QUADRANGLE MAP
OREGON, OHIO



OHIO

figure 1

SITE LOCATION
COMMERCIAL OIL SERVICES SITE
Oregon, Ohio

CRA

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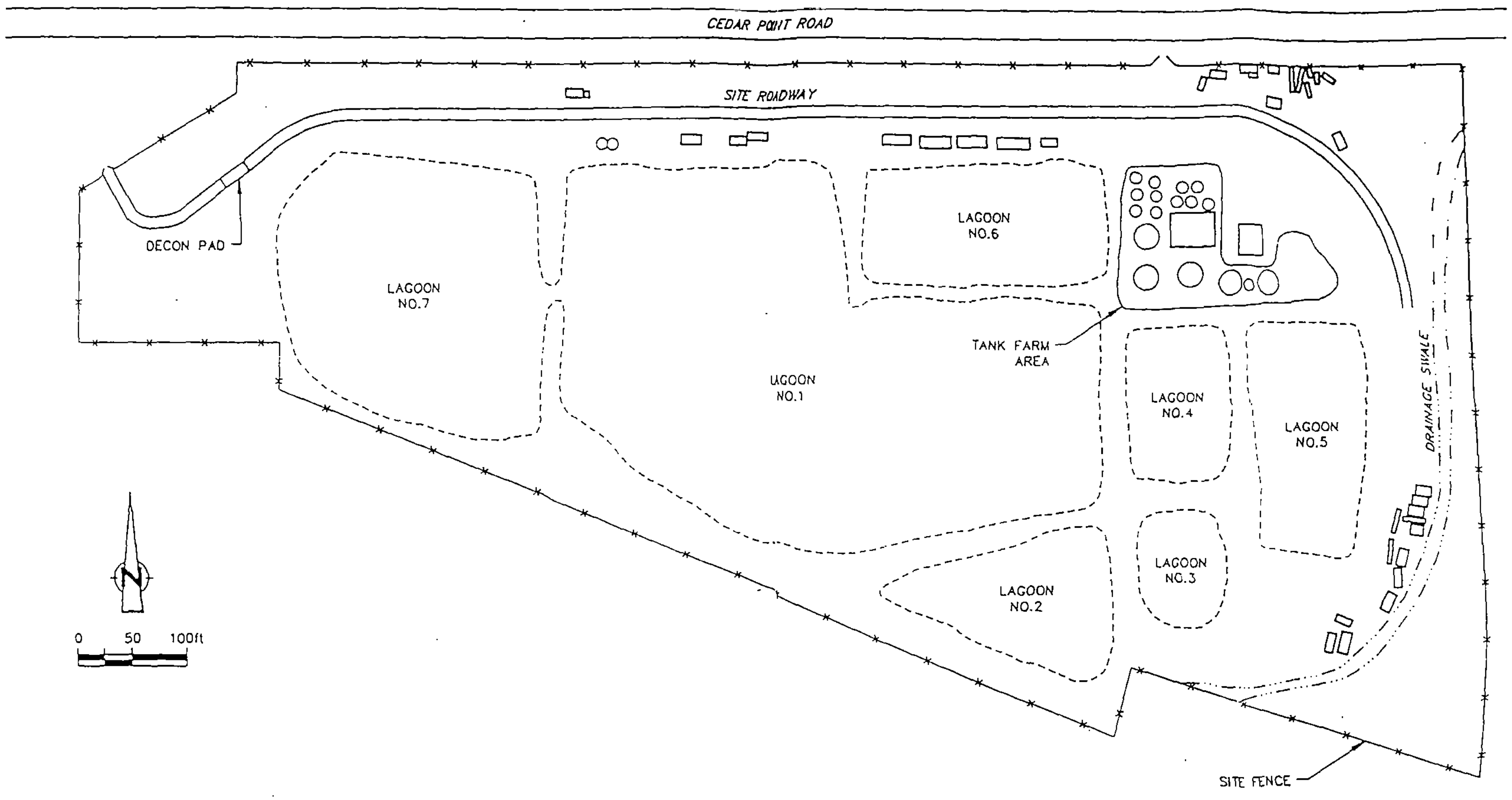

NOTE:
ALL LOCATIONS ARE APPROXIMATE

figure 2
SITE PLAN
COMMERCIAL OIL SERVICES SITE
Oregon, Ohio

CRA

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4.0 CONTRACTOR'S SITE-SPECIFIC HEALTH AND SAFETY PLAN

A Site-specific Health and Safety Plan will be developed, implemented, maintained, and enforced by the selected Contractor for work performed at the Site. The executed plan will address, at minimum, the requirements specified in this Health and Safety Plan. A copy of the Site-specific Health and Safety Plan will be maintained on-Site during all removal activities.

The Contractor will follow applicable protocol as specified in the American Petroleum Institute (API) Guides 2015, 2202, 2207, and 1604 for the cleaning and dismantling of tanks.

An asbestos survey will be completed for the on-Site structures which are to be demolished as part of the removal activities. If asbestos is present, an abatement program will be undertaken during the removal activities. The Contractor will present the appropriate health and safety procedures in their Site-specific HASP in accordance with 29 CFR 1926.1101.

If the Contractor expects confined space work to be performed, a confined space entry program will be included in the Site-specific HASP.

5.0 RESPONSIBILITIES AND ADMINISTRATION

The Contractor will designate an on-Site individual to act as the Health and Safety Officer (HSO). CRA, in conjunction with the HSO, will be responsible for decisions regarding when work will be stopped or started for health and safety considerations. The HSO will report directly to and be under the direction of a Certified Industrial Hygienist (CIH). The CIH will oversee operations as necessary to ensure that the work is performed in accordance with the Contractor's HASP. Specifically, the CIH will be responsible for the following:

1) oversee operations as necessary to ensure work is performed in accordance with the Site-specific Health and Safety Plan;

2) oversee and be present during the Health and Safety Training Session and, as a minimum, complete qualitative respirator fit testing; and

3) oversee the Health and Safety Officer's activities on a part-time basis and be available on an as-needed basis for emergency situations.

The HSO will:

1) have a minimum of two years site related working experience specific to the activities associated with removal of tanks and structures and asbestos abatement;

2) have a basic working knowledge of State and Federal occupational safety and health regulations;

3) have formal education and/or training in occupational safety and health;

4) be responsible for daily enforcement and monitoring of the Site-specific Health and Safety Plan;

5) be responsible for the pre-construction indoctrination of on-Site personnel with regard to the Site-specific Health and Safety Plan and other safety requirements to be observed during construction, including:

    a) potential hazards;
    b) personal hygiene principles;
    c) use of personal protective equipment (PPE);
    d) respiratory protection equipment usage and fit testing; and
    e) emergency procedures for dealing with fire and medical situations.

6) be responsible for completing the health and safety training session and ensure that personnel not successfully completing the required training are not permitted to enter the Site to perform work in the Exclusion Zone or Contaminant Reduction Zone;

7) be responsible for ensuring reusable personal protective equipment is decontaminated before being reissued;

8) be responsible for conducting Air Monitoring;

9) be responsible for ensuring that on-Site personnel have obtained the required medical examinations prior to arrival at the Site and at the termination of their assignment as required;

10) be responsible for incorporating the provisions of both on-Site and off-Site emergency contingency plans in the Site-specific Health and Safety Plan and maintaining a state of readiness to enact the provisions;

11) be responsible for alerting appropriate on-Site and/or off-Site emergency services and the Engineer before starting any particularly hazardous work;

12) assist the Engineer in contacting and advising local authorities of the removal activities to be performed; and

13) have the authority and obligation to stop removal activities if, in his/her sole discretion, stoppage of the work is necessary or advisable for considerations of health or safety.

If work in confined spaces is to be performed, the HSO will be responsible for ensuring that minimum precautions have been taken to assure safe entry of confined spaces, in accordance with 29 CFR 1910.146.

6.0 WORK AREAS

Specific work areas as outlined in the Contractor's Site-specific Health and Safety Plan will be delineated clearly in the field with temporary fencing of standard snow fence or construction fence supported by posts with warning signs. Work areas will be established as temporary or permanent, depending on the work activity and the sequence in which it is performed. These areas will include:

a) Exclusion Zone (EZ) - This zone will include all areas where hazardous or potentially contaminated soils, debris and other materials are being, or may be contacted, disturbed or handled, and all areas where contaminated equipment or personnel travel.

   The EZ will be clearly delineated in the field prior to commencing Site work. Temporary Exclusion Zones will be established around remote work areas beyond the limits of the EZ and will be clearly delineated in the field by temporary snow fencing and/or barricades and warning signs.

b) Contaminant Reduction Zone (CRZ) - This zone will occur at the interface of the EZ and Clean Zone and will provide access for the transfer of construction materials and Site dedicated equipment to the EZ, the decontamination of equipment, vehicles, personnel and clothing prior to entering the Clean Zone, and for the physical segregation of the Clean Zone and EZ.

c) Clean Zone (CZ) - This area is the portion of the Site defined as the area outside the zone of significant air and soil contamination. The Clean Zone will be clearly delineated and procedures implemented to prevent active or passive migration of contamination from the work Site. The function of the Clean Zone includes:

   1) an entry area for personnel, material and equipment to the CRZ;

2) an exit area for decontaminated personnel, materials and equipment from the CRZ; and
3) a storage area for clean safety and work equipment.

7.0 COMMUNICATIONS

Telephone service will be provided to the Site during removal activities. Emergency numbers including police, fire, ambulance, hospital, and appropriate Regulatory agencies will be prominently posted near each phone and are attached in Table 4.

An alarm system will be provided by the Contractor to notify workers of on-Site emergency situations or to stop work activities if necessary.

TABLE 4

EMERGENCY TELEPHONE NUMBERS

Agency	*Contact*	*Telephone Number*
Emergency		911
Non-Emergency		
St. Charles Hospital		419-698-7200
Ambulance		419-691-5787
Police		419-691-5787
Fire		419-691-5787
USEPA	Emergency Response	800-424-8802
USEPA - Region V	P.C. Lall	313-692-7685
Ohio EPA	Emergency Response	614-644-2924
ChemTrec	Spill Response	800-424-9300
National Response Center		800-424-8802
CRA, Romulus, MI	Cindy Walczak	313-942-0909
CRA, Waterloo, Ontario	Alan Van Norman	519-725-3313
CRA, Waterloo, Ontario	Mike Shephard	519-725-3313
Engineering Management, Inc.	Jim Campbell	412-351-6132
Altech Environmental, Inc.	Al Aguwa	313-353-3832

8.0 MEDICAL SURVEILLANCE

In accordance with requirements detailed in 29 CFR 1910.120 and 29 CFR 1910.134, all Site personnel who will come in contact with potentially contaminated materials will have received, within one year prior to starting field activities, medical surveillance by a licensed physician or physician's group.

Medical records for all on-Site personnel will be maintained by their respective employers. The medical records will detail the tests that were taken and will include a copy of the consulting physician's statement regarding the tests and the employee's suitability for work.

Each employer will ensure that its personnel involved in on-Site work will have all necessary medical examinations prior to commencing work which requires respiratory protection or exposure to hazardous materials. Personnel not obtaining medical certification will not perform work within contaminated areas.

Interim medical surveillance will be completed if an individual exhibits poor health or high stress responses due to on-Site activity or when accidental exposure to elevated concentrations of contaminants occurs.

9.0 TRAINING

All Site personnel involved in removal work will be required to complete Site training and refresher sessions conducted by the HSO. Site training and refresher sessions are designed to ensure that all personnel are capable of and familiar with the use of safety, health, respiratory and protective equipment and with the safety and security procedures required for this Site. The Site training session will be conducted by the HSO (or other qualified professional in the presence of the Certified Industrial Hygienist) prior to beginning work at the Site.

In accordance with 29 CFR 1910.120, all employees exposed to hazardous substances, health hazards or safety hazards will receive training including a minimum of 40 hours instruction off Site, as required by OSHA, and three days of actual field experience under direct supervision. The Contractor will provide documentation stating that all on-Site personnel have complied with this regulation. Each individual's name will be included on this confirmatory letter. The training program will include at a minimum the following items:

1) personnel responsible for Site health and safety;
2) Site-specific potential hazards;
3) use of personal protective equipment, including proper donning and doffing procedures;
4) work practices by which the employee can minimize risks from these potential hazards;
5) safe use of engineering controls and on-Site equipment;
6) discussion and completion of medical surveillance requirements and recognition of symptoms associated with exposure to hazards;
7) Site control methods;
8) on and off-Site contingency plans;
9) decontamination procedures;
10) Site-specific standard operating procedures;
11) delineation between work zones;
12) use of the buddy system;

13) scope of the intended works for the project;
14) review on-Site communications and appropriate hand signals between personnel working in the EZ and/or CRZ;
15) confined space entry procedures (if confined space work is to be performed);
16) the content of the OSHA standards, including the Appendices;
17) tank cleaning procedures as detailed in API Guides 2015, 2202, 2207, and 1604 (for personnel designated to clean/dismantle tanks);
18) methods of recognizing asbestos; and
19) the health effects associated with asbestos.

The HSO will be responsible for ensuring that personnel not successfully completing the required training prior to beginning work are not permitted to enter the Site to perform work.

Individuals performing asbestos inspection and removal will be qualified by formal training and practical experience which comply with Federal and State regulations.

The Contractor will implement a hazard communication ("Right-to-Know") program in accordance with 29 CFR 1910.1200.

10.0 PERSONAL PROTECTIVE EQUIPMENT

All on-Site personnel will be equipped with personal protective equipment (PPE) and protective clothing appropriate for the hazardous material being handled and the nature of work being completed. All PPE and protective clothing will be kept clean and well-maintained.

PPE and apparel as required for general removal activities within the Exclusion Zone or Contaminant Reduction Zone will consist of, at a minimum:

1) individually assigned half or full-facepiece air purifying respirators with dual organic vapor and high-efficiency particulate cartridges (NIOSH approved). Respirators should be available and donned when required as indicated by air monitoring;

2) disposable coveralls, liquid resistant, splash resistant, full coverage;

3) disposable latex and/or thin nitrile inner gloves;

4) disposable chemical resistant nitrile outer gloves;

5) steel toed, steel shank, chemical resistant work boots;

6) disposable rubber, chemical resistant overboots;

7) workclothing (full length pants, long sleeve shirts);

8) hardhats; and

9) safety glasses with sideshields.

Additional protective equipment usage guidelines to be implemented include:

1) all prescription eyeglasses in use on the Site will be safety glasses. Contact lenses will not be permitted on-Site within the EZ or CRZ;

2) during periods of respirator usage in contaminated areas, respirator cartridges will be changed daily or upon breakthrough, whichever occurs first;

3) footwear used on Site will be steel-toed work boots, and will be covered by rubber overboots when entering or working in the EZ;

4) on-Site personnel unable to pass a respirator fit test will not enter or work in the EZ or CRZ;

5) all on-Site personnel will wear an approved hardhat when present in the EZ if overhead hazards are present;

6) all PPE worn on Site will be decontaminated or disposed of at the end of each work day. The HSO will be responsible for ensuring individuals decontaminate PPE before reuse; and

7) duct tape will be used to ensure that disposable coveralls and gloves are tightly secured when personnel are working within contaminated zones.

11.0 RESPIRATORY PROTECTION

All on-Site personnel will receive extensive training in the usage and limitations of, and be qualitatively fit tested for, half and/or full-facepiece respirators in accordance with 29 CFR 1910.134. This will include both air purifying and supplied air type respirators.

Appropriate respiratory protection will be mandatory during all on-Site removal activities which involve the contact or potential contact with contaminated materials. As a minimum, all on-Site personnel will be required to have available half-facepiece air purifying respiratory protection when working in the EZ, which will be modified based on air monitoring readings.

Levels of respiratory protection have been chosen consistent with potential airborne hazards. The selection of appropriate protection is based upon the potential presence of compounds with the lowest recommended threshold limit value.

In the absence of additional air monitoring information or substance identification, the following levels of respiratory protection will be required when working in the EZ:

Sustained Photoionization Total Organic Vapor Concentration (ppm)	*Level of Respiratory Protection Required*
0-1	Half- or full-facepiece respirator available
1-10	Full-or half-facepiece air purifying respirator, Level C
greater than 10	Shut down activities, evaluate the need for Level B or higher respiratory protection

On-Site personnel unable to pass a respirator fit test will not be permitted to enter or work in the EZ or CRZ.

12.0 PERSONAL HYGIENE FACILITIES

The HSO will be responsible for ensuring that all personnel performing or supervising removal work within a hazardous work area, or who may potentially be exposed to hazardous chemical vapors, liquids, or contaminated solids, observe and adhere to the personal hygiene-related provisions of this section.

On-Site personnel found to be disregarding the personal hygiene-related provisions of this plan will be barred from the Site.

The following equipment/facilities will be provided by the Contractor for the personal hygiene of all on-Site personnel:

1) suitable disposable outerwear, gloves, and footwear on a daily or as-needed basis for the use of on-Site personnel;

2) contained storage and disposal for used disposable outerwear; and

3) potable water and a suitable sanitation facility.

The following regulations for personnel working within the EZ will also be enforced:

1) on-Site personnel will wear disposable outerwear and gloves at all times whenever entering or working in the EZ or CRZ;

2) used disposable outerwear will not be reused, and when removed, will be placed inside disposable containers provided for that purpose;

3) smoking will be prohibited except in a designated smoking area;

4) eating and drinking will be prohibited except in the designated lunch or break area;

5) soiled disposable outerwear will be removed prior to entering the lunch area, and prior to cleansing hands;

6) on-Site personnel will thoroughly cleanse their hands and other exposed areas before entering the smoking or lunch area; and

7) on-Site personnel working in potentially contaminated work areas and/or CRZ will shower and change to fresh clothing after each working period or shift, prior to leaving the Site.

13.0 EMERGENCY AND FIRST AID EQUIPMENT

The safety equipment listed below will be located and maintained in appropriate locations as directed by the Health and Safety Officer.

1) portable emergency eye wash and shower;
2) two 20-pound ABC type dry chemical fire extinguishers;
3) two self contained breathing apparatus;
4) blankets and towels;
5) stretcher, cot, and crutches;
6) one hand-held emergency siren;
7) two complete sets of Level B equipment; and
8) first aid kit.

An on Site certified first aid technician will be provided by the Contractor.

14.0 HEAT STRESS/COLD STRESS MONITORING

The Contractor will implement a heat stress/cold stress monitoring program based on recommendations by ACGIH, NIOSH, and other recognized authorities, and including the following components:

1) training of personnel to recognize and mitigate heat/cold stress situations and symptoms;

2) target conditions which will initiate monitoring of personnel;

3) monitoring methods; and

4) the means and methods to mitigate such conditions.

After each worker has become familiar with his own limitations, and as long as the daily activities are not noticeably altered, it will remain the responsibility of the worker to remain cognizant of his own physical condition. Each individual will be made aware of the effects of acclimatization and that the loss of some acclimatization after a few days of rest will occur.

15.0 BUDDY SYSTEM

Removal activities performed by Contractor employees will be conducted under a buddy system. This system is designed to ensure that no one Contractor employee enters the EZ without the support and assistance of a coworker.

The daily safety briefings will be the forum where buddy assignments will be made for the Site. In the event that an odd number of employees are present on the Site, then one team of three "buddies" will be established.

The key responsibilities of a buddy are as follows:

1) monitor your buddy's work practices and physical condition;

2) if your buddy appears to be in distress or has had an accident, assist him/her in a manner consistent with the Site-specific Health and Safety Plan; and

3) do not permit your buddy to enter the EZ alone.

16.0 EMERGENCY COMMUNICATIONS

A system of emergency communications will be required to ensure that communications are maintained and emergency procedures are followed in the event of a release or accident.

The emergency communication procedures to be followed during removal activities are:

1) emergency communications are to be made by hand held sirens, by vehicle horns, or a hand/arm signals;

2) one long blast of a siren or one arm continuously waving over a worker's head means to stop work and return to the CRZ; and

3) repeated short blasts of a siren or both arms continuously waving over a worker's head will mean that an emergency condition exists on-Site and all employees are to leave the Site immediately and congregate at the Site gate.

17.0 CONTINGENCY AND RESPONSE PLAN

17.1 OFF-SITE CONTINGENCY PLAN

Prior to commencing work involving the transportation of potentially contaminated material, the Contractor will coordinate the development of an off-Site emergency contingency plan. This plan is intended to provide response to spills that could occur during transporation of materials from the Site.

A coordination meeting will be held with appropriate local officials to identify the removal action activities to be performed on Site and to discuss the protocols to be taken in the event of an incident. CRA's Resident Engineer will be the on-Site emergency response coordinator and will be responsible for coordinating with local officials. At the coordination meeting, an off-Site emergency response coordinator will be identified through whom information and coordination will occur in the event of an incident. Responsibilities of local authorities will also be identified at the meeting, including but not limited to the following:

1) transport of injured personnel to medical facilities;
2) priority transportation routes;
3) firefighting procedures; and
4) coordination and/or modification of highway operations.

17.2 ON-SITE CONTINGENCY PLAN

On-Site emergency response activities will be coordinated by the Health and Safety Officer. His/her responsibilities will be as described in Section 5.0.

In the event of injury to on-Site personnel or contact with hazardous materials, the following protocols will be followed:

1) in the event of injury, notify the Health and Safety Officer, and the Engineer;
2) contact the closest medical center and describe the injury;
3) decontaminate personnel and administer appropriate emergency first aid; and
4) transport personnel to the defined medical facility along a predefined route (as shown on Figure 3).

A list of emergency and first aid equipment that will be maintained on-Site is presented in Section 13.0.

In the event that barrels or canisters are encountered, personnel will immediately cease work and notify the Engineer and Health and Safety Officer.

In the event that excessive gases or vapors are detected at a work area, personnel will be evacuated upwind from the effected area. The contaminant will be identified and concentrations monitored to determine the type of respiratory protection and/or engineering controls required before workers re-enter the area.

In the event of a fire at a work area, fire extinguishers and/or earth moving equipment will be used to smother the fire, if possible. Otherwise, personnel will be evacuated upwind of the area. Firefighting equipment and personnel trained to operate the equipment will be provided to fight small fires and to prevent fires from spreading. Firefighting equipment will include hand held fire extinguishers (Class A, B, C; 5-, 10-, or 20-pound) and will be located in excavation equipment, Site service vehicles, in the tank farm area, in on-Site trailers, and anywhere containers of oil/solvents are stored.

The Contractor will provide a person who has received formal training in firefighting and the use of mobile firefighting equipment. Such training will include:

1) Incipient Fire Brigade Training, 29 CFR 1910.156, Subpart L;
2) First Responder Training, 29 CFR 1910.120, Subpart Q;
3) Performance Standards for First Responder at the Operational Level NFPA 472; and
4) Advanced Exterior Firefighting under NFPA 600.

The Contractor will maintain on-Site near the tank farm area or on a dedicated vehicle foam generating equipment capable of supplying 35 cubic feet of fire suppressing foam in a 1 minute period, and at least 75 cubic feet without the need for refill. The foam will be low in toxicity, non-corrosive and biodegradable.

In the event of a fire which is too large to fight using the equipment supplied by the Contractor, the Health and Safety Officer and Resident Engineer will proceed as prescribed in the off-Site Contingency and Response Plan.

In the event of significant release of potentially toxic or hazardous vapors, personnel will be evacuated upwind to a safe distance and the Police, Fire Department and local hospital will be notified as deemed necessary by the Engineer and the Health and Safety Officer.

Emergency telephone numbers for the area surrounding the Site are listed on Table 4.

Figure 3 and Table 4 will be posted in a prominent place in the CZ.

18.0 AIR MONITORING

18.1 PROTOCOLS

During the progress of removal activities, air quality will be monitored in and around the EZ by the Contractor. Sampling will be conducted on a regular periodic basis (as a minimum on an hourly basis), and additionally as required by special or work-related conditions. Any departures from general background will be reported to the Engineer who will, in conjunction with the Health and Safety Officer, determine when operations should be shut down and restarted.

Instruments required for air monitoring will include an organic vapor photoionizer or organic vapor analyzer, an oxygen level meter and explosimeter.

The air monitoring equipment will be operated by personnel trained in the use of the specific equipment provided and will be under the control of the Health and Safety Officer.

Should the organic vapor level in the breathing zone of any active working location exceed 50 ppm for any single reading, or 25 ppm for any two successive readings, or should the explosimeter indicate in excess of 10 percent of the lower explosive limit (LEL) on any single reading, or reduced oxygen concentrations less than 19.5 percent oxygen, or if toxic gases and particulate are present in concentrations which present Immediate Danger to Life and Health (IDLH) or in excess of the protection factor afforded by the air purifying respirator (whichever is lower), then that work location will be shut down and all personnel will be evacuated upwind. Work will not resume at such a work location until authorized by the Engineer and Health and Safety Officer. Organic vapors will be monitored continuously using an organic vapor photoionizer.

A wind direction indicator will be installed and maintained by the Contractor at each active work location.

18.2 REPORTING

The results of air monitoring programs will be reported daily to the Engineer on specific forms included in the Contractor's Health and Safety Plan and will include the following information:

1) site location/date;
2) work process/operation name;
3) temperature, wind speed and wind direction;
4) area sample description/location;
5) field notes
    - description of operations
    - chemicals/materials/equipment in use
    - engineering/administration controls in effect
    - personal protective equipment in use
    - sampling observations/comments.

In addition, all daily air monitoring activities will be recorded in a hard cover log book which will be maintained on Site.

19.0 CONTAMINANT MIGRATION CONTROL

Appropriate measures will be taken by the Contractor to prevent the tracking of contaminants on- and off-Site. Vehicles, equipment, and personnel leaving areas of potential contamination will be decontaminated prior to entry into Clean Zones.

Decontamination procedures will be strictly adhered to for all personnel and equipment used in the EZ. The procedures for personnel are as follows:

1) all personnel will remove rubber overshoes, respirators and disposable outer clothing, if it is being worn;

2) disposable clothing will be placed in designated containers;

3) eating, drinking, smoking, and chewing nicotine products will be prohibited except in designated areas;

4) personnel will remove soiled disposable outerwear and thoroughly cleanse hands and other exposed areas before entering the lunch or smoking areas; and

5) personnel working in potentially contaminated work areas will be required to shower and change to fresh clothing after each working period or shift, prior to leaving the Site.

Decontamination procedures for equipment are as follows:

1) decontamination of equipment will be conducted on the decontamination pad after working in potentially contaminated work areas and prior to subsequent work or travel on clean areas;

2) packed dirt, grit and debris will be removed by scraping and brushing, and high pressure, low volume, warm water as appropriate, paying

particular attention to tire treads, equipment tracks, springs, joints, sprockets, and undercarriages;

3) surfaces will be scrubbed with long handle scrub brushes;

4) equipment will be air dried in the Clean Zone before removing from the Site or traveling on clean areas;

5) decontamination will be certified by the Engineer; and

6) following certification, the equipment can be removed into the Clean Zone and off-Site.

An inspection record will be maintained on-Site which includes:

1) equipment descriptions with identification numbers or license plates;

2) time and date entering the decontamination facility;

3) time and date exiting the decontamination facility; and

4) name of the inspector with comment stating that decontamination was performed and completed.

Appropriate measures will be taken to minimize the drift of mist and spray during decontamination. Decontamination wash waters and sediments which accumulate on the equipment decontamination pad will be collected and transferred to temporary storage tanks.

Personnel engaged in equipment decontamination will wear protective equipment including disposable clothing, respiratory protection, and face shields.

20.0 DUST, PARTICULATE AND VAPOR CONTROL

During removal activities, a dust control program will be implemented by the Contractor to prevent the generation of dust. In the event that visible dust is generated by removal activities, potable water will be sprayed on roadways. Appropriate covers will be used on trucks hauling fine or dusty material and watertight vehicles will be used to haul wet materials.

In the event that excessive gases or vapors are detected during removal activities, workers will be evacuated to an area upwind from the effected area. Proper respiratory protection will be determined by the Health and Safety Officer and appropriate action will be taken to control the release of gases or vapors. This control action may include covering the area of release with tarps, soil or foam.

21.0 SAFETY MEETINGS

The Health and Safety Officer will conduct a safety meeting with all employees prior to the initiation of Site removal activities, followed by weekly safety meetings which will be mandatory for all Site personnel. The meetings will provide refresher training for existing equipment and protocols, and will examine new Site conditions as they are encountered. Additional safety meetings will be held on an as required basis.

Daily meetings will be held to discuss scheduled work activities for the day and any specific safety concerns related to the activities.

Should any unforeseen or Site peculiar safety related factor, hazard, or condition become evident during the performance of work at this Site, it will immediately be brought to the attention of the Engineer and the Health and Safety Officer for resolution. In the interim, prudent action will be taken to establish and maintain safe working conditions and to safeguard employees, the public and the environment.

22.0 SITE SECURITY

The Site will be secured throughout construction by ensuring that existing fencing is in good repair and that gates and other access points are secured prior to the termination of work activities each day.

A security guard will be at the main entrance during working hours to prevent unauthorized entry, vandalism, or theft. Access gates to the Site will be kept closed except for the passage of authorized persons or vehicles. The security guard will maintain a sign in sheet for the Site.

ADDENDUM #1

HEALTH AND SAFETY PLAN
REMOVAL OF TANKS AND STRUCTURES

COMMERCIAL OIL SERVICES
OREGON, OHIO

This is to serve as Addendum #1 to the Health and Safety Plan (HASP) for the Removal of Tanks and Structures at the Commercial Oil Services Site (January, 1995). This HASP was prepared by Conestoga-Rovers and Associates (CRA) on behalf of the Commercial Oil Services Phase II Trust. This addendum includes hazards associated with Polychlorinated Biphenyls (PCBs) and Material Safety Data Sheets (MSDS) for PCBs.

During removal activities, personnel may come in contact with PCBs. The routes of entry causing primary concern with PCBs are through skin absorption and ingestion. Contact of PCBs with skin will be controlled by wearing proper Personal Protective Equipment (PPE) as described in the HASP. The possible ingestion of PCBs will be controlled through proper hygiene practices as described in the HASP.

APPENDIX A

MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: ACETONE

MSDS No: Genium / 300
Revision: E
Date: November, 1988

National Paint and Coatings Association

Hazardous Material Identification System

HEALTH HAZARD	1 - Slight
FLAMMABILITY HAZARD	3 - Serious
REACTIVITY HAZARD	0 - Minimal
PERSONAL PROTECTION	SEE SECT. 8

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name: ACETONE

Description: Used as a solvent for fats, oils, waxes, resins, rubber, plastics, varnishes, and rubber cements; also used in the manufacture of methyl isobutyl ketone, mesityl oxide, acetic acid, diacetone alcohol, chloroform, iodoform, bromoform, explosives, rayon, photographic films, and isoprene. Used to store acetylene gas. *Widely used in the chemical process industry* (CPI).

Other Designations: Dimethylformaldehyde; Dimethylketal; Dimethyl Ketone; Ketone Propane; Pyroacetic Acid; Pyroacetic Ether; C_3H_6O

CAS: 0067-64-1

R 1
I 1
S 2
K 4

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the Chemicalweek Buyers' Guide (Genium ref. 73) for a list of suppliers.

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:	CAS Number:	Percent:	Exposure Limits:
Acetone	0067-64-1	Ca 100	OSHA PELs 8-Hr TWA: 750 ppm, 1800 mg/m^3 STEL: 1000 ppm, 2400 mg/m^3 ACGIH TLVs, 1988-89 TLV-TWA: 750 ppm, 1780 mg/m^3 TLV-STEL: 1000 ppm, 2375 mg/m^3

INGREDIENTS AND HAZARDS continues on page 2

INGREDIENTS AND HAZARDS continued from page 1

Toxicity Data*
Man, Inhalation, TD_{Lo}: 440 $\mu g/m^3$ (6 Mins)
Man, Inhalation, TD_{Lo}: 10 mg/m^3 (6 Hrs)

* See NIOSH, <u>RTECS</u> (AL3150000), for additional data with references to reproductive, mutagenic, and irritative effects.

SECTION III. PHYSICAL DATA

Appearance & Odor: A clear, colorless, highly flammable, volatile liquid with a characteristic, pleasant, sweetish odor.

Boiling point: 134°F (56°C)
Vapor pressure: 180 Torrs at 68°F (20°C)
Water solubility (%): Complete
Vapor density (air=1): 2

Evaporation rate: Faster than That of n-Butyl Acetate
Specific gravity (H_2O=1): 0.778 at 77°F (25°C)
Melting point: -137°F (-94°C)
% volatile by volume: 100
Molecular weight: 58 Grams/Mole

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (method): 1.4°F (-17°C) CC   Limits: LEL %: 2.9% v/v   UEL %: 12.8% v/v

NFPA Fire Hazard Symbol Codes: Flammability: 3 Health: 1 Reactivity: 0 Special: -

Extinguishing Media: Use "alcohol" foam, dry chemical, or carbon dioxide. Use a blanketing effect to smother flames. Use water spray to reduce the rate of burning and to cool containers. Water will probably not be effective in directly extinguishing an acetone fire.

Autoignition Temp: 869°F (465°C)

Unusual fire or explosion hazards: Acetone vapor is heavier than air and may travel a considerable distance to a low-lying source of ignition and flash back.

Special fire-fighting procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

MSDS 300 continues on page 3

SECTION V. REACTIVITY DATA

Material is stable in closed containers during routinue operations. Hazardous polymerization cannot occur

Chemical incompatibilities: Acetone can react dangerously with strong oxidizing agents such as nitrates, perchlorates, permanganates, and concentrated sulfuric acid; chromic anhydride; chromyl chloride; hydrogen peroxide; hexachloromelamine; nitrosyl chloride; permonosulfuric acid; mixtures of sulfuric acid and nitric acid; mixtures of nitric acid and acetic acid; and potassium <u>tert</u>-butoxide.

Conditions to avoid: Do not expose acetone to sources of ignition and incompatible chemicals.

Hazardous decomposition Products: Carbon monoxide and carbon dioxide can be produced during acetone fires.

SECTION VI. HEALTH HAZARD INFORMATION

This product is not considered a carcinogen by the NTP, IARC, or OSHA.

Summary of risks: Inhalation of high concentrations of acetone vapor can cause dryness of the mouth and throat; dizziness, nausea, incoordination, slurred speech, drowsiness, and, in severe exposures, coma. Inhalation of small quantities of acetone vapor for an extended period causes irritation of the respiratory tract, coughing, and headache. Prolonged or repeated skin contact with acetone has a defatting effect causing dryness, irritation, and mild dermatitis. Under routine operating conditions the amount of acetone absorbed through the skin is small. Ingestion of acetone may cause irritation of the gastrointestinal tract and narcosis. Acetone acts primarily as a depressant to the central nervous system (CNS) when exposures are severe or prolonged.

Medical conditions which may be aggravated by contact: None reported.

Target organs: Skin, eyes, respiratory system, and CNS.

Primary entry route(s): Inhalation, skin contact.

Acute effects: See Summary of Risks, above.

Chronic effect(s): None reported.

First aid:

Eye contact: Immediately flush eyes, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 minutes.

HEALTH HAZARD INFORMATION continues on page 4

HEALTH HAZARD INFORMATION continued from page 3

Skin contact: 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. Monitor the exposed person for symptoms of depression of the CNS such as incoordination and drowsiness.

Ingestion: Unlikely.* If a small amount is ingested, dilute it slowly with 1 to 2 glasses of water or milk.

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 Physician: Treatment for accidental ingestion of a small amount of acetone is unnecessary. If a large amount has been ingested, administer a charcoal slurry, either aqueous or mixed with a saline cathartic or sorbital.

SECTION VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill / Leak procedures: Notify safety personnel, evacuate unnecessary personnel, eliminate all sources of ignition immediately, and provide adequate ventilation. Cleanup personnel need protection against this liquid's contact with skin or eyes as well as inhalation of its vapor (see sect. 8). Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways.

Waste management / Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations. Consider saving the waste hydrochloric acid for use as a neutralizing agent during cleanup operations of basic materials.

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z).

EPA Designations (40 CFR 302.4)
RCRA Hazardous Waste, No. U002
CERCLA Hazardous Substance, Reportable Quantity: 5000 lbs (2270 kg), per the Resource Conservation and Recovery Act, Section 3001.

MSDS 300 continues on page 5

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: ACETONE

MSDS No: Genium / 300
Revision: E
Date: November, 1988

SECTION VIII. SPECIAL PROTECTION INFORMATION

Personal protective equipment:

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 butyl or natural rubber gloves, boots, aprons, and gauntlets to prevent prolonged or repeated contact with this material.

Workplace considerations:

Ventilation: Install and operate general and local maximum, explosion-proof ventilation systems powerful enough to maintain airborne levels of acetone 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.

Other: Automatic sprinkler systems for fire protection are desirable in work areas.

Practice good personal hygiene; always wash thoroughly after using this material. 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 acetone vapor.

MSDS 300 continues on page 6

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: ACETONE

MSDS No: Genium / 300
Revision: E
Date: November, 1988

SECTION IX. SPECIAL PRECAUTIONS

Storage segregation: Store acetone in closed containers (carbon steel is recommended) in a cool, dry, well-ventilated area away from sources of ignition and strong oxidizers. Protect containers from physical damage.

Engineering controls: Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. Electrically ground and bond all containers and pipelines, etc., used in shipping, transferring, reacting, production, and sampling operations to prevent generating static sparks.

Other precautions: Use labeled safety cans when handling small amounts of acetone. Acetone presents a dangerous fire hazard; perform all work operations involving it carefully and in a way that will prevent exposing the liquid or its vapor to sources of ignition.

Transportation Data (49 CFR 172.101-2) --

DOT Shipping Name: Acetone
DOT Label: Flammable Liquid

IMO Label: Flammable Liquid
IMO Hazard Class: 3.1
IMDG Packaging Group: II

DOT Class: Flammable Liquid UN Register: UN1090
Data source code(s): 1, 26, 38, 84-94, 100, 116, 117, 120, 122.

Prepared/revised by: Patrick J. Igoe, BS

November, 1988

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: ETHYL BENZENE

MSDS No: Genium / 385
Revision: A
Date: November, 1988

National Paint and Coatings Association
Hazardous Material Identification System

HEALTH HAZARD	2 - Moderate
FLAMMABILITY HAZARD	3 - Serious
REACTIVITY HAZARD	0 - Minimal
PERSONAL PROTECTION	SEE SECT. 8

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name: ETHYL BENZENE

Description: Used as a solvent and as an intermediate in the production of styrene monomer.

Other Designations: Phenylethane; Ethylbenzol; $C_2H_5C_6H_5$

CAS: 0100-41-4

R 1
I 3
S 2
K 4

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the Chemicalweek Buyers' Guide (Genium ref. 73) for a list of suppliers.

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:	CAS Number:	Percent:	Exposure Limits:
Ethyl Benzene	0100-41-4	Ca 100	OSHA PELs 8-Hr TWA: 100 ppm, 435 mg/m^3 15-Min STEL: 125 ppm, 545 mg/m^3 ACGIH TLVs, 1988-89 TLV-TWA: 100 ppm, 435 mg/m^3 TLV-STEL: 125 ppm, 545 mg/m^3 Toxicity Data* Human, Inhalation, TC_{Lo}: 100 ppm (8 Hrs) Rat, Oral, LD_{50}: 3500 mg/kg

* See NIOSH, RTECS (DA0700000), for additional data with references to reproductive, irritative, and mutagenic effects.

SECTION III. PHYSICAL DATA

Appearance & Odor: A clear, colorless, flammable liquid; characteristic aromatic hydrocarbon odor.

Boiling point: 277°F (136°C)
Vapor pressure: 7.1 Torrs at 68°F (20°C)
Water solubility (%): Slight
Vapor density (air=1): 3.7

Specific gravity (H_2O=1): 0.86258 at 77°F (25°C)
Melting point: -139°F (-95°C)
% volatile by volume: Ca 100
Molecular weight: 106 Grams/Mole

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (method). 64°F (18°C) CC Limits: LEL %: 1% v/v UEL %: 6.7% v/v

NFPA Fire Hazard Symbol Codes: Flammability: 3 Health: 2 Reactivity: 0 Special: -

Extinguishing Media: Use foam, dry chemical, or carbon dioxide to put out ethyl benzene fires. A water spray may be ineffective in extinguishing the fire, because it can scatter and spread the burning liquid. Use water spray to cool fire-exposed containers of ethyl benzene, to disperse ethyl benzene vapor, and to protect the personnel attempting to stop an ethyl benzene leak.

Autoignition Temp: 810°F (432.22°C)

Unusual fire or explosion hazards: This liquid can readily form explosive vapor-air mixtures, especially when heated. Ethyl benzene vapor is heavier than air and may travel a considerable distance to a low-lying source of ignition and flash back to its origin.

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 V. REACTIVITY DATA

Material is stable in closed containers during routine operations. Hazardous polymerization cannot occur

Chemical incompatibilities: Hazardous chemical reactions can occur between ethyl benzene and strong oxidizing agents, acids, ammonia, and bases.

Conditions to avoid: Avoid any exposure to sources of ignition such as heat, sparks, open flame, and lighted tobacco products, etc., and to incompatible chemicals. Use caution when entering confined spaces, particularly low-lying areas where explosive concentrations of ethyl benzene vapor may be present. Provide good ventilation to such areas to prevent the concentration of this vapor.

REACTIVITY DATA continues on page 3

REACTIVITY DATA continued from page 2

Hazardous decomposition Products: Thermal-oxidative degradation can include toxic gases such as carbon monoxide and/or aromatic hydrocarbon gases.

SECTION VI. HEALTH HAZARD INFORMATION

This product is not considered a carcinogen by the NTP, IARC, or OSHA.

Summary of risks: Ethyl benzene vapor is severely irritating to the eyes and to the mucous membranes of the respiratory system. Sustained inhalation of excessive levels can cause depression of the central nervous system (CNS) characterized by dizziness, headache, narcosis, and coma. Skin contact with liquid ethyl benzene causes irritation; dermatitis and defatting can also develop. The acute oral toxicity of ethyl benzene is low; however, ingestion of it presents a serious aspiration hazard. Aspirating even a small amount into the lungs can result in extensive edema (lungs filled with fluid) and hemorrhaging of the lung tissue. No systemic effects are expected at the levels that produce pronounced, unignorable, disagreeable skin and eye irritation. The TLVs cited in section 2 are set to prevent this intolerable irritation.

Medical conditions which may be aggravated by contact: None reported.

Target organs: Skin, eyes, respiratory system, and CNS.

Primary entry route(s): Inhalation, skin contact.

Acute effects: Irritation of the skin, eyes, and respiratory system. Also, cardiac-rhythm disturbance due to sensitization; acute bronchitis, bronchospasm, pulmonary and laryngeal edema; euphoria; headache; giddinesss; dizziness; and incoordination, as well as possible depression; confusion; and coma.

Chronic effect(s): None reported.

First aid:

Eye contact: Immediately flush eyes, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 minutes.

Skin contact: Rinse the affected area with plenty 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.

HEALTH HAZARD INFORMATION continues on page 4

HEALTH HAZARD INFORMATION continued from page 3

Ingestion: Unlikely. Should this type of exposure occur, the aspiration hazard must be considered. Do not induce vomiting unless directed to do so by a physician. To prevent aspiration by spontaneous vomiting, keep the victim's head low (between his or her knees).

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 Physician: Professional judgment is required as to whether or not to induce vomiting because of the possibility of aspiration. A gastric lavage may be administered, followed by saline catharsis, if this procedure is appropriate to the specific incident. Monitor cardiac and pulmonary functions.

SECTION VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill / Leak procedures: Notify safety personnel, evacuate unnecessary personnel, eliminate all sources of ignition immediately, and provide adequate explosion-proof ventilation. Cleanup personnel need protection against skin or eye contact with this liquid as well as inhalation of its vapor (see sect. 8). Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways.

Waste management / 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)
CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per the Clean Water Act (CWA), Sections 311 (b) (4) and 307 (a).

SECTION VIII. SPECIAL PROTECTION INFORMATION

Personal protective equipment:

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: Wear 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.

SPECIAL PROTECTION INFORMATION continues on page 5

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: ETHYL BENZENE

MSDS No: Genium / 385
Revision: A
Date: November, 1988

SPECIAL PROTECTION INFORMATION continued from page 4

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact with this material.

Workplace considerations:

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 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 shoes and equipment.

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 ethyl benzene vapor.

SECTION IX. SPECIAL PRECAUTIONS

Storage segregation: Store ethyl benzene in closed containers in a cool, dry, well-ventilated area away from sources of ignition and strong oxidizers. Protect containers from physical damage.

Special handling / storage: Outside, isolated, detached, or remote storage is recommended for large quantities of ethyl benzene. Isolate bulk storage areas from acute fire hazards.

Engineering controls: Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. To prevent static sparks, electrically ground and bond all containers, pipelines, etc., used in shipping, transferring, reacting, production, and sampling operations.

Other precautions: Use safety cans for transferring small amounts of ethyl benzene.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Ethyl Benzene
DOT Label: Flammable Liquid

SPECIAL PRECAUTIONS continues on page 6

SPECIAL PRECAUTIONS continued from page 5

DOT Packaging Exceptions: 49 CFR 173.118
DOT Packaging Requirements: 49 CFR 173.119

IMO Shipping Name: Ethylbenzene
IMO Hazard Class: 3.2
IMO Label: Flammable Liquid
IMDG Packaging Group: II

DOT Class: Flammable Liquid UN Register: UN1175
Data source code(s): 1, 26, 38, 84-94, 100, 116, 117, 120, 122.

Prepared/revised by: Patrick J. Igoe, BS

November, 1988

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: TOLUENE

MSDS No: Genium / 317
Revision: D
Date: April, 1986

National Paint
and Coatings
Association

Hazardous Material
Identification
System

HEALTH HAZARD	2 - Moderate
FLAMMABILITY HAZARD	3 - Serious
REACTIVITY HAZARD	0 - Minimal
PERSONAL PROTECTION	SEE SECTION 8

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name: TOLUENE

Other Designations: Methyl Benzene, Methyl Benzol, Phenylmethane, Toluol, C_7H_8

CAS: 0108-88-3

Available from many suppliers, including:

Manufacturers: Allied Corp.
PO Box 2064R
Morristown, NJ 07960

Phone: (201) 455-4400

Ashland Chemical Co.
Industrial Chemicals & Solvents Div.

PO Box 2219
Columbus, OH 43216

Phone: (614) 889-3844

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:	Percent:	Exposure Limits:
Toluene	ca 100	8-hr TLV: 100 ppm, or 375 mg/m^3* (Skin) **
		Man, Inhalation, TCLo: 100 ppm: Psychotropic ***
		Rat, Oral, LD_{50}: 5000 mg/kg Rat, Inhalation, LCLo: 4000 ppm/4 hrs.

INGREDIENTS AND HAZARDS continues on page 2

INGREDIENTS AND HAZARDS continued from page 1

Rabbi , Skin,
LD_{50}: 14 gm/kg

Human, Eye: 300 ppm

* 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 500 ppm/10 minutes.

** Skin designation indicates that toluene can be absorbed through intact skin and contribute to overall exposure.

*** Affects the mind.

SECTION III. PHYSICAL DATA

Appearance & 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.

Boiling point: 231°F (111°C)
Vapor pressure: @ 20°C, mm Hg: 2
Water solubility (%): @ 20°C, wt.%: 0.05
Vapor density (air=1): 3.14

Evaporation rate: (BuAc=1): 2.24
Specific gravity (H_2O=1): 0.866
Melting point: -139°F (-95°C)
% volatile by volume: ca 100
Molecular weight: 92.15

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (method): 40°F (4°C) CC   Limits: LEL %: 1.27   UEL %: 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.

Autoignition Temp: 896°F (480°C)

Unusual fire or 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.

MSDS 317 continues on page 3

SECTION V. REACTIVITY DATA

Material is stable in closed containers at room temperature under normal storage and handling conditions. Hazardous polymerization does not occur

Chemical incompatibilities: This material is incompatible with strong oxidizing agents, dinitrogen tetraoxide, silver perchlorate, tetranitromethane, 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 nitrated 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 VI. HEALTH HAZARD INFORMATION

This product 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.*

HEALTH HAZARD INFORMATION continues on page 4

HEALTH HAZARD INFORMATION continued from page 3

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 VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill / Leak procedures: 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. 8).

Waste management / 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.

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 VIII. SPECIAL PROTECTION INFORMATION

Personal protective equipment:

Goggles: Safety glasses or splash goggles should be worn in all work areas.

Gloves: Neoprene gloves should be worn.

Respirator: 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.

SPECIAL PROTECTION INFORMATION continued from page 4

Other: 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.

Workplace considerations:

Ventilation: 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 lfm (linear feet per minute) and be designed to capture heavy vapor.

Safety stations:
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 IX. SPECIAL PRECAUTIONS

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: Preplacement 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.

Emptied containers contain product residues. Handle accordingly! Toluene is designated as a hazardous substance by the EPA (40 CFR 116).

DOT Class: Flammable Liquid UN Register: UN1294
Data source code(s): 1-9, 12, 16, 20, 21, 24, 25, 34, 81, 82. CR

Prepared/revised by: Genium Pubishing Corp.

SPECIAL PRECAUTIONS continues on page 6

SPECIAL PRECAUTIONS continued from page 5

April, 1986

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: XYLENE (MIXED ISOMERS)

MSDS No: Genium / 318
Revision: D
Date: August, 1988

National Paint and Coatings Association Hazardous Material Identification System	HEALTH HAZARD	2 - Moderate
	FLAMMABILITY HAZARD	3 - Serious
	REACTIVITY HAZARD	0 - Minimal
	PERSONAL PROTECTION	SEE SECTION 8

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name: XYLENE (MIXED ISOMERS)

Description: Used as a raw material for the production of benzoic acid, phthalic anhydride, isophthalic and terephthalic acids and their dimethyl esters in the manufacture of polyester fibers; in sterilizing catgut; with Canadian balsalm as oil-immersion in microscopy; and as a cleaning agent in microscopic techniques.

Other Designations: Dimethylbenzene; Xylol; C_8H_{10}

CAS: 1330-20-7

F 1
I 3
S 2
K 3

Contact your supplier or distributor. Consult the latest edition of the Chemicalweek Buyers' Guide (Genium ref. 73) for a list of suppliers.

Comments: Although there are three different isomers of xylene (ortho, meta, and para), the health and physical hazards of all three are very similar. This MSDS is written for a xylene mixture of all three isomers, which is usually commercial xylene.

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:	CAS Number:	Percent:	Exposure Limits:
Xylene (Mixed Isomers)	1330-20-7*	**	IDLH*** Level: 1000 ppm OSHA PEL 8-Hr TWA: 100 ppm, 435 mg/m^3 ACGIH TLVs, 1987-88 TLV-TWA: 100 ppm, 435 mg/m^3 TLV-STEL: 150 ppm, 655 mg/m^3

INGREDIENTS AND HAZARDS continues on page 2

INGREDIENTS AND HAZARDS continued from page 1

Toxicity Data****
Human, Inhalation, TC_{Lo}: 200 ppm
Man, Inhalation, LC_{Lo}:10000 ppm/6 Hrs
Rat, Oral, LD_{50}: 4300 mg/kg

* o-Xylene, CAS No. 0095-47-6
m-Xylene, CAS No. 0108-38-3
p-Xylene, CAS No. 0106-42-3

** Check with your supplier to determine if there are additions, contaminants or impurities (such as benzene) that are present in reportable quantities per 29 CFR 1910.
*** Immediately dangerous to life and health.
**** See NIOSH, RTECS (ZE2100000), for additional data with references to reproductive, irritative, and mutagenic effects.

SECTION III. PHYSICAL DATA

Appearance & Odor: A clear liquid; aromatic hydrocarbon odor.

Boiling point:	275°F to 293°F (135°C to 145°C)*	Evaporation rate:	0.6 Relative to BuAc=1
Vapor pressure:	7 to 9 Torrs at 68°F (20°C)	Specific gravity (H_2O=1):	0.86
		Melting point:	-13°F (-25°C)
Water solubility (%):	Insoluble	% volatile by volume:	Ca 100
Vapor density (air=1):	3.7	Molecular weight:	106 Grams/Mole

* Materials with wider and narrower boiling ranges are commercially available.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (method): 81°F to 90°F (27°C to 32°C)	Limits: LEL %: 1		UEL %: 7

NFPA Fire Hazard Symbol Codes: Flammability: 3 Health: 2 Reactivity: 0 Special: --

Extinguishing Media: Use foam, dry chemical, or carbon dioxide. Use water sprays to reduce the rate of burning and to cool containers.

Autoignition Temp: 867°F (464°C)

Unusual fire or explosion hazards: Xylene vapor is heavier than air and may travel a considerable distance to a low-lying source of ignition and flash back.

FIRE AND EXPLOSION DATA continues on page 3

FIRE AND EXPLOSION DATA continued from page 2

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 V. REACTIVITY DATA

Material is stable in closed containers during routinue operations. Hazardous polymerization cannot occur

Chemical incompatibilities: Xylene may react dangerously with strong oxidizers.

Conditions to avoid: Avoid any exposure to sources of ignition and to strong oxidizers.

Hazardous decomposition Products: Carbon monoxide (CO) may be evolved during xylene fires.

SECTION VI. HEALTH HAZARD INFORMATION

This product is not considered a carcinogen by the NTP, IARC, or OSHA.

Summary of risks: Liquid xylene is a skin irritant and causes erythema, dryness, and defatting; prolonged contact may cause blistering. Inhaling xylene can depress the central nervous system (CNS), and ingesting it can result in gastrointestinal disturbance; and possibly hematemesis (vomiting blood). Effects on the eyes, kidneys, liver, lungs, and the CNS are also reported.

Medical conditions which may be aggravated by contact: Problems with eyes, skin, central nervous system, kidneys, and liver may be worsened by exposure to xylene.

Target organs: CNS, eyes, gastrointestinal tract, blood, liver, kidneys, skin.

Primary entry route(s): Inhalation, skin contact/absorption.

Acute effects: Dizziness; excitement; drowsiness; incoordination; staggering gait, irritation of eyes, nose, and throat; corneal vacuolization; anorexia; nausea; vomiting; abdominal pain; and dermatitis.

Chronic effect(s): Reversible eye damage, headache, loss of appetite, nervousness, pale skin, and skin rash.

HEALTH HAZARD INFORMATION continues on page 4

HEALTH HAZARD INFORMATION continued from page 3

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.

Inhalation: Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have a trained person administer oxygen.

Ingestion: Never give anything by mouth to someone who is unconscious or convulsing. Vomiting may occur spontaneously, but do not induce it. If vomiting should occur, keep the exposed person's head below his or her hips to prevent aspiration (breathing the liquid xylene into the lungs). Severe hemorrhagic pneumonitis with grave, possibly fatal, pulmonary injury can occur from aspiring very small quantities of xylene.

Get medical help (in plant, paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid. If exposure is severe, hospitalization for at least 72 hours with careful monitoring for delayed onset of pulmonary edema is recommended.

SECTION VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill / Leak procedures: Notify safety personnel, provide ventilation, and eliminate all sources of ignition immediately. Cleanup personnel need protection against contact with and inhalation of vapor (see sect. 8). Contain large spills and collect waste or absorb it with an inert material such as sand, earth, or vermiculite. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways.

Waste management / 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. U239
CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per the Clean Water Act (CWA), section 311 (b) (9)

SECTION VIII. SPECIAL PROTECTION INFORMATION

Personal protective equipment:

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield as a supplementary protective measure. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Wear 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 OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine use (leaks or cleaning reactor vessels and storage tanks), wear an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode.*

Other: Wear impervious gloves, boots, aprons, gauntlets, etc., as required by the specifics of the work operation to prevent prolonged or repeated skin contact with xylene.

Workplace considerations:

Ventilation: Install and operate general and local maximum explosion-proof ventilation systems powerful enough to maintain airborne levels of xylene below the OSHA PEL standard cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of xylene into general work areas by eliminating it at its source. Consult the latest edition of the Genium reference 103 for detailed recommendations.

Safety stations:
Make eyewash stations, safety/quick-drench showers, and washing facilities 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 xylene from shoes and equipment.

* Warning: Air-purifying respirators will not protect workers in oxygen-deficient atmospheres.

Comments: Practice good personal hygiene; always wash thoroughly after using this material. Keep it off of 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 xylene vapor.

SECTION IX. SPECIAL PRECAUTIONS

Storage segregation: Store xylene in a cool, dry, well-ventilated area away from sources of ignition and strong oxidizers. Protect containers from physical damage.

Engineering controls: Make sure all engineering systems (production, transportation) are of maximum explosion-proof design. Ground and bond all containers, pipelines, etc. , used in shipping, transferring, reacting, producing, and sampling operations.

Transportation Data (49 CFR 172.101-2)
DOT Shipping Name: Xylene
DOT Label: Flammable Liquid
IMO Label: Flammable Liquid
IMO Class: 3.2 or 3.3

DOT Class: Flammable Liquid UN Register: UN1307
Data source code(s): 1, 2, 12, 73, 84-94, 100, 103.

Prepared/revised by: Genium Publishing Corporation

November, 1987

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyr Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: BENZENE

MSDS No: Genium / 316
Revision: E
Date: August, 1990

National Paint and Coatings Association Hazardous Material Identification System

HEALTH HAZARD	3 - Serious
FLAMMABILITY HAZARD	3 - Serious
REACTIVITY HAZARD	0 - Minimal
PERSONAL PROTECTION	SEE SECTION 8

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name: BENZENE

Description: Derived by fractional distillation of coal tar, hydrodealkylation 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, ethylbenzene (for styrene monomer), and nitrobenzene (for aniline).*

Other Designations: C_6H_6; benzol; carbon oil; coal naphtha; cyclohexatriene; mineral naphtha; nitration benzene; phene; phenyl hydride; pyrobenzol.

CAS: 0071-43-2

R 1
I 4
S 2 - Skin absorption
K 4

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

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.

* Additional manufacturing uses dodecylbenzene (for detergents), cyclohexane (for nylon), chlorobenzene, diphenyl, benzene hexachloride, maleic anhydride, benzene-sulfonic acid, artificial leather, linoleum, 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.

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: BENZENE

MSDS No: Genium / 316
Revision: E
Date: August, 1990

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:	CAS Number:	Percent:	Exposure Limits:
Benzene	0071-43-2	ca 100*	1989 OSHA PELs (29 CFR 1910.1000, Table Z-1-A) 8-hr TWA: 1 ppm, 3 mg/m^3 15-min STEL: 5 ppm, 15 mg/m^3 (Table Z-2) 8-hr TWA: 10 ppm Acceptable Ceiling Concentration: 25 ppm Acceptable Maximum Peak: 50 ppm (10 min) ** 1989-90 ACGIH TLV TLV-TWA: 10 ppm, 32 mg/m^3 1988 NIOSH RELs TWA: 0.1 ppm, 0.3 mg/m^3 Ceiling: 1 ppm, 3 mg/m^3 1985-86 Toxicity Data*** Man, oral, LD_{Lo}: 50 mg/kg; no toxic effect noted Man, inhalation, TC_{Lo}: 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

INGREDIENTS AND HAZARDS continues on page 3

INGREDIENTS AND HAZARDS continued from page 2

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, mutative, reproductive, tumorigenic, and toxicity data.

SECTION III. PHYSICAL DATA

Appearance & 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.

Boiling point: 176°F (80°C)
Vapor pressure: 100 mm Hg at 79°F (26.1°C)
Water solubility (%): Slightly (0.180 g/100 g of H_2O at 25°C)
Vapor density (air=1): 2.7

Evaporation rate: 2.8
Specific gravity (H_2O=1): 0.8787
Melting point: 42°F (5.5°C)
% volatile by volume: 100
Molecular weight: 78.11

Viscosity: 06468 mPa at 20°C

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (method): 12°F (-11.1°C), CC Limits: LEL %: 1.3% v/v UEL %: 7.1% v/v

NFPA Fire Hazard Symbol Codes: Flammability: 3 Health: 2 Reactivity: 0 Special: —

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.

Autoignition Temp: 928°F (498°C)

Unusual fire or explosion hazards: Benzene is a Class 1B 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

FIRE AND EXPLOSION DATA continues on page 4

FIRE AND EXPLOSION DATA continued from page 3

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 V. REACTIVITY DATA

Chemical incompatibilities: Benzene explodes on contact with diborane, permanganic acid, bromine pentafluoride, peroxodisulfuric acid, and peroxomonosulfuric acid. It ignites on contact with dioxygen difluoride, dioxygenyl 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). Benzene is incompatible with oxidizing materials.*

Conditions to avoid: Avoid heat and ignition sources.

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

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

* A vigorous or incandescent reaction occurs with bromine trifluoride, uranium hexafluoride, and hydrogen + Raney nickel [above 410°F (210°C)].

SECTION VI. HEALTH HAZARD INFORMATION

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 exposure. Higher level exposures may irritate the respiratory tract and cause central nervous system (CNS) depression.

Medical conditions which may be aggravated by contact: 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 route(s): Inhalation, skin contact.

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

HEALTH HAZARD INFORMATION continues on page 5

HEALTH HAZARD INFORMATION continued from page 4

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

First aid:

Eye contact: 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 contact: 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.

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 1).

After first aid, get appropriate in-plant, paramedic, or community medical attention and 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 VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill / Leak procedures: 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, dike 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 spaces such as sewers, watersheds, and waterways because of explosion danger. Follow applicable OSHA regulations (29 CFR 1910.120).

SPILL, LEAK AND DISPOSAL PROCEDURES continued from page 5

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

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

SECTION VIII. SPECIAL PROTECTION INFORMATION

Personal protective equipment:

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.

Workplace considerations:

Ventilation: Provide general and local explosion-proof 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. (103)

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. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment.

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.

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SECTION IX. SPECIAL PRECAUTIONS

Storage segregation: 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 CAPS below Transportation Data) 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

Data source code(s): 1, 2, 12, 26, 73, 84-94, 100, 101, 103, 109, 124, 126, 127, 132, 134, 136, 138, 139, 143

Prepared/revised by: MJ Allison, BS

August, 1990

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Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: **CHLOROBENZENE**

MSDS No: Genium / 365
Revision: B
Date: November, 1990

National Paint and Coatings Association
Hazardous Material Identification System

HEALTH HAZARD	2 - Moderate
FLAMMABILITY HAZARD	3 - Serious
REACTIVITY HAZARD	0 - Minimal
PERSONAL PROTECTION	SEE SECTION 8

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name: CHLOROBENZENE

Description: Produced by chlorinating benzene in the presence of a catalyst. Used in dry cleaning; as a solvent in manufacturing paints, adhesives, polishes, waxes, diisocyanates, natural rubber, and pharmaceuticals; a chemical intermediate for phenol, o-, and p-chloronitrobenzene, DDT, and aniline; and an intermediate in manufacturing dyestuffs.

Other Designations: C_6H_5Cl; benzene chloride; clorobenzol; MCB; monochlorobenzene; phenyl chloride.

CAS: 0108-90-7

R 1
I 3
S 2
K 3

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

Cautions: Chlorobenzene is a skin and mucous membrane irritant, a fairly strong narcotic, and a central nervous system (CNS) depressant. Chronic inhalation may cause lung, liver, and kidney damage. This material is a dangerous fire hazard when exposed to heat or flame.

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:	CAS Number:	Percent:	Exposure Limits:
Chlorobenzene	0108-90-7	ca 100	1989 OSHA PEL 8-hr TWA: 75 ppm, 350 mg/m^3 1990-91 ACGIH TLV* TWA: 75 ppm, 345 mg/m^3

INGREDIENTS AND HAZARDS continues on page 2

INGREDIENTS AND HAZARDS continued from page 1

1988 NIOSH REL
None established
1985-86 Toxicity Data**
Rat, oral, LD_{50}: 2910 mg/kg; toxic effects not yet reviewed
Rat, inhalation, TC_{Lo}: 210 ppm administered for 6 hr to a 6- to 15-day pregnant female produces specific developmental abnormalities
1987 IDLH Level
2400 ppm

* In its "Notice of Intended Changes (for 1990-91)," the ACGIH lists a proposed lower level TWA for chlorobenzene: 10 ppm, 46 mg/m³. (154)
** See NIOSH, RTECS (CZ0175000), for additional mutative, reproductive, and toxicity data.

SECTION III. PHYSICAL DATA

Appearance & Odor: A clear, colorless, volatile liquid with a faint, almond-like odor. Threshold odor concentration: 100% recognition, 0.21 ppm.

Boiling point: 270°F (132°C) at 760 mm Hg
Vapor pressure: 11.8 mm Hg at 77°F (25°C)
Water solubility (%): Insoluble
Vapor density (air=1): 3.88
Specific gravity (H_2O=1): (20°C/4°C) : 1.1058
Melting point: -50.1°F (-45.6°C)
Molecular weight: 112.56

Viscosity: 0.790 centipoise at 70°F (21°C)

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (method): 85°F (29.5°C), CC Limits: LEL %: 1.8% V/V UEL %: 9.6% V/V

NFPA Fire Hazard Symbol Codes: Flammability: 3 Health: 2 Reactivity: 0 Special: —

Extinguishing Media: Use carbon dioxide, dry chemical, halon, water spray, or standard foam to extinguish fires involving chlorobenzene. Use water in flooding quantities as fog since

FIRE AND EXPLOSION DATA continues on page 3

FIRE AND EXPLOSION DATA continued from page 2

solid streams of water may spread fire. Apply water spray from as far as possible to cool fire-exposed containers.

Autoignition Temp: 1180°F (638°C)

Unusual fire or explosion hazards: Chlorobenzene is dangerous when exposed to heat or flame. Vapor may travel to an ignition source 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. Do not extinguish fire unless flow can be stopped. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

SECTION V. REACTIVITY DATA

Chemical incompatibilities: Chlorobenzene is incompatible with strong oxidizers; contact may cause fires and explosions. It reacts violently with dimethyl sulfoxide. Silver perchlorate forms a solvated, shock-sensitive salt with chlorobenzene (explosion). Chlorobenzene is potentially explosive with powdered sodium or phosphorus trichloride + sodium.

Conditions to avoid: Avoid all heat and ignition sources and incompatible materials.

Hazardous decomposition Products: Thermal oxidative decomposition of products of chlorobenzene can include soot, hydrogen chloride, phosgene, and carbon monoxide.

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

SECTION VI. HEALTH HAZARD INFORMATION

Summary of risks: Chlorobenzene is a fairly strong narcotic and can cause central nervous sytem (CNS) depression. Overexposure is irritating to the eyes, nasal passages, and upper respiratory tract. It is moderately toxic by inhalation or ingestion and can be absorbed slowly through the skin. Short exposures to liquid may cause skin irritation and defatting, while prolonged or repeated skin contact may result in dermatitis or skin burns. Following absorpiton of toxic doses, liver and kidney degeneration are also observed. Chlorobenzene may also cause hemolysis.

Medical conditions which may be aggravated by contact: Individuals with skin, liver, kidney, or chronic respiratory disease may be at increased risk from exposure.

Target organs: Respiratory system, eyes, skin, central nervous system, and liver.

Primary entry route(s): Inhalation, ingestion, eye and skin contact.

HEALTH HAZARD INFORMATION continues on page 4

HEALTH HAZARD INFORMATION continued from page 3

Acute effects: Symptoms to be expected from acute exposure are headache, eye and upper respiratory tract irritation, dizziness, drowsiness, cyanosis, spastic contractions of extremities, and loss of consciousness, depending on the exposure's concentration and duration. Symptoms of ingestion include pallor, cyanosis, and coma, followed by complete recovery.

Chronic effect(s): Frequently repeated contact with chlorobenzene may result in skin burns, eye and upper respiratory tract irritation, headaches, dizziness, somnolence, and dyspeptic disorders (indigestion). Chronic inhalation may result in lung, liver, and kidney damage.

First aid:

Eye contact: 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 contact: 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. Consult a physician immediately. If vomiting occurs, administer more water.

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

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

Physician's Note: In a conscious patient, attempt to induce vomiting with syrup of Ipecac. Consider activated charcoal cathartic. Administer charcoal slurry with saline, water, or sorbitol. In an unconscious patient, do gastric lavage with suction.

SECTION VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill / Leak procedures: Design and practice a chlorobenzene spill control and counter measure plan (SCCP). Notify safety personnel, evacuate all unnecessary personnel, eliminate all heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and contact with liquid. Take up spilled material with a noncombustible absorbent material and place into containers for disposal. For large spills, dike far ahead of spill to contain. Do not release runoff to sewers or waterways since chlorobenzene is harmful to aquatic life in very low concentrations. Aquatic toxicity: A 20-ppm concentration of chlorobenzene administered to bluegill in fresh water during a 96-hr test period is the median tolerance limit (TLm) at which 50% of the aquatic organisms survive. Follow applicable OSHA regulations (29 CFR 1910.120).

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

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)
EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33), Hazardous Waste No. U037
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)

SECTION VIII. SPECIAL PROTECTION INFORMATION

Personal protective equipment:

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. Use an organic vapor-acid gas respirator where appropriate. 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 (polyvinyl alcohol is recommended) to prevent prolonged or repeated skin contact.

Workplace considerations:

Ventilation: Provide general and local explosion-proof 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.(103)

SPECIAL PROTECTION INFORMATION continues on page 6

SPECIAL PROTECTION INFORMATION continued from page 5

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. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment.

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 IX. SPECIAL PRECAUTIONS

Storage segregation: Store in tightly closed containers in a well-ventilated, fire-resistant area away from heat and ignition sources and oxidizing agents. Outside or detached storage is preferred. Storage and handling must be suitable for an OSHA Class IC flammable liquid. To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas. Protect containers from physical damage.

Engineering controls: Avoid vapor inhalation and contact with liquid. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures.

Other precautions: Provide a preplacement questionnaire that emphasizes detecting a history of skin, liver, kidney, or chronic respiratory disease.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Chlorobenzene
DOT Hazard Class: Flammable liquid
ID No.: UN1134
DOT Label: Flammable liquid
DOT Packaging Exceptions: 173.118
DOT Packaging Requirements: 173.119

IMO Shipping Name: Chlorobenzene
IMO Hazard Class: 3.3
ID No.: UN1134
IMO Label: Flammable liquid
IMDG Packaging Group: II

Data source code(s): 38, 73, 84, 85, 89, 100, 101, 103, 124, 126, 131, 133, 136, 138, 139, 140, 143, 146, 148

SPECIAL PRECAUTIONS continued from page 6

Prepared/revised by: MJ Allison, BS

November, 1990

Occupational Health Guideline for 1,1-Dichloroethane

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: CH_3CHCl_2
- Synonyms: Asymmetrical dichloroethane; ethylidene chloride; 1,1-ethylidene dichloride
- Appearance and odor: Colorless liquid with a chloroform-like odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for 1,1-dichloroethane is 100 parts of 1,1-dichloroethane per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 400 milligrams of 1,1-dichloroethane per cubic meter of air (mg/m^3). The American Conference of Governmental Industrial Hygienists has recommended for 1,1-dichloroethane a Threshold Limit Value of 200 ppm.

HEALTH HAZARD INFORMATION

- **Routes of exposure**

1,1-Dichloroethane can affect the body if it is inhaled or if it comes in contact with the eyes or skin. It can also affect the body if it is swallowed.

- **Effects of overexposure**

1. Short-term Exposure: Breathing 1,1-dichloroethane vapor may cause drowsiness and unconsciousness. It might also cause damage to the liver, kidneys, and lungs. Splashing the liquid in the eyes may cause irritation.

2. Long-term Exposure: Prolonged, confined, or repeated skin contact with 1,1-dichloroethane can produce a slight burn.

3. Reporting Signs and Symptoms: A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to 1,1-dichloroethane.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to 1,1-dichloroethane at potentially hazardous levels:

1. Initial Medical Screening: Employees should be screened for history of certain medical conditions (listed below) which might place the employee at increased risk from 1,1-dichloroethane exposure.

—Skin disease: 1,1-Dichloroethane can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

—Liver disease: Although 1,1-dichloroethane is not known as a liver toxin in humans, the importance of this organ in the biotransformation and detoxification of foreign substances should be considered before exposing persons with impaired liver function.

—Kidney disease: Although 1,1-dichloroethane is not known as a kidney toxin in humans, the importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of 1,1-dichloroethane might cause exacerbation of symptoms due to its irritant properties.

2. Periodic Medical Examination: Any employee developing the above-listed conditions should be referred for further medical examination.

- **Summary of toxicology**

1,1-Dichloroethane vapor is a narcotic. Rats exposed to 32,000 ppm for 30 minutes did not survive. The most consistent findings in animals exposed to concentrations

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

[illegible] 1978

of above 8,000 ppm for up to 7 hours were pathologic changes in the kidney and liver, and at much higher concentrations, near 64,000 ppm, damage to the lungs as well. Repeated daily exposure of several species of animals to 1,000 ppm resulted in no pathologic or hematologic changes. The liquid applied to the intact or abraded skin of rabbits produced slight edema and very slight necrosis after six daily applications. Instilled in the eyes of rabbits there was immediate, moderate conjunctival irritation and swelling which subsided within a week. There have been no reported cases of human overexposure by inhalation; prolonged, confined, or repeated skin contact can produce a slight burn.

CHEMICAL AND PHYSICAL PROPERTIES

- **Physical data**
  1. Molecular weight: 99
  2. Boiling point (760 mm Hg): 57.3 C (135 F)
  3. Specific gravity (water = 1): 1.2
  4. Vapor density (air = 1 at boiling point of 1,1-dichloroethane): 3.4
  5. Melting point: −96.7 C (−142 F)
  6. Vapor pressure at 20 C (68 F): 182 mm Hg
  7. Solubility in water, g/100 g water at 20 C (68 F): Less than 0.1
  8. Evaporation rate (butyl acetate = 1): 11.6
- **Reactivity**
  1. Conditions contributing to instability: Heat
  2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions. Contact with strong caustics will cause formation of flammable and toxic acetaldehyde gas.
  3. Hazardous decomposition products: Toxic gases and vapors (such as vinyl chloride, hydrogen chloride, phosgene, and carbon monoxide) may be released in a fire involving 1,1-dichloroethane.
  4. Special precautions: 1,1-Dichloroethane will attack some forms of plastics, rubber, and coatings.
- **Flammability**
  1. Flash point: −8.5 C (17 F) (closed cup)
  2. Autoignition temperature: Data not available
  3. Flammable limits in air, % by volume: Lower: 5.9; Upper: 15.9
  4. Extinguishant: Foam, dry chemical, carbon dioxide
- **Warning properties**

The AIHA *Hygienic Guide* reports that 1,1-dichloroethane has a distinctive, easily recognizable odor at the TLV.

1,1-Dichloroethane is *not known to be an eye irritant.*

MONITORING AND MEASUREMENT PROCEDURES

- General

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

- **Method**

Sampling and analyses may be performed by collection of vapors using an adsorption tube with subsequent desorption with carbon disulfide and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure 1,1-dichloroethane may be used. An analytical method for 1,1-dichloroethane is in the *NIOSH Manual of Analytical Methods,* 2nd Ed., Vol. 2, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00260-6).

RESPIRATORS

- Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.
- In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

- Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid 1,1-dichloroethane.
- Clothing wet with liquid 1,1-dichloroethane should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of 1,1-dichloroethane from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the 1,1-dichloroethane, the person performing the operation should be informed of 1,1-dichloroethane's hazardous properties.
- Any clothing which becomes wet with liquid 1,1-dichloroethane should be removed immediately and not

reworn until the 1,1-dichloroethane is removed from the clothing.

- Employees should be provided with and required to use splash-proof safety goggles where liquid 1,1-dichloroethane may contact the eyes.

SANITATION

- *Skin that becomes wet with liquid 1,1-dichloroethane* should be immediately washed or showered with soap or mild detergent and water to remove any 1,1-dichloroethane.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to 1,1-dichloroethane may occur and control methods which may be effective in each case:

Operation	Controls
Use as dewaxer of mineral oils; extractant for heat-sensitive substances	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use as a fumigant	General dilution ventilation of work area; personal protective equipment
Use in manufacture of vinyl chloride by vapor phase cracking; use in manufacture of high vacuum rubber and silicon grease; use as a chemical intermediate	General dilution ventilation; local exhaust ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

- **Eye Exposure**

If 1,1-dichloroethane gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

- **Skin Exposure**

If 1,1-dichloroethane gets on the skin, promptly flush the contaminated skin using soap or mild detergent and water. If 1,1-dichloroethane soaks through the clothing, remove the clothing immediately and flush the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.

- **Breathing**

If a person breathes in large amounts of 1,1-dichloroethane, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

- **Swallowing**

When 1,1-dichloroethane has been swallowed, get medical attention immediately. If medical attention is not immediately available, get the afflicted person to vomit by having him touch the back of his throat with his finger or by giving him syrup of ipecac as directed on the package. This non-prescription drug is available at most drug stores and drug counters and should be kept with emergency medical supplies in the workplace. Do not make an unconscious person vomit.

- **Rescue**

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL, LEAK, AND DISPOSAL PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.
- If 1,1-dichloroethane is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of spill or leak.
3. For small quantities, absorb on paper towels. Evaporate in a safe place (such as a fume hood). Allow sufficient time for evaporating vapors to completely clear the hood ductwork. Burn the paper in a suitable location away from combustible materials. Large quantities can be reclaimed or collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. 1,1-Dichloroethane should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion. Sewers designed to preclude the formation of explosive concentrations of 1,1-dichloroethane vapors are permitted.

- Waste disposal method:

1,1-Dichloroethane may be disposed of by atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

REFERENCES

- American Conference of Governmental Industrial Hygienists: "1,1-Dichloroethane (Ethylidene Chloride)." *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
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- Sax, N. I.: *Dangerous Properties of Industrial Materials* (3rd ed.), Van Nostrand Reinhold, New York, 1968.

RESPIRATORY PROTECTION FOR 1,1-DICHLOROETHANE

Condition	**Minimum Respiratory Protection* Required Above 100 ppm**
Vapor Concentration	
1000 ppm or less	Any chemical cartridge respirator with an organic vapor cartridge(s). Any supplied-air respirator. Any self-contained breathing apparatus.
4000 ppm or less	A gas mask with a chin-style or a front- or back-mounted organic vapor canister. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece. A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 4000 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against organic vapors. Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.

MATERIAL SAFETY DATA SHEET

C IPATIONAL HEALTH SERVICES, INC.
4. PLAZA DRIVE
HARMON MEADOWS
SECAUCUS, NJ 07094
1-800-223-8978

EMERGENCY CONTACT:
JOHN S. BRANSFORD, JR. (615)292-1180

SUBSTANCE IDENTIFICATION

CAS-NUMBER 50-32-8

SUBSTANCE: BENZO(A)PYRENE

TRADE NAMES/SYNONYMS:
3,4-BENZOPYRENE; 6,7-BENZOPYRENE; BENZO(A)PYRENE; B(A)P; 3,4-BP; 3,4-BENZPYRENE; 3,4-BENZ(A)PYRENE; 3,4-BENZYLPYRENE; BENZO(D,E,F)-CHRYSENE; U022; OHS02670

CHEMICAL FAMILY:

[illegible]DROCARBON, POLYNUCLEAR

MOLECULAR FORMULA: C20-H12 MOL WT: 252.32

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

COMPONENTS AND CONTAMINANTS

COMPONENT: BENZO(A)PYRENE PERCENT: 100

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
COAL PITCH TAR VOLATILES: 0.2 MG/M3 OSHA TWA;
0.1 MG/M3 NIOSH RECOMMENDED TWA

PHYSICAL DATA

DESCRIPTION: YELLOW CRYSTALS WITH A FAINT AROMATIC ODOR.

BOILING POINT: 594 F (312 C) MELTING POINT: 354 F (179 C)

SPECIFIC GRAVITY: > 1.0 VAPOR PRESSURE: 1.0 MMHG @ 20 C

SOLUBILITY IN WATER: INSOLUBLE VAPOR DENSITY: 8.7

SOLVENT SOLUBILITY: BENZENE, TOLUENE, XYLENE

FIRE AND EXPLOSION DATA

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

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR FOAM
(1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR ALCOHOL FOAM

(1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. DO NOT SCATTER SPILLED MATERIAL WITH MORE WATER THAN NEEDED FOR FIRE CONTROL. DIKE FIRE CONTROL WATER FOR LATER DISPOSAL (1984 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.3, GUIDE PAGE 31).

USE AGENTS SUITABLE FOR TYPE OF SURROUNDING FIRE. AVOID BREATHING HAZARDOUS VAPORS, KEEP UPWIND (BUREAU OF EXPLOSIVES, EMERGENCY HANDLING OF HAZARDOUS MATERIALS IN SURFACE TRANSPORTATION, 1981).

TOXICITY

50 MG/KG SUBCUTANEOUS-RAT LD50; 500 MG/KG INTRAPERITNEAL-MOUSE LDLO; 11 MG/KG INTRARENAL-FROG LDLO; MUTAGENIC DATA (RTEC); TERATOGENIC DATA (RTEC); POSITIVE ANIMAL CARCINOGEN (IARC); SUSPECT HUMAN CARCINOGEN (NTP).

BENZO(A)PYRENE IS A COAL TAR PITCH VOLATILE THAT MAY IRRITATE THE EYES, SKIN, AND MUCOUS MEMBRANES, AND MAY CAUSE PHOTOSENSITIZATIONAND LACRIMATION. THERE IS CONVINCING EVIDENCE THAT B(A)P PRODUCED LOCAL SARCOMAS FOLLOWING REPEATED SUBCUTANEOUS INJECTIONS, LUNG CARCINOMAS FOLLOWING INTRATRACHIAL INSTILLATION, AND AN INITIATOR IN SKIN CARCINOGENESIS IN MICE, AND IS

CARCINOGENIC IN SINGLE-DOSE EXPERIMENTS, AND FOLLOWING PRENATAL EXPOSURE.

HEALTH EFFECTS AND FIRST AID

INHALATION:
IRRITANT.
ACUTE EXPOSURE- MAY CAUSE RESPIRATORY IRRITATION, COUGH, DYSPNEA, AND PULMONARY EDEMA.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE BRONCHITIS. EXPOSURE IS ASSOCIATED WITH CANCERS OF THE LUNGS, BLADDER, KIDNEYS, AND GASTROINTESTINAL TRACT.

FIRST AID- REMOVE FROM EXPOSURE.

SKIN CONTACT:
IRRITANT/SENSITIZER.
ACUTE EXPOSURE- DELAYED EFFECTS ARE ERYTHEMA AND SWELLING, WHICH APPEARS A FEW HOURS AFTER EXPOSURE OF SKIN SURFACES TO ULTRAVIOLET LIGHT. HYPERMELANOSIS IS COMMON. INTENSE CONTACT HAS CAUSED ACNE AND/OR FOLLICULITIS. DESQUAMATION, PIGMENTATION, DERMATITIS, AND THERMAL BURNS HAVE ALSO OCCURRED. ALLERGIC DERMATITIS IS RARE.

CHRONIC EXPOSURE- LEUKODERMA AND SKIN CANCER HAVE OCCURRED.

FIRST AID- IMMEDIATELY FLUSH SKIN WITH SOAP AND WATER. REMOVE CONTAMINATED CLOTHING AND SHOES. GET MEDICAL ATTENTION FOR CHEMICAL OR THERMAL BURNS.

EYE CONTACT:
IRRITANT.

ACUTE EXPOSURE- DELAYED IRRITATION MAY OCCUR, WITH CONJUNCTIVAL ERYTHEMA, LACRIMATION, PALPEDRAL EDEMA, PHOTOPHOBIA, AND CORNEAL ULCERATION.

CHRONIC EXPOSURE- PROLONGED EXPOSURE MAY PRODUCE THE SAME EFFECTS AS ACUTE EXPOSURE.

FIRST AID- FLUSH EYES WITH PLENTY OF WATER. GET MEDICAL ATTENTION FOR CHEMICAL OR THERMAL BURNS.

INGESTION:

ACUTE EXPOSURE- INGESTION MAY CAUSE DIZZINESS, NAUSEA AND VOMITING, WEAKNESS, HEADACHE, TIGHTNESS IN THE CHEST, AND STAGGERING. IF LARGER AMOUNTS AMOUNTS HAVE BEEN INGESTED, THESE SYMPTOMS MAY PROGRESS TO VISUAL DISTURBANCES, TREMORS, SHALLOW AND RAPID RESPIRATION, CONVULSIONS AND COMA. VIOLENT EXCITEMENT OR DELIRIUM MAY PRECEDE UNCONSCIOUSNESS. KIDNEY OR LIVER DAMAGE MAY OCCUR.

CHRONIC EXPOSURE- HAS NOT BEEN REPORTED IN HUMANS.

FIRST AID- IF VICTIM IS CONSCIOUS, REMOVE INGESTED POISON BY GASTRIC LAVAGE, WITH ACTIVATED CHARCOAL AND A CUFFED ENDOTRACHEAL TUBE TO PREVENT ASPIRATION. IN THE ABSENCE OF DEPRESSION, CONVUSION OR IMPAIRED GAG REFLEX, IPECAC EMESIS CAN ALSO BE DONE WITHOUT INCREASING THE HAZARD OF ASPIRATION WHEN VOMITING OCCURS, HOLD THE PATIENT WITH HEAD LOWER THAN HIPS TO HELP PREVENT PULMONARY ASPIRATION. AFTER VOMITING STOPS, GIVE 30 TO 60 ML. OF FLEET'S PHOSPHO-SODA DILUTED 1:4 IN WATER. (DREISBACH, HANDBOOK OF POISONING, 11TH ED.).

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:
CONTACT WITH STRONG OXIDIZERS MAY CAUSE FIRES AND EXPLOSIONS.

DECOMPOSITION:
THERMAL DECOMPOSITION MAY RELEASE ACRID SMOKE AND IRRITATING FUMES.

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

* * *

CONDITIONS TO AVOID

MAY BE IGNITED BY HEAT, SPARKS OR FLAMES. VAPORS MAY TRAVEL TO A SOURCE OF IGNITION AND FLASH BACK. CONTAINER MAY EXPLODE IN HEAT OF FIRE. VAPOR EXPLOSION HAZARD INDOORS, OUTDOORS OR IN SEWERS. RUNOFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD.

DANGER: CANCER HAZARD. DO NOT BREATH DUST, FUME, OR VAPOR. DO NOT GET IN EYES, ON SKIN,, OR ON CLOTHING. DO NOT TAKE INTERNALLY. USE ONLY WITH ADEQUATE VENTILATION. WEAR GOGGLES, FACE SHIELD, GLOVES, AND PROTECTIVE CLOTHING WHEN HANDLING.

* * *

SPILL AND LEAK PROCEDURES

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

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

WATER SPILL:
USE ACTIVATED CARBON TO ABSORB SPILLED SUBSTANCE THAT IS DISSOLVED.

USE SUCTION HOSES TO REMOVE TRAPPED SPILL MATERIAL.

USE DREDGES OR LIFTS TO EXTRACT IMMOBILIZED MASSES OF POLLUTION AND PRECIPITATES.

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

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST VENTILATION AND/OR GENERAL DILUTION VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS.

RESPIRATOR:
2 MG/M3- CHEMICAL CARTRIDGE RESPIRATOR WITH AN ORGANIC VAPOR CARTRIDGE WITH A FUME OR HIGH-EFFICIENCY FILTER.
SUPPLIED-AIR RESPIRATOR.
SELF-CONTAINED BREATHING APPARATUR.

10 MG/M3- CHEMICAL CARTRIDGE RESPIRATOR WITH AN ORGANIC VAPOR CANISTER WITH A FUME OR HIGH-EFFICIENCY FILTER AND A FULL FACEPIECE.
GAS MASK WITH AN ORGANIC VAPOR CANISTER (CHIN-STYLE OR FRONT- OR BACK-MOUNTED CANISTER) WITH A FUME OR HIGH-EFFICIENCY FILTER AND A FULL FACEPIECE.
SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE, HELMET, OR HOOD.

```
                         SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.

        200 MG/M3- TYPE 'C' SUPPLIED-AIR RESPIRATOR OPERATED IN PRESSURE-DEMAND,
                           POSITIVE-PRESSURE, OR CONITUSOUS-FLOW MODE.
                         POWERED AIR-PURIFYING RESPIRATOR WITH AN ORGANIC VAPOR CARTRIDGE
                           AND A HIGH-EFFICIENCY PARTICULATE FILTER.

         400 MG/M3- TYPE 'C' SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE OPERATED


                                                                OHS02670      PAGE 05 OF 05
                            IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE OR WITH A
                            FULL FACEPIECE, HELMET, OR HOOD OPERATED IN CONTINUOUS-FLOW
                            MODE.

             ESCAPE- GAS MASK WITH AN ORGANIC VAPOR CANISTER (CHIN-STYLE OR FRONT-
                            OR BACK-MOUNTED CANISTER) WITH A HIGH-EFFICIENCY PARTICULATE

                            FILTER WITH A FULL FACEPIECE, INCLUDING PESTICIDE RESPIRATORS
                            MEETING THESE REQUIREMENTS.

    FIREFIGHTING- SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE
                           OPERATED IN PRESSURE-DEMAND OR POSITIVE PRESSURE MODE.

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

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


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

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


                         AUTHORIZED - OCCUPATIONAL HEALTH SERVICES, INC.
                  CREATION DATE: 03/18/85           REVISION DATE: 12/10/85


    ===> ENTER OHS NUMBER, QUIT, HELP, OR LOGOFF COMMAND:
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Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

No. 0—

NAPHTHALENE

Issued: November 1987

SECTION 1. MATERIAL IDENTIFICATION

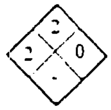
24

Material Name: NAPHTHALENE

Description (Origin/Uses): Used as a moth repellant and in many industrial processes.

Other Designations: Naphthalin; Naphthene; Tar Camphor; $C_{10}H_8$; NIOSH *RTECS* No. QJ0525000; CAS No. 0091-20-3

Manufacturer: *Contact your supplier or distributor. Consult the latest edition of the Chemicalweek Buyer's Guide* (Genium ref. 73) for a list of suppliers.

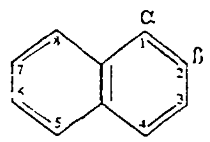


HMIS
H 2
F 2
R 0
PPG*
*See sect. 8

R 1
I 4
S 1
K 2

SECTION 2. INGREDIENTS AND HAZARDS | % | EXPOSURE LIMITS

Naphthalene. CAS No. 0091-20-3 | ca 100



*Immediately dangerous to life and health
**See NIOSH *RTECS* for additional data with references to irritative, mutagenic, reproductive, and tumorigenic effects.

IDLH* Level: 500 ppm

ACGIH TLVs, 1987-88
TLV-TWA: 10 ppm, 50 mg/m³
OSHA PEL
8-Hr TWA: 10 ppm, 50 mg/m³
Toxicity Data**
Child, Oral, LD_{Lo}: 100 mg/kg
Man, Unknown, LD_{Lo}: 74 mg/kg
Rat, Oral, LD_{50}: 1250 mg/kg

SECTION 3. PHYSICAL DATA

Boiling Point: 424°F (218°C)
Vapor Density (Air = 1): 4.4
Vapor Pressure: 0.087 Torr at 77°F (25°C)
Water Solubility: Insoluble

Specific Gravity (H_2O = 1): 1.162 at 68°F (20°C)
Melting Point: 176°F (80°C)
Molecular Weight: 128 Grams/Mole
% Volatile by Volume: ca 100

Appearance and Odor: White crystalline flakes; strong coal tar odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
174°F (79°C) OC; 190°F (88°C) CC	979°F (526°C)	% by Volume	0.9	5.9

Extinguishing Media: *Use water spray, dry chemical, or carbon dioxide to fight fires involving naphthalene.* **Caution:** Foam or direct water spray applied to molten naphthalene may cause extensive foaming.

Unusual Fire or Explosion Hazards: Naphthalene is a volatile solid that gives off flammable vapor when heated (as in fire situations). This vapor is much denser than air and will collect in enclosed or low-lying areas like sumps. In these areas an explosive air-vapor mixture may form, and extra caution is required to prevent any ignition sources from starting an explosion or fire.

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

Naphthalene is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

Chemical Incompatibilities: Naphthalene is incompatible with strong oxidizing agents, chromic anhydride, and mixtures of aluminum trichloride and benzoyl chloride.

Conditions to Avoid: Ignition sources like open flame, unprotected heaters, excessive heat, lighted tobacco products, and electric sparks must not occur in work areas where naphthalene vapor may become concentrated.

Hazardous Products of Decomposition: Toxic gases like carbon monoxide are produced during fire conditions. Irritating, flammable vapor forms below the melting point because even solid naphthalene has a significant vapor pressure.

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 ID No.** UN1334
DOT Hazard Class: ORM-A	**IMO Label:** Flammable Solid
IMO Class: 4.1	**DOT Label:** None

References: 1, 2, 12, 73, 84-94, 103. PJI

Approvals	
Indust. Hygiene/Safety	
Medical Review	

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12308
(518) 377-8854
From Genium's collection, to be used as reference

Product: PYRENE

MSDS No: Genium # [illegible]
Date: April, 1990

National Paint and Coatings Association
Hazardous Material Identification System

HEALTH HAZARD	2 -- Moderate
FLAMMABILITY HAZARD	1 -- Slight
REACTIVITY HAZARD	0 -- Minimal
PERSONAL PROTECTION	SEE SECTION 8

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name: PYRENE

Description: A condensed ring, polyaromatic hydrocarbon compound derived from coal tar. Also synthesized from o,o'-ditolyl. Used in biochemical research and as starting material for synthesizing benzo(a)pyrene. An ingredient of smoked and broiled meat, tobacco smoke, and air pollution.

Other Designations: $C_{16}H_{10}$; beta-pyrene; benzo(d,e,f)phenanthrene; benzo(d,e,f) phenathrene.

CAS: 0129-00-0

R 1
I 3
S 2 - Skin absorption
K --

Manufacturer: Contact your supplier or distributor. Consult the latest <u>Chemicalweek Buyers' Guide</u>(73) for a suppliers list.

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:	CAS Number:	Percent:	Exposure Limits:
Pyrene	0129-00-0	ca 100	OSHA PEL 8-hr TWA: 0.2 mg/m^3 ACGIH TLV, 1989-90 None established NIOSH REL, 1987 None established Toxicity Data* Rat, oral, LD_{50}: 2700 mg/kg ingested produces conjuctiva irritation, excitement, and muscle contraction

INGREDIENTS AND HAZARDS continues on page 2

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
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From Genium's collection, to be used as reference

Product: PYRENE

MSDS No: Genium / 711
Date: April, 1990

INGREDIENTS AND HAZARDS continued from page 1

Rat, inhalation, LC_{50}: 170 mg/m³ inhaled produces conjunctiva irritation, excitement, and muscle contraction
Gene mutation in mammalian cells: human cell types: 12 µmol/l

* See NIOSH, RTECS (UR2450000), for additional mutative, tumorigenic, and toxicity data.

SECTION III. PHYSICAL DATA

Appearance & Odor: Colorless solid or a slight blue florescent solution. Tetracene impurities give pyrene a yellow color.

Boiling point: 759°F/404°C
Vapor pressure: 6.85 x 10^{-7} torr at 68°F/20°C
Water solubility (%): Insoluble (0.135 mg/l)
Specific gravity (H_2O=1): 1.271 at 73°F/23°C*
Melting point: 313°F/156°C
Molecular weight: 202.26 g/mo

* Water's specific gravity is 1 at 39°F/4°C.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (method): None reported
Limits: LEL %: None reported
UEL %: None reported

NFPA Fire Hazard Symbol Codes: Flammability: 1 Health: 2 Reactivity: 0 Special: —*

Extinguishing Media: Use foam, dry chemical, and CO_2 to extinguish fire.

Autoignition Temp: None reported

Unusual fire or explosion hazards: Pyrene is a flammable and combustible material that heat and ignition sources may ignite. It burns rapidly with a flare-like effect.

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. Avoid skin contact. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

* Genium determined these hazard values because the NFPA Guidebook did not.

MSDS 711 continues on page 3

Material Safety Data Sheet

Genium Publishing Corporation
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Product: PYRENE

MSDS No: Genium / 711
Date: April, 1990

SECTION V. REACTIVITY DATA

Hazardous decomposition Products: Thermal oxidative decomposition of pyrene can emit irritating fumes and acrid smoke.

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

SECTION VI. HEALTH HAZARD INFORMATION

Summary of risks: Pyrene is irritating to exposed skin and eyes, moderately toxic by ingestion and intraperitoneal routes, and a poison by inhalation. Experimental studies show pyrene is a tumorigen in animals and a mutagen in humans. Workers exposed to concentrations between 3 and 5 mg/m^3 showed some unspecified teratogenic effects. In general, human exposure occurs mainly through inhalation of tobacco smoke and polluted air. Although ingesting smoked and broiled meats may expose humans to pyrene, there is little indication of serious health effects

Medical conditions which may be aggravated by contact: None reported.

Target organs: Skin, eyes, respiratory tract.

Primary entry route(s): Inhalation, ingestion, skin contact.

Acute effects: Vapor inhalation may irritate the nose mucosa and respiratory tract. Vapors may also cause conjunctival irritation. Pyrene is absorbed through intact skin and causes dermal irritation. Ingestion may irritate and burn the esophagus and gastrointestinal tract.

Chronic effect(s): None reported.

First aid:

Eye contact: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin contact: Quickly remove contaminated clothing. After rinsing affected skin with flooding amounts of water, wash it 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 a conscious person drink 1 to 2 glasses of milk or water. Do not induce vomiting.

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists pyrene as a carcinogen.

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

HEALTH HAZARD INFORMATION continues on page 4

HEALTH HAZARD INFORMATION continued from page 3

Physician's Note: Observe patients with dermal exposure for systemic poisoning since pyrene is absorbed through intact skin.

SECTION VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill / Leak procedures: Notify safety personnel, evacuate all unnecessary personnel, and remove all heat and ignition sources. Cleanup personnel should protect against vapor inhalation and skin and eye contact. Scoop spilled material into appropriate disposal containers. Absorb liquid with inert, noncombustible material and place waste in appropriate disposal containers. Follow applicable OSHA regulations (29 CFR 1910.120).

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

OSHA Designations
Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed
EPA Designations
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 5000 lb (2270 kg) [* per Clean Water Act, Sec. 307(a)]
Listed as SARA Extremely Hazardous Substance (40 CFR 355), Reportable Quantity: 5000 lb. Threshold Planning Quantity (TPQ): 1000/10,000 lb
SARA Toxic Chemical (40 CFR 372.65): Not listed

SECTION VIII. SPECIAL PROTECTION INFORMATION

Personal protective equipment:

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

Respirator: 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 <u>not</u> protect workers in oxygen-deficient atmospheres.

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

Workplace considerations:

Material Safety Data Sheet

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Product: PYRENE

MSDS No: Genium / 711
Date: April, 1990

SPECIAL PROTECTION INFORMATION continued from page 4

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred since 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:
Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment.

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 IX. SPECIAL PRECAUTIONS

Storage segregation: Store in closed containers in a cool, well-ventilated area. Protect containers from physical damage.

Engineering controls: Avoid vapor inhalation and skin contact. Practice good personal hygiene and housekeeping procedures. To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas. Provide preplacement and periodic medical examinations, including comprehensive medical histories with emphasis on the oral cavity, respiratory tract, bladder, and kidneys. Examine the skin for premalignant and malignant lesion.

Transportation Data (49 CFR 172.101, .102): Not listed

Data source code(s): 7, 73, 87, 103, 123, 124, 126, 127, 136

Prepared/revised by: MJ Allison, BS

April, 1990

MONSANTO PRODUCT NAME

Polychlorinated Biphenyls (PCBs)

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

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

PRODUCT IDENTIFICATION

The following materials contain 99.9% or greater PCBs. For information about other ingredients in formulations containing PCBs, contact the manufacturer of those ingredients.

Synonyms:	PCBs Chlorodiphenyl (__% Cl) Chlorinated biphenyl Polychlorinated biphenyl Chlorinated biphenyls (approx. __% Cl)
Trade Names *(Commonly used Monsanto products)*	Askarel** Aroclor® Series 1016, 1221, 1232, 1242, 1248, 1254, 1260 Therminol® FR Series
CAS No.:	001336363, 053469219, 012672296, 011097691, 011096825 and others

WARNING STATEMENTS

Federal regulations under the Toxic Substances Control Act require PCBs and PCB items to be marked. (Check regulations for details.)

> **CAUTION**
> **CONTAINS**
> **PCBs**
> **(Polychlorinated Biphenyls)**
>
> A toxic environmental contaminant requiring special handling and disposal in accordance with U.S. Environmental Protection Agency Regulations 40 CFR 761 For Disposal Information contact the nearest U.S. E.P.A. Office
>
> In case of accident or spill, call toll free the U.S. Coast Guard National Response Center 800 424-8802
>
> Also Contact: ____________________
> Tel. No ____________________ ML2

> CAUTION —
> CONTAINS
> **PCBs**
> (Polychlorinated Biphenyls)
> FOR PROPER DISPOSAL INFORMATION
> CONTACT U.S. ENVIRONMENTAL
> PROTECTION AGENCY
> MS

PRECAUTIONARY MEASURES

Care should be taken to prevent entry into the environment through spills, leakage, use, vaporization, or disposal of liquid or containers. Avoid prolonged breathing of vapors or mists. Avoid contact with eyes or prolonged contact with skin. If skin contact occurs, remove by washing with soap and water. Following eye contact, flush with water. In case of spillage onto clothing, the clothing should be removed as soon as practical, skin washed, and clothing laundered. *Comply with all federal, state, and local regulations.*

EMERGENCY AND FIRST AID PROCEDURES

Ingestion: Consult a physician. Do not induce vomiting or give any oily laxatives. NOTE TO PHYSICIAN—*If large amounts are ingested, gastric lavage is suggested.*

Skin: If liquid or solid PCBs are splashed or spilled on skin, contaminated clothing should be removed and the skin washed thoroughly with soap and water. NOTE TO PHYSICIAN—*Hot PCBs may cause thermal burns.*

Eyes: Eyes should be irrigated immediately with copious quantities of running water for at least 15 minutes if liquid or solid PCBs get into them. A petrolatum-based ophthalmic ointment may be applied to the eye to relieve the irritating effects of PCBs.

Inhalation: Remove to fresh air. If skin rash or respiratory irritation persists, consult a physician. NOTE TO PHYSICIAN—If electrical equipment arcs over, PCBs or other chlorinated hydrocarbon dielectric fluids may decompose to produce HCl, hydrochloric acid, a respiratory irritant.

OCCUPATIONAL CONTROL PROCEDURES

Eye Protection: Wear chemical splash goggles and have eye baths available where there is significant potential for eye contact.

Skin Protection: Wear appropriate protective gloves and protective clothing that provide a barrier to prevent skin contact. Consult glove manufacturer to determine appropriate type glove for given application. Wear chemical safety goggles and a face shield and a protective apron that provides a barrier when splashing is likely. Wash immediately if skin is contaminated. Remove contaminated clothing promptly and launder before reuse. Clean protective equipment before reuse. Provide a safety shower at any location where skin contact can occur. Wash thoroughly *after handling.*

ATTENTION: Repeated or prolonged contact may cause chloracne in some people.

Respiratory Protection: Avoid breathing vapor or mist. Use NIOSH/MSHA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical splash goggles. Consult respirator manufacturer to determine type equipment for given application. The respirator use limitations specified by NIOSH/MSHA or the manufacturer must be observed. High airborne concentrations may require use of self-contained breathing apparatus or supplied air respirator. Respiratory protection programs *must be in compliance* with 29 CFR Part 1910.134.

Ventilation: Provide ventilation to control exposure levels below airborne exposure limits. Use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.

Airborne Exposure Limits: Chlorinated biphenyl (approximately 42% chlorine)

OSHA PEL: 1 mg/m^3 8-hour time-weighted average - Skin*
ACGIH TLV®: 1 mg/m^3 8-hour time-weighted average - Skin*
2 mg/m^3 short-term exposure limit - Skin*

Chlorinated biphenyl (approximately 54% chlorine)

OSHA PEL: 0.5 mg/m^3 8-hour time-weighted average - Skin*
ACGIH TLV®: 0.5 mg/m^3 8-hour time-weighted average - Skin*
1 mg/m^3 short-term exposure limit - Skin*

**Skin notation means that skin absorption of this material may add to the overall exposure. Avoid skin contact.*

FIRE PROTECTION INFORMATION

Fire and Explosion. PCBs are fire-resistant compounds. They may decompose to form CO, CO_2, HCl, phenolics, aldehydes and other toxic combustion products under severe conditions such as exposure to flame or hot surfaces.

At temperatures in the range of 600-650°C in the presence of excess oxygen PCBs may form polychlorinated dibenzofurans (PCDFs). Laboratory studies under similar conditions have demonstrated that PCBs do *not* produce polychlorinated dibenzo-p-dioxins (PCDDs).

PCBs in electrical equipment have been reported to produce both chlorinated dioxins (PCDDs) and furans (PCDFs) during fire situations. These combustion products may result all, or in part, from non-PCB components of the dielectric fluids or other combusted materials. Consult the equipment manufacturer for information regarding composition of the dielectric fluids in electrical apparatus.

Standard fire fighting wearing apparel and self-contained breathing apparatus should be worn when fighting fires that involve possible exposure to chemical combustion products. Fire fighting equipment should be thoroughly cleaned and decontaminated after use.

If a PCB transformer is involved in a fire-related incident, the owner of the transformer may be required to report the incident. Consult and follow appropriate federal, state, and local regulations.

REACTIVITY DATA

PCBs are very stable, fire-resistant compounds.

HEALTH EFFECTS SUMMARY

Skin Contact: PCBs can be absorbed through intact skin. Local action on skin is similar to that of common organic solvents where contact leads to removal of natural fats and oils with subsequent drying and cracking of the skin. A potential exists for the contracting of chloracne.

Eye Contact: The liquid products and their vapors are moderately irritating to eye tissues.

Ingestion: The acute oral toxicities of the undiluted compounds are: LD_{50} rats—8.65 gm/kg for 42% chlorinated, and 11.9 gm/kg for 54% chlorinated—"slightly toxic."

Inhalation: Animal experiments of varying duration and at different air concentrations show that for similar exposure conditions, the 54% chlorinated material produces more liver injury than the 42% chlorinated material.

Other: There are literature reports that PCBs can impair reproductive functions in monkeys. A study reported in the literature with female rats using Aroclor® 1260 stated that Aroclor 1260 caused liver cancers. Monsanto sponsored animal feeding studies of Aroclor 1242, 1254 and 1260. These compounds, fed to both sexes of rats, did not produce cancers. The National Cancer Institute performed a study in 1977 using Aroclor 1254 with both sexes of rats. NCI stated that the PCB, Aroclor 1254, was not carcinogenic under the conditions of their bioassay.

(Health Effects Summary Continued On Next Page)

HEALTH EFFECTS SUMMARY (Continued)

The consistent finding in animal studies with PCBs is that they produce liver injury following prolonged and repeated exposure by any route, if the exposure is of sufficient degree and duration. Liver injury is produced first, and by exposures that are less than those reported to cause cancer in rodents. Therefore, exposure by all routes should be kept sufficiently low to prevent liver injury.

Numerous epidemiological studies of humans, both occupationally exposed and non-worker environmentally exposed populations, have not demonstrated any statistically significant causal relationship between PCB exposures and chronic human illnesses such as cancer or neurological or cardiovascular effects. Nor was there any increase in overall cancer mortality as a result of PCB exposure. PCBs can cause dermatological symptoms; however, these are reversible upon removal of exposure source.

PCBs are identified as hazardous chemicals under criteria of the OSHA Hazard Communication Standard (29 CFR Part 1910.1200). The Standard requires that this document mention that PCBs have been listed in the International Agency for Research on Cancer (IARC) Monographs (1982)-Group 2B and in the National Toxicology Program (NTP) Annual Report on Carcinogens (Third).

PHYSICAL DATA

Properties of Selected Aroclors[3]

Property	1016	1221	1232	1242	1248	1254	1260
Color (APHA)	40	100	100	100	100	100	150
Physical state	mobile oil	mobile oil	mobile oil	mobile oil	mobile oil	viscous liquid	sticky resin
Stability	inert	inert	inert	inert	inert	inert	inert
Density (lb/gal 25°C)	11.40	9.85	10.55	11.50	12.04	12.82	13.50
Specific gravity x/15.5°C	1.36-1.37 x-25°	1.18-1.19 x-25°	1.27-1.28 x-25°	1.30-1.39 x-25°	1.40-1.41 x-65°	1.49-1.50 x-65°	1.55-1.56 x-90°
Distillation range (°C)	323-356	275-320	290-325	325-366	340-375	365-390	385-420
Acidity mg KOH/g, maximum	.010	.014	.014	.015	.010	.010	.014
Fire point (°C)	none to boiling point	176	238	none to boiling point	none to boiling point	none to boiling point	none to boiling point
Flash point (°C)	170	141-150	152-154	176-180	193-196	none	none
Vapor pressure (mm Hg @ 100°F)	NA	NA	0.005	0.001	0.00037	0.00006	NA
Viscosity (Saybolt Univ. Sec. @ 100°F)	71-81	38-41	44-51	82-92	185-240	1800-2500	—

NA - Not Available

SPILL, LEAK & DISPOSAL INFORMATION

Disposal of liquid PCBs and other PCB items is strictly regulated by the federal government. The regulations are found at 40 CFR Part 761. Consult these regulations as well as applicable state and local regulations prior to any disposal of PCBs, PCB items, or PCB-contaminated items.

If PCBs leak or are spilled, the following steps should be taken immediately:

All non-essential personnel should leave the leak or spill area.

The area should be adequately ventilated to prevent the accumulation of vapors.

The spill/leak should be contained. Loss to sewer systems, navigable waterways and streams should be prevented. Spills/leaks should be removed promptly by means of absorptive material, such as sawdust, vermiculite, dry sand, clay, dirt or other similar materials, or trapped and removed by pumping or other suitable means (traps, drip-pans, trays, etc.).

Personnel entering the spill or leak area should be furnished with appropriate personal protective equipment and clothing as needed. See Occupational Control Procedures section of this MSDS.

Personnel trained in the emergency procedures and protected against the attendant hazards should shut off sources of PCBs, clean up spills, control and repair leaks and fight fires in PCB areas.

All wastes and residues containing PCBs (e.g., wiping cloths, absorbent material, used disposable protective gloves, clothing, etc.) should be collected, placed in proper containers, marked and disposed of in the manner prescribed by EPA regulations (40 CFR Part 761) and applicable state and local regulations.

Various federal, state, and local regulations may require reporting of PCB spills and may also define spill clean-up levels. Consult your attorney or appropriate regulatory officials for information relating to spill reporting and spill clean-up.

ADDITIONAL COMMENTS

Polychlorinated Biphenyls

For regulatory purposes, under the Toxic Substances Control Act the term "PCBs" refers to a chemical substance limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contain such substance (40 CFR Part 761).

Chemically, commercial PCBs are defined as a series of technical mixtures, consisting of many isomers and compounds that vary from mobile oily liquids to white crystalline solids and hard non-crystalline resins. Technical products vary in composition, in the degree of chlorination and possibly according to batch.

The mixtures generally used contain an average of 3 atoms of chlorine per molecule (42% chlorine) to 5 atoms of chlorine per molecule (54% chlorine). They are used as components of dielectric fluids in transformers and capacitors. Prior to 1972, PCB applications included heat transfer media, hydraulic and other industrial fluids, plasticizers, carbonless paper, paints, inks and adhesives. Federal regulations specify that non-totally enclosed PCB activities are permitted only if specifically exempted or authorized. (40 CFR Part 761).

CAS No. 001336363: For general class of compounds

(Additional Comments Continued On Next Page)

ADDITIONAL COMMENTS (Continued)

Trade Names/Common Names

**ASKAREL- Generic name for a broad class of fire-resistant synthetic chlorinated hydrocarbons and mixtures used as dielectric fluids that commonly contained about 30-70% PCBs. Some ASKAREL fluids contained 99% or greater PCBs.

PYRANOL®[2] and INERTEEN®[3] are trademarks for commonly used dielectric fluids that may have contained varying ratios of PCBs as well as other components including chlorinated benzenes.

®[1] Registered trademark of Monsanto Company

®[2] Registered trademark of General Electric Company

®[3] Registered trademark of Westinghouse Electric Corporation

This list of trade names is representative of several commonly used Monsanto products (or formulated with Monsanto products). Other trademarked PCB products were marketed by Monsanto and other manufacturers. PCBs were also manufactured and sold by several European and Japanese companies. Contact the manufacturer of the trademarked product directly, if not in this listing, to determine if the formulation contained PCBs and its composition.

DATE: 10/15/85 **REVISED:** **SUPERSEDES:** All prior to 10/15/85
MSDS NO.: G 4048

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

John H. Craddock
Product & Environmental Safety Director

Robert G. Kaley, II
Product & Environmental Safety Manager

Environmental Policy Staff
Monsanto Company
800 North Lindbergh Boulevard
St. Louis, Missouri 63167
(314) 694-4764

Material Safety Data Sheet

Conestoga-Rovers & Associates
382 West County Road D
St. Paul, MN 55112
(612) 639-0913

Product: POLYCHLORINATED
BIPHENYLS (PCBS)

MSDS No: CRA / 001
Date: June, 1991

National Paint and Coatings Association

Hazardous Material Identification System

HEALTH HAZARD	1 - Slight
FLAMMABILITY HAZARD	1 - Slight
REACTIVITY HAZARD	0 - Minimal
PERSONAL PROTECTION	SEE SECTION 8

SECTION I. MATERIAL IDENTIFICATION

rade/Material Name: POLYCHLORINATED BIPHENYLS (PCBS)

D ription: Commercial PCBs are mixtures that were once widely manufactured by ining chlorine gas, iron filings, and biphenyls. Their high stability contributes o their intended commercial applications and their accidental long-term adverse nvironmental and health effects. PCBs are useful as insulators in electrical equipment because they are electrically nonconductive. Their distribution has been imited since 1976. The Aroclor PCB codes identify*

ther Designations: Chlorodiphenyls**

s by type. The first two digits of a code indicate whether the PCB contains inated biphenyls (12), chlorinated terphenyls (54), or both (25, 44); the last wo 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, dhesives, electrical capacitors, electrical transformers, vacuum pumps, as-transmission turbines, heat-transfer fluids, hydraulic fluids, lubricating and utting oil, copying paper, carbonless copying paper, and fluorescent light ballasts.

* Other Designations

roducer	Trade Name	Nation
onsanto	Aroclor	USA, Great Britain
er	Clophen	German Democratic Republic
rodelec	Phenoclor Pyralene	France
Kanegafuchi	Kanechlor	Japan
Mitsubishi	Santotherm	Japan
affaro	Fenclor	Italy

Material Safety Data Sheet

Conestoga-Rovers & Associates
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Product: POLYCHLORINATED BIPHENYLS (PCBS)

MSDS No: CRA / 001
Date: June, 1991

SECTION II. INGREDIENTS AND HAZARDS

ngredient Name:	CAS Number:	Percent:	Exposure Limits:
8-42% Chlorine/Aroclor 1242	53469-21-9		OSHA PEL (Skin*) 8-Hr TWA: 1 mg/m^3 ACGIH TLV (Skin*), 1990 TLV-TWA: 1 mg/m^3
3-54% Chlorine/Aroclor 1254	11097-69-1		OSHA PEL (Skin*) 8-Hr TWA: 0.5 mg/m^3 ACGIH TLV (Skin*), 1990-91 TLV-TWA: 0.5 mg/m^3
ll PCBs/Aroclors	1336-36-3		NIOSH REL 1977 10-Hr TWA: 0.001 mg/m^3 Toxicity Data** Mouse, Oral, LD_{50}: 1900 mg/kg IDLH: 10 mg/m^3 (42% Cl); 5 mg/m^3 (54% Cl) ONTARIO MINISTRY of LABOUR TWAEV 0.05 mg^3

This material can be absorbed through intact skin, which contributes to overall xposure.
See NIOSH, RTECS at the locations specified in section 1 for additional data th references to tumorigenic, reproductive, mutagenic, and irritative effects.

rade Name	CAS No.	RTECS No.
oclors	01336-36-3	TQ1350000
oclor 1016	12674-11-2	TQ1351000
oclor 1221	11104-28-2	TQ1352000
or 1232	11141-16-5	TQ1354000
oclor 1242	53469-21-9	TQ1356000
oclor 1248	12672-29-6	TQ1358000
oclor 1254	11097-69-1	TQ1360000
roclor 1260	11096-82-5	TQ1362000

SECTION III. PHYSICAL DATA

earance & Odor: Clear to light yellow mobile oil to a sticky resin; a sweet omatic" odor. As the percentage of chlorine increases, the PCB becomes thicker and avier; e.g., Aroclor 1254 is more viscous than Aroclor 1242.

PHYSICAL DATA continues on page 3

PHYSICAL DATA continued from page 2

Boiling point: Ranges from 527°F (275°C) to 725°F (385°C)

ter solubility (%): Insoluble

% volatile by volume: Ranges from .2 to 1.6

Molecular weight: (Average)
Aroclor 1242: 258 Grams/Mole
Aroclor 1254: 326 Grams/Mole

ur Point: Ranges from -31°F (-35°C) to 87.8°F (31°C)

SECTION IV. FIRE AND EXPLOSION DATA

sh Point (method): Ranges from 284°F (140°C) to 392°F (200°C)

Limits: LEL %: Not Found UEL %: Not Found

A Fire Hazard Symbol Codes: Flammability: 1 Health: 3 Reactivity: 0 Special:

tinguishing Media: Use water spray/fog, carbon dioxide , dry chemical, or "alcohol" foam to extinguish fires involve polychlorinated biphenyls. Although it is very icult to ignite PCBs, they are often mixed with more lammable materials (oils, solvents, etc.).

Autoignition Temp: Not Found

usual fire or explosion hazards: If a transformer containing PCBs is involved in a ire, its owner may be required to report the incident to appropriate authorities. onsult and follow all pertinent Federal, state, and local regulations.

ecial fire-fighting procedures: Wear a self-contained breathing apparatus (SCBA) th a full facepiece operated in the pressure-demand or positive-pressure mode; fire i ers must also wear a complete set of protective clothing.

e hazards of PCB fires are associated with the possibility of their being released to the environment where they and their products of degeneration can pose serious ong-term health risks. These potential problems are heightened by the PCBs' esistance to biological and chemical degradation and by the possibility that they ll contaminate underground water systems (see sect. 5).

SECTION V. REACTIVITY DATA

Material is very stable Hazardous polymerization cannot occur

hemical incompatibilities: PCBs can react dangerously with sodium or potassium. nese reactions are part of an industrial process used to destroy PCBs; however, eople have been killed by explosions at PCB treatment, storage, and disposal sites.

onditions to avoid: Limit human exposure to PCBs to the lowest possible level; especially avoid contact with skin.

REACTIVITY DATA continues on page 4

REACTIVITY DATA continued from page 3

azardous decomposition Products: Thermal-oxidative degradation of PCBs can produce oxic 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 ombustion), and polychlorinated dibenzo-p-dioxin (PCDD or dioxin).

SECTION VI. HEALTH HAZARD INFORMATION

his product is considered a carcinogen by the EPA, and the IARC classifies it as a probable human carcinogen (group 2B).

hary of risks: Effects of accidental exposure to PCBs include acneform eruptions: ye discharge; swelling of the upper eyelids and hyperemia of the conjunctiva; yperpigmentation of skin, nails, and mucous membrane; chloroacne: distinctive hair follicles; fever; hearing difficulties; limb spasms; headache; vomiting; and diarrhea. CBs are potent liver toxins that can be absorbed through unbroken skin in hazardous mounts without immediately discernible pain or discomfort. Severe health effects can evelop 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 d cancer in rodents.

edical conditions which may be aggravated by contact: None reported.

Target organs: Skin, eyes, eyelids, blood, liver.

rimary entry route(s): Inhalation, skin contact/absorption.

Acute effects: Skin and eye irritation, acneform dermatitis, nausea, vomiting, abdominal pain, jaundice, liver damage.

hronic effect(s): Possible cancer (evidence of this is inconclusive); reproductive effects (jaundice, excessive secretion of tears, dermal chromopexy) ; and hepatitis.

irst aid:

Eye contact: Immediately flush eyes, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 minutes.

Skin contact: 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.

HEALTH HAZARD INFORMATION continues on page 5 --

HEALTH HAZARD INFORMATION continued from page 4

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.

;et medical help (in plant, paramedic, community) for all exposures. Seek prompt
:dical assistance for further treatment, observation, and support after first aid.
›te to Physician: PCBs are poorly metabolized, soluble in lipids, and they
.ccumulate in tissues or organs rich in lipids. Liver function tests can help to
ietermine the extent of body damage in exposed persons. If electrical equipment
›ntaining PCBs arcs over, the PCBs or other hydrocarbon dielectric fluids may
:compose and give off hydrochloric acid (HCl), a potent respiratory irritant.

SECTION VII. SPILL, LEAK AND DISPOSAL PROCEDURES

:pill / Leak procedures: Treat any accidental release of PCBs as an emergency. An
;PCCP (spill-prevention control and countermeasure plan) must be formulated before
ills or leaks occur. PCBs are resistant to biodegradation, soluble in lipids, and
emically stable; as such they have become significant contaminants of global
...ystems. Releases of PCBs require immediate, competent, professional response from
ed personnel. Each release situation is unique and requires a specifically
gned cleanup response. General recommendations include adhering to Federal
gulations (40 CFR Part 761). Notify safety personnel, evacuate nonessential
rsonnel, ventilate the spill area, and contain the PCBs. All wastes, residues, and
ontaminated cleanup equipment from the incident are subject to EPA requirements (40
R 761). Consult your attorney or appropriate regulatory officials for information
out reporting requirements and disposal procedures.

aste management / Disposal: Contact your hazardous waste diposal firm or a licensed
ontractor for detailed recommendations, especially when PCBs are unexpectedly
scovered. Follow Federal, state, and local regulations. PCBs are biomagnified in
food chain; i.e., their concentration increase at each link. The disposal of PCBs
PCB-contaminated materials is strictly regulated; violations of applicable laws
ar [illegible] sult in fines, lawsuits, and negative publicity.*

HA Designations
sted as an Air Contaminant (29 CFR 1910.1000 Subpart Z).

Designations (40 CFR 302.4)
CLA Hazardous Substance, Reportable Quantity: 10 lbs (4.54 kg), per the Clean
er Act (CWA), Sections 311 (b) (4) and 307 (a).

arning: Accidental spills of PCBs that may affect water supplies must be reported
Coast Guard personnel at the National Response Center, telephone (202) 426-2675.

Material Safety Data Sheet

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Product: POLYCHLORINATED
BIPHENYLS (PCBS)

MSDS No: CRA / 001
Date: June, 1991

SECTION VIII. SPECIAL PROTECTION INFORMATION

ersonal protective equipment:

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).

Gloves: Wear Butyl Rubber, Neoprene or Viton gloves if hand contact is probable.

Respirator: Wear a NIOSH-approved respirator 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 boots, aprons, and gauntlets to prevent any skin contact with PCBs.
Saranex type coveralls and gloves are required for hazardous waste cleanup operations.

lc lace considerations:

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 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. Heavily soiled clothing must be properly discarded in a manner consistent with applicable regulations.

ractice good personal hygiene: always wash thoroughly after using this material and efore 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.

MSDS 001 continues on page 7

SECTION IX. SPECIAL PRECAUTIONS

torage segregation: Store PCBs in closed containers in a cool, dry, well-ventilated
area. Protect containers from physical damage.

pecial handling / storage: All storage facilities must have adequate containment
ystems (dikes; elevated, nonporous holding platforms; retaining walls) to prevent
y major release of PCBs into the environment. Carefully design and implement these
tra precautions now; do not wait until you have to respond to an accidental release
this material.

ransportation Data (49 CFR 172.101-2; PCBs were the first materials to be directly
gulated by Congress by way of TSCA in 1976.)

OT Shipping Name: Polychlorinated Biphenyls
OT ckaging Requirements: 49 CFR 173.510

) Shipping Name: Polychlorinated Biphenyls
Hazard Class: 9
MDG Packaging Group: II

Class: ORM-E UN Register: UN2315
source code(s): 1, 6, 26, 38, 84-94, 100, 101, 116, 117, 120, 122.

pared/revised by: Mitchell S. Bergner CIH

June, 1991

MATERIAL SAFETY DATA SHEET

GENIUM PUBLISHING CORPORATION
1145 CATALYN STREET
SCHENECTADY, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

NO. 59

BERYLLIUM
METAL/POWDER

Date April 1980

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: BERYLLIUM METAL/POWDER

OTHER DESIGNATIONS: Glucinium, Glucinum, Be, CAS #007 440 417

MANUFACTURER: Material is available from several suppliers, including:

CERAC, Inc. P.O. Box 1178 Milwaukee, WI 53201 Phone: (414) 289-9800	Brush Wellman Metal & Oxide Div. Elmore, OH 43416 Phone: (419) 862-2745

SECTION II. INGREDIENTS AND HAZARDS

SECTION II. INGREDIENTS AND HAZARDS	%	HAZARD DATA
Beryllium	> 97	8-hr TWA 2 $\mu g/m^3$* (as Be)
Beryllium Oxide	< 3	Ceiling Level 5 $\mu g/m^3$ Peak 25 $\mu g/m^3$/30 min
*Current (1979) OSHA and ACGIH TLV. In 1975 OSHA proposed an 8-hr TWA of 1 $\mu g/m^3$ with a ceiling of 5 $\mu g/m^3$ (15 min. sample); OSHA believes that beryllium and its compounds should be treated as a carcinogenic threat to man. (The proposed OSHA standard is still under review, but is expected to issue in 1980.)		Human, inhalation TCLo 300 mg/m^3, pulmonary effects Rabbit, intravenous TDLo 20 mg/kg, neoplastic effects

SECTION III. PHYSICAL DATA

Boiling point at 1 atm, deg C	2970	Specific gravity at 20 C	1.848
Vapor pressure at 1910 C, mm Hg	7.6	Melting point, deg C	1278±5
Water solubility, hot water	Slight	Atomic weight	9.01
cold water	Insol.		

Appearance & Odor: A grayish-white metal (hexagonal crystal structure) also as powdered metal; no odor.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER
N/A	Powder ca. 1200 F	Dust explosion hazard		

Extinguishing Media: Do not use water or CO_2. Smother fire with approved dry powder extinguisher.* Beryllium can be a moderate fire hazard if exposed to flame. The hazard increases as particle size decreases. A cloud of Be dust in air can be explosive (areas where dusting may occur require Class II, Group E electrical services, 29 CFR 1910.309). Combustion products of this material are highly toxic.

Firefighters should use full protective clothing, eye protection, and self-contained breathing apparatus. After exposure to a beryllium fire, they should clean equipment and clothing thoroughly and bathe carefully. *Sand, graphite, powder, and sodium chloride have also been recommended.

SECTION V. REACTIVITY DATA

Beryllium is stable at room temperature and resists oxidation at ordinary temperatures.* When heated in air or in mixed CO_2 and nitrogen, it can be ignited.

It is acid and alkali soluble; it reacts with strong bases to evolve hydrogen.

Mixtures of the powdered metal with CCl_4 or trichloroethylene will flash on heavy impact.

Warm beryllium will react incandescently with phosphorus, fluorine or chlorine.

Molten lithium metal (180 C) severely attacks beryllium metal.

*Will form oxide on solid surfaces when moist.

No. 59

SECTION VI. HEALTH HAZARD INFORMATION

TLV 2 $\mu g/m^3$ (See Sect. II)

Be is highly toxic by inhalation of fume or dust. Prolonged or repeated skin contact can cause skin irritation or dermatitis. Eye contact can produce conjunctivitis.

Implantation under the skin (via a chip or sliver or by particles entering a wound) can produce hard lesions with central non-healing areas which must be surgically removed.

Acute inhalation can produce pneumonitis with non-productive cough, chest pain, shortness of breath, weakness, and pulmonary edema. Chronic exposures can produce berylliosis (progressive lung damage) and systemic beryllium disease, including pneumonitis (as above), joint pain, skin lesions, chills & fever, & damage to liver, spleen & heart.

Present studies have indicated that Be is so poorly absorbed through the gut that ingestion is not an important hazard. (Hamilton, Industrial Toxicology, 3rd Edition). Animal studies have shown beryllium to produce lung and bone tumors; it is a suspected carcinogen for man.

FIRST AID:

Eye Contact: Flush eyes thoroughly with running water for 15 minutes, including under the eyelids. Get medical attention.

Skin Contact: Wash affected area thoroughly with soap and water after removing contaminated clothing. If skin is broken, get medical attention.

Inhalation: Remove to fresh air. Restore breathing and support with oxygen as needed. Keep warm and at rest. Get medical attention.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

If powdered metal is spilled, notify safety personnel. Exclude all from area except clean-up personnel with protective equipment against contact or inhalation hazards. Provide ventilation and remove sources of heat or ignition. Pick up powder spills by methods such as vacuuming or wet mopping; prevent dusting conditions. Collect particulate scrap in sealed container for recovery or disposal.

DISPOSAL: Scrap or waste material disposal is best accomplished by arranging to return to the supplier in a mutually acceptable form. Beryllium waste unsuitable for recycle must be handled in accordance with Federal, State, and Local regulations. Burying in an approved landfill, or burning in an approved incinerator with a scrubber, followed by burying the residues in an approved landfill, have been used in the past.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Isolate workplaces where beryllium dust and fume are generated. Provide adequate general and local exhaust ventilation (with filtration to purify recycled air and to protect the external environment) to meet TLV requirements. Provide approved respirators for emergency and nonroutine use above the TLV: High efficiency filter masks are suitable as high as 50 $\mu g/m^3$; use air-supplied or self-contained respirators above 50 $\mu g/m^3$. A full-facepiece respirator is needed above 10 $\mu g/m^3$.

Workers may require body-covering protective clothing, gloves and safety goggles. When exposed above the TLV, a change of clean protective clothing and a shower at the end of the day is required. (Wash protective clothing with suitable protection for the launderer.) Avoid carrying beryllium particulate outside the workplace on hair or clothing.

Eyewash stations and safety showers should be available.

Monitor the workplace to properly determine and control exposure to beryllium.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Use only with adequate ventilation where Be can become airborne. When Be or its alloys is heated (as in welding or sintering processes) hazardous levels of fume can be generated. Store in clean, dry place away from incompatible materials (see Sect V) in low fire-hazard area. Protect containers from physical damage. Label clearly.

Use good housekeeping practices to prevent accumulation of Be-containing deposits. Give preplacement and annual medical exams to those who may be exposed above the TLV. Preclude from exposure those with pulmonary disease, chronic skin, liver, heart, or kidney conditions, abnormal chest X-ray or blood count, or vital capacity depression greater than 10% Provide worker training.

DOT Classification of powder - POISON B.

DATA SOURCE(S) CODE: 1-12, 18-20, 24-26

APPROVALS: MIS, CRD

Industrial Hygiene and Safety 4.21.80

MEDICAL REVIEW: 5/5/80

CADMIUM
CADMIUM
CADMIUM

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
112 COLONNADE ROAD
NEPEAN, ONTARIO
K2E 7L6
(613)226-8874

EMERGENCY CONTACT:
REGULATORY AFFAIRS OFFICER
(613)226-8874

DATE 07/20/89

ACCT: 17871-00

CAT NO: C3500

PURCHASE ORDER NUMBER

N/A. SPECIAL CUSTOMER REQUEST.

SUBSTANCE IDENTIFICATION

CAS-NUMBER 7440-43-9

SUBSTANCE: **CADMIUM**

TRADE NAMES/SYNONYMS:
CADMIUM DUST; C.I. NO. 77180; C-3; C-565; ACC03720

CHEMICAL FAMILY:
METAL

MOLECULAR FORMULA: CD

MOLECULAR WEIGHT: 112.40

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

COMPONENTS AND CONTAMINANTS

COMPONENT: CADMIUM PERCENT: <100.0

OTHER CONTAMINANTS: ZINC, COPPER, LEAD, TIN, SILVER, ANTIMONY, ARSENIC, THALLIUM

EXPOSURE LIMITS:
CADMIUM:
* OSHA EXPOSURE LIMIT REMOVED AS PER OSHA INSTRUCTION PUB 8-1.4
0.05 MG(CD)/M3 ACGIH TWA (DUST, SALTS)
(NOTICE OF INTENDED CHANGES 1987-1988)
0.05 MG(CD)/M3 ACGIH CEILING LIMIT (CADMIUM OXIDE FUME)
(NOTICE OF INTENDED CHANGES 1987-1988)
LOWEST FEASIBLE LIMIT NIOSH RECOMMENDED EXPOSURE CRITERIA

SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING
SUBJECT TO CALIFORNIA PROPOSITION 65 CANCER AND/OR REPRODUCTIVE TOXICITY

WARNING AND RELEASE REQUIREMENTS- (OCTOBER 1, 1987)

CADMIUM:
1 POUND CERCLA SECTION 103 REPORTABLE QUANTITY

PHYSICAL DATA

DESCRIPTION: SOFT, DUCTILE, MALLEABLE SILVER-WHITE, BLUE-TINGED, LUSTROUS METAL OR GRAYISH-WHITE POWDER   BOILING POINT: 1409 F (765 C)

MELTING POINT: 610 F (321 C)   SPECIFIC GRAVITY: 8.64

VAPOR PRESSURE: 1 MMHG @ 394 C   SOLUBILITY IN WATER: INSOLUBLE

SOLVENT SOLUBILITY: ACIDS, AMMONIUM NITRATE SOLUTION, HOT SULFURIC ACID

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
THE FINELY DIVIDED METAL IS PYROPHORIC; THE DUST IS A SEVERE FIRE HAZARD AND MODERATE EXPLOSION HAZARD WHEN EXPOSED TO HEAT OR FLAME. THE SUBSTANCE REACTS VIOLENTLY WITH EXTINGUISHING AGENTS SUCH AS WATER, FOAM, CARBON DIOXIDE AND HALONS.

FLASH POINT: FLAMMABLE (DUST)

FIREFIGHTING MEDIA:
USE DRY SAND, DOLOMITE, GRAPHITE, SODIUM CHLORIDE, SODA ASH, OR APPROPRIATE METAL-EXTINGUISHING POWDER. DO NOT APPLY WATER TO BURNING MATERIAL (NFPA FIRE PROTECTION HANDBOOK, 15TH EDITION).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. DO NOT SCATTER SPILLED MATERIAL WITH HIGH PRESSURE WATER STREAMS. DIKE FIRE CONTROL WATER FOR LATER DISPOSAL (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, GUIDE PAGE 31).

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

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49CFR172.101:
*FLAMMABLE SOLID

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND 172.402:
*FLAMMABLE SOLID

*HAZARD CLASSIFICATION AND LABEL APPLY TO DUST AND POWDER FORM ONLY.

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.154
EXCEPTIONS: 49CFR173.153

TOXICITY

CADMIUM:

TOXICITY DATA: 88 UG/M3/8.6 YEAR INHALATION-MAN TCLO; 39 MG/M3/20 MINUTES INHALATION-HUMAN LCLO; 15 MG/KG UNREPORTED-MAN LDLO; 225 MG/KG ORAL-RAT LD50; 25 MG/M3/30 MINUTES INHALATION-RAT LC50; 890 MG/KG ORAL-MOUSE LD50; 170 MG/M3 INHALATION-MOUSE LCLO; 70 MG/KG ORAL-RABBIT LDLO; 4 MG/KG INTRAPERITONEAL-RAT LD50; 9 MG/KG SUBCUTANEOUS-RAT LD50; 5 MG/KG SUBCUTANEOUS-RABBIT LDLO; 1800 UG/KG INTRAVENOUS-RAT LD50; 1140 MG/KG UNREPORTED-RAT LD50; 5 MG/KG INTRAVENOUS-RABBIT LDLO; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS); TUMORIGENIC DATA (RTECS).

CARCINOGEN STATUS: ANTICIPATED HUMAN CARCINOGEN (NTP); HUMAN LIMITED EVIDENCE, ANIMAL SUFFICIENT EVIDENCE (IARC CLASS 2A). CADMIUM HAS PRODUCED LOCAL SARCOMAS IN RATS FOLLOWING INTRAMUSCULAR ADMINISTRATION. EXPOSURE TO CADMIUM, PRIMARILY AS THE OXIDE, HAS BEEN ASSOCIATED WITH INCREASED RISKS OF PROSTATIC AND RESPIRATORY CANCERS.

LOCAL EFFECTS: IRRITANT- EYE, SKIN, MUCOUS MEMBRANES.

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

TARGET EFFECTS: POISONING MAY AFFECT THE KIDNEYS, BONE, BLOOD LIVER, LUNGS AND THE RESPIRATORY, NERVOUS, CARDIOVASCULAR AND GASTROINTESTINAL SYSTEMS.

AT INCREASED RISK FROM EXPOSURE: PERSONS WITH KIDNEY, LIVER OR RESPIRATORY, DISORDERS.

ADDITIONAL DATA: DRUG METABOLIZING ENZYMES MAY BE INHIBITED. EYE AND RESPIRATORY IRRITATION ARE NOT SUFFICIENT WARNING PROPERTIES FOR SYSTEMIC AND RESPIRATORY DAMAGE. IRON OR CALCIUM DEFICIENCY MAY INCREASE THE ABSORPTION OF CADMIUM.

HEALTH EFFECTS AND FIRST AID

INHALATION:

CADMIUM:

IRRITANT/HIGHLY TOXIC.

ACUTE EXPOSURE- THE AVERAGE CONCENTRATION RESPONSIBLE FOR FATALITIES IS 40-50 MG/M3 FOR 1 HOUR OR 9 MG/M3 FOR 5 HOURS. EARLY SYMPTOMS MAY INCLUDE MILD IRRITATION OF THE UPPER RESPIRATORY TRACT, A SENSATION OF CONSTRICTION OF THE THROAT, A NASTY OR METALLIC TASTE IN THE MOUTH AND COUGH. A LATENT PERIOD FROM 1-10 HOURS MAY PRECEDE THE ONSET OF RAPIDLY PROGRESSING DYSPNEA, CYANOSIS, SUBSTERNAL OR PRECORDIAL CHEST PAIN, AND A FLU-LIKE SYNDROME WITH WEAKNESS, MALAISE, NAUSEA, VOMITING, HEADACHE, FEVER, CHILLS, SHIVERING, PROFUSE SWEATING, AND MUSCULAR PAINS IN THE BACK AND LIMBS. COUGH WITH FOAMY OR BLOODY SPUTUM AND PULMONARY RALES MARK THE ONSET OF ACUTE PULMONARY EDEMA WHICH USUALLY DEVELOPS WITHIN 24 HOURS AND REACHES A MAXIMUM BY 3 DAYS. IF DEATH FROM ASPHYXIA DOES NOT OCCUR, AND EXPOSURE WAS MILD, SYMPTOMS MAY RESOLVE WITHIN A WEEK. IN MORE SEVERE EXPOSURES, FEVER, COUGH, CHEST PAIN, DYSPNEA, AND PROLIFERATIVE INTERSTITIAL PNEUMONITIS MAY PERSIST FROM 5-10 DAYS. PERMANENT PULMONARY FIBROSIS AND HYPERTROPHY OF BRONCHIAL VESSELS MAY OCCUR. THE FATALITY RATE HAS BEEN ESTIMATED TO BE BETWEEN 15-20%. ACUTE RENAL NECROSIS AND/OR LIVER DAMAGE MAY DEVELOP FOLLOWING MASSIVE ACUTE EXPOSURE. SEQUELAE FROM NON-FATAL EXPOSURE MAY INCLUDE MICROCYTIC, HYPOCHROMIC ANEMIA, TESTICULAR ATROPHY, CARDIOVASCULAR EFFECTS, EMPHYSEMA, ANEMIA, TERATOGENIC EFFECTS AND OSTEOMALACIA.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE RENAL TUBULAR DAMAGE WITH KIDNEY LESIONS, PROTEINURIA, AMINO-ACIDURIA, GLUCOSURIA AND PHOSPHATURIA. AS KIDNEY DYSFUNCTION CONTINUES, MINERALS SUCH AS CALCIUM AND PHOSPHORUS ARE LOST IN THE URINE, AND MAY ACCOUNT FOR BONE

DEMINERALIZATION AND THE PREVALENT FORMATION OF KIDNEY STONES. AS A RESULT, OSTEOMALACIA, OSTEOPOROSIS, AND SPONTANEOUS FRACTURES MAY OCCUR AND BE MANIFESTED AS BACK PAIN, PAIN IN THE EXTREMITIES, DIFFICULTY IN WALKING, AND PAIN ON BONE PRESSURE. CADMIUM-INDUCED KIDNEY DAMAGE IS IRREVERSIBLE AND MAY GROW WORSE EVEN WHEN EXPOSURE CEASES. IRREVERSIBLE LUNG INJURY OF THE EMPHYSEMATOUS TYPE WITH COUGH AND SHORTNESS OR BREATH, ABNORMAL LUNG FUNCTION, AIRWAYS OBSTRUCTION AND POSSIBLY PULMONARY FIBROSIS. OTHER EFFECTS MAY INCLUDE ULCERATION OF THE NASAL SEPTUM, DAMAGE OF THE OLFACTORY NERVE AND ANOSMIA, HEMOLYTIC AND IRON-DIFICIENCY ANEMIA, WEIGHT LOSS, IRRITABILITY AND A YELLOW CADMIUM FRINGE ON THE TEETH. SOME STUDIES SUGGEST A RELATIONSHIP BETWEEN CADMIUM LEVELS IN AIR AND HUMAN CARDIOVASCULAR DISEASE AND HYPERTENSION, BUT CAUSAL ASSOCIATION HAS NOT BEEN PROVEN. LONG-TERM SEQUELAE MAY INCLUDE RENAL TUBULAR NECROSIS, CARDIOVASCULAR EFFECTS, LIVER DAMAGE, ANEMIA, EMPHYSEMA AND OSTEOMALCIA. OCCUPATIONAL EXPOSURE TO CADMIUM IS IMPLICATED IN A SIGNIFICANT INCREASE IN THE INCIDENCE OF PROSTATIC, RESPIRATORY AND RENAL CANCERS.

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

SKIN CONTACT:
CADMIUM:
IRRITANT.

ACUTE EXPOSURE- DIRECT CONTACT MAY RESULT IN IRRITATION.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE TO IRRITANTS MAY RESULT IN DERMATITIS.

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

EYE CONTACT:
CADMIUM:
IRRITANT.

ACUTE EXPOSURE- DIRECT CONTACT MAY CAUSE REDNESS OR PAIN, BUT NO INJURY HAS BEEN REPORTED.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE CONJUNCTIVITIS.

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

INGESTION:
CADMIUM:
TOXIC.

ACUTE EXPOSURE- CADMIUM IS A POWERFUL EMETIC WHICH INDUCES VOMITING SO THAT LESS IS RETAINED AND ABSORBED. IF SUFFICIENT AMOUNTS ARE ABSORBED SYSTEMIC TOXICITY MAY OCCUR. SYMPTOMS, WHICH MAY BEGIN 15 MINUTES TO 1 HOUR AFTER INGESTION ARE SALIVATION, CHOKING, SEVERE NAUSEA, PERSISTENT VOMITING, DIARRHEA, TENESMUS, ABDOMINAL PAIN, BLURRED VISION, DIZZINESS, VERTIGO, HEADACHE, MUSCULAR CRAMPS AND RARELY, CONVULSIONS, EXHAUSTION, COLLAPSE,

SHOCK AND UNCONSCIOUSNESS. IF DEATH OCCURS, IT IS USUALLY WITHIN 24 HOURS FROM SHOCK DUE TO FLUID LOSS, OR, IT MAY BE DELAYED 7-14 DAYS AND RESULT FROM ACUTE RENAL FAILURE OR CARDIOPULMONARY DEPRESSION. IF VICTIM SURVIVES, DELAYED LIVER AND/OR KIDNEY DAMAGE MAY OCCUR. A DOSE EXCEEDING 300 MG MAY BE FATAL.

CHRONIC EXPOSURE- PROLONGED LOW LEVEL EXPOSURE MAY CAUSE IRREVERSIBLE RENAL TUBULAR DYSFUNCTION AND/OR GLOMERULAR INJURY WITH PROTEINURIA WHICH MAY PROGRESS TO AMINO-ACIDURIA, GLUCOSURIA AND PHOSPHATURIA. AS KIDNEY DYSFUNCTION CONTINUES, MINERALS SUCH AS CALCIUM AND PHOSPHORUS ARE LOST IN THE URINE AND MAY ACCOUNT FOR BONE DEMINERALIZATION AND THE PREVALENT FORMATION OF KIDNEY STONES. AS A RESULT, OSTEOMALACIA, OSTEOPOROSIS AND SPONTANEOUS FRACTURES MAY OCCUR AND BE MANIFESTED AS BACK PAIN, PAIN IN THE EXTREMITIES, DIFFICULTIES IN WALKING, AND PAIN ON BONE PRESSURE. CADMIUM-INDUCED KIDNEY DAMAGE IS IRREVERSIBLE AND MAY GROW WORSE EVEN WHEN EXPOSURE CEASES. ANIMAL EXPERIMENTS INDICATE ANTAGONISTIC ACTIVITY BETWEEN CADMIUM AND ZINC SUCH THAT ABNORMAL ZINC METABOLISM WAS FOUND TO CONTRIBUTE SIGNIFICANTLY TO THE TOXIC SYNDROME FOLLOWING PROLONGED INGESTION OF CADMIUM. FUNCTIONAL CHANGES IN THE LIVER, PANCREAS AND ADRENAL GLANDS WHICH ALTER GLUCOSE METABOLISM MAY OCCUR. ALTHOUGH INCONCLUSIVE, SOME STUDIES SUGGEST A RELATIONSHIP BETWEEN PROLONGED EXPOSURE TO CADMIUM AND HUMAN CARDIOVASCULAR DISEASE AND HYPERTENSION. A STUDY WHICH SUPPORTS THIS THEORY WAS REPORTED WHERE FEMALE RATS EXHIBITED HYPERTENSION AFTER CHRONICALLY INGESTING CADMIUM THROUGH THEIR DRINKING WATER. REPRODUCTIVE EFFECTS SUCH AS CONGENITAL ABNORMALITIES, INCREASED MORTALITY, AND REDUCED RATES OF GROWTH HAVE BEEN FOUND IN EXPERIMENTAL ANIMALS AFTER PROLONGED INGESTION OF CADMIUM.

FIRST AID- GIVE MILK OR BEATEN EGGS EVERY 4 HOURS TO RELIEVE GASTROINTESTINAL IRRITATION. REMOVE UNABSORBED CADMIUM BY CATHARSIS WITH FLEET'S PHOSPHO-SODA, 30-60 ML DILUTED 1:4 IN WATER. (DREISBACH, HANDBOOK OF POISONING, 11TH ED.) TREATMENT MUST BE ADMINISTERED MEDICAL PERSONNEL.

ANTIDOTE:
THE FOLLOWING ANTIDOTE HAS BEEN RECOMMENDED. HOWEVER, THE DECISION AS TO WHETHER THE SEVERITY OF POISONING REQUIRES ADMINISTRATION OF ANY ANTIDOTE AND ACTUAL DOSE REQUIRED SHOULD BE MADE BY QUALIFIED MEDICAL PERSONNEL.

CADMIUM POISONING:
DO NOT GIVE DIMERCAPROL. IF SYMPTOMS PERSIST, THE ADMINISTRATION OF CALCIUM DISODIUM EDETATE IS RECOMMENDED. GIVE 15-25 MG/KG (0.08-0.125 ML OF 20% SOLUTION PER KILOGRAM OF BODY WEIGHT) IN 250-500 ML OF 5% DEXTROSE INTRAVENOUSLY OVER A 1 TO 2 HOUR PERIOD, TWICE DAILY. THE MAXIMUM DOSE SHOULD NOT EXCEED 50 MG/KG/DAY. THE DRUG SHOULD BE GIVEN IN 5-DAY COURSES WITH A REST PERIOD OF AT LEAST 2 DAYS BETWEEN COURSES. AFTER THE FIRST COURSE, SUBSEQUENT COURSES SHOULD NOT EXCEED 50 MG/KG/DAY. DAILY URINALYSES SHOULD BE DONE DURING THE TREATMENT PERIOD. THE DOSAGE SHOULD BE REDUCED IF ANY UNUSUAL URINARY FINDINGS APPEAR. INTRAVENOUS ADMINISTRATION IS CONTRA-INDICATED IN THE PRESENCE OF ELEVATED CEREBROSPINAL FLUID PRESSURE.
FOR INTRAMUSCULAR ADMINISTRATION, GIVE 20% SOLUTION (200 MG/ML), 12.5 MG/KG BODY WEIGHT EVERY 4-6 HOURS. DILUTE EACH DOSE WITH AN EQUAL VOLUME OF 1% PROCAINE. DOSE LIMITATION IS THE SAME AS THAT GIVEN ABOVE (DREISBACH, HANDBOOK OF POISONING, 11TH ED.). ANTIDOTE SHOULD BE ADMINISTERED BY QUALIFIED MEDICAL PERSONNEL.

REACTIVITY

REACTIVITY:
CADMIUM:
STABLE WHEN KEPT IN SEALED CONTAINERS UNDER NORMAL TEMPERATURES AND PRESSURES, BUT DUST MAY IGNITE UPON CONTACT WITH AIR. METAL TARNISHES IN MOIST AIR. REACTS VIOLENTLY WITH WATER.

INCOMPATIBILITIES:
CADMIUM:
  AMMONIUM NITRATE (FUSED): VIOLENT OR EXPLOSIVE REACTION.
  HYDRAZOIC ACID: MAY EXPLODE VIOLENTLY.
  NITRYL FLUORIDE: INCANDESCENT REACTION WHEN HEATED SLIGHTLY.
  OXIDIZERS (STRONG): FIRE AND EXPLOSION HAZARD.
  SELENIUM: EXOTHERMIC REACTION.
  SULFUR: FIRE AND EXPLOSION HAZARD.
  TELLURIUM: INCANDESCENT REACTION IN HYDROGEN ATMOSPHERE.
  ZINC: INTENSE EXOTHERMIC REACTION.

DECOMPOSITION:
CADMIUM:
THE HEATED METAL RAPIDLY FORMS HIGHLY TOXIC, BROWNISH FUMES OF OXIDES OF CADMIUM.

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

****

CONDITIONS TO AVOID

MAY IGNITE ITSELF IF EXPOSED TO AIR AND MAY RE-IGNITE AFTER FIRE IS EXTINGUISHED. MAY BURN RAPIDLY WITH FLARE-BURNING EFFECT. RUNOFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD.

****

SPILL AND LEAK PROCEDURES

OCCUPATIONAL SPILL:
DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. DO NOT GET WATER INSIDE CONTAINER. FOR SMALL SPILLS, FLUSH AREA WITH FLOODING AMOUNTS OF WATER. FOR LARGER SPILLS, DIKE SPILL FOR LATER DISPOSAL. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA AND DENY ENTRY.

REPORTABLE QUANTITY (RQ): 1 POUND
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT

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

RESPIRATOR:
THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS OR NIOSH CRITERIA DOCUMENTS; OR DEPARTMENT OF LABOR, 29CFR1910 SUBPART I.
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION.

AT ANY DETECTABLE CONCENTRATION:

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.
SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

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

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE DEMAND OR OTHER POSITIVE PRESSURE MODE.

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

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

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

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE. CONTACT LENSES SHOULD NOT BE WORN.

AUTHORIZED - FISHER SCIENTIFIC
CREATION DATE: 12/03/84 REVISION DATE: 03/15/89

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: CHROMIUM METAL/POWDER

MSDS No: Genium / 83
Revision: A
Date: November, 1989

National Paint and Coatings Association Hazardous Material Identification System

HEALTH HAZARD	2 - Moderate
FLAMMABILITY HAZARD	1 - Slight
REACTIVITY HAZARD	1 - Slight
PERSONAL PROTECTION	SEE SECTION 8

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name: CHROMIUM METAL/POWDER

Description: Obtained from chrome ore, chormite ($FeCr_2O_4$), by electrolysis of chromium solutions, by direct reduction (ferrochrome), and by reducing the oxide with finely divided carbon or aluminum. Used for chromeplating other metals; for greatly increasing metal resistance and durability; in manufacturing chrome-steel or chrome-nickel-steel alloys (stainless steel).

Other Designations: Chrome; Cr

CAS: 7440-47-3

R - 1
I - 4
S - 1
K - 1

Manufacturer: Contact your supplier or distributor. Consult the latest Chemicalweek Buyers' Guide (Genium ref. 73) for a suppliers list.

Also used as a constituent of inorganic pigments; as protective coating for automotive and equipment accessories; and in nuclear and high-temperature research.

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:	CAS Number:	Percent:	Exposure Limits:
Chromium metal/powder	7440-47-3	ca 100	OSHA PEL 8-hr TWA: 1 mg/m^3 ACGIH TLV, 1988-89* TLV-TWA: 0.5 mg/m^3 NIOSH REL, 1987** 8-hr TWA (for chromium metal and insoluble salts): 1 mg Cr/m^3

INGREDIENTS AND HAZARDS continues on page 2

INGREDIENTS AND HAZARDS continued from page 1

Toxicity Data***
Rat, implant,
TD_{Lo}: 1200 µg/kg
body weight
administered
intermittently over
six weeks

* This TLV is applicable to Cr^{+2} and Cr^{+3} compounds. For water soluble and water-insoluble Cr^{+6}, the 8-hr TWA is 0.05 mg Cr^{+6}/m^3. Certain water-insoluble Cr^{+6} compounds (zinc chromate, calcium chromate, lead chromate, barium chromate, strontium chromate, and sintered chromium trioxide) are designated as A1a (human carcinogen).

** The NIOSH REL (10-hr TWA) for carcinogen Cr^{+6} compounds is 1 µg/m^3; for noncarcinogenic Cr^{+6} compounds (including chromic acid), the RELs (10-hr TWAs are 25 µg/m^3 and 50 µg/m^3 (15-min ceiling). The noncarcinogenic compounds include mono- and dichromates of hydrogen, cesium, sodium, lithium, potassium, rubidium, ammonia, and Cr^{+6} (chromic acid anhydride). Any and all Cr^{+6} materials excluded from the noncarcinogenic group above are carcinogenic Cr^{+6} compounds.

*** See NIOSH, <u>RTECS</u> (GB4200000), for additional data with references to tumorigenic effects.

SECTION III. PHYSICAL DATA

Appearance & Odor: Steel-gray, lustrous metal; no odor.

Boiling point: 4788°F (2642°C)
Vapor pressure: 1 mm Hg at 2941°F (1616°C)
Water solubility (%): Insoluble
Vapor density (air=1): 1.79
Specific gravity (H_2O=1): 7.2 at 68°F (20°C)*
Melting point: 3452°F (1900°C)

* Water's specific gravity is 1 at 39°F (4°C).

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (method): None reported
Limits: LEL %: Dust cloud explosion* UEL %: None reported

NFPA Fire Hazard Symbol Codes: Flammability: 1 Health: 2 Reactivity: 1 Special: —***

Extinguishing Media: Use dry chemical or sand.

FIRE AND EXPLOSION DATA continued from page 2

Autoignition Temp:
Cloud, 1076°F (580°C)
**

Unusual fire or explosion hazards: Particle size and dispersion in air determine reactivity. Chromium powder explodes spontaneously in air, while chromium dust suspended in CO_2 is ignitable and explosive when heated.

Special fire-fighting procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

* 0.230 oz/ft^3

** Dust Layer, 752°F (400°C). One hundred percent of dust goes through a 74-µm sieve. A 140-mJ spark can ignite a dust cloud.

*** Genium determined these hazard values because the NFPA Guidebook did not.

SECTION V. REACTIVITY DATA

Chemical incompatibilities: Chromium reacts readily with dilute, not nitric, acids to form chromous salts. It is soluble in acids (not nitric) and strong alkalis. Its powder is incompatible with strong oxidizing agents, including high O_2 concentration. Evaporation of mercury (Hg) from Cr amalgam leaves pyrophoric chromium. Finely divided Cr attains incandescence with nitrogen oxide, potassium chlorate, and sulfur dioxide. Molten lithium at 18°C severely attacks Cr. Fused ammonium nitrate below 200°C reacts explosively and may ignite or react violently with bromine pentafluoride.

Hazardous decomposition Products: Thermal oxidative decomposition of Cr can produce toxic chromium oxide fumes.

Stability/Polymerization: Chromium is stable when properly handled and stored. Hazardous polymerization cannot occur.

SECTION VI. HEALTH HAZARD INFORMATION

Summary of risks: When ingested chromium is a human poison, with gastrointestinal (GI) effects. Chromium 3 (Cr^{+3}) compounds show little or no toxicity. Less soluble chromium 6 (Cr^{+6}) compounds are suspected carcinogens and severe irritants of the larynx, nasopharynx, lungs, and skin (Sec. 2). Chromic acid or chromate salts cause irritation of the skin and respiratory passage. Ingestion leads to severe irritation of the gastrointestinal tract, renal damage, and circulatory shock. Chromium metal (when heated to high temperatures) and insoluble salts are said to be involved in histological fibrosis of the lungs, which may progress to clinically evident pneumoconiosis. Exposure to chromate dust and powder can cause skin (dermatitis) and eye irritation (conjunctivitis).

HEALTH HAZARD INFORMATION continues on page 4

HEALTH HAZARD INFORMATION continued from page 3

Medical conditions which may be aggravated by contact: An increased incidence of bronchogenic carcinoma occurs in workers exposed to chromate dust.

Target organs: Respiratory system.

Primary entry route(s): Inhalation, percutaneous absorption (through skin), and ingestion.

Acute effects: Acute exposures to dust may cause headache, coughing, shortness of breath, pneumoconiosis, fever, weight loss, nasal irritation, inflammation of the conjunctiva, and dermatitis.

Chronic effect(s): Asthmatic bronchitis.

First aid:

Eye contact: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin contact: Brush off chromium dust. After rinsing affected area with flooding amounts of water, wash it 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 slowly drink 1 to 2 glasses of water to dilute. Do not induce vomiting. A physician should evaluate all ingestion cases.

Carcinogenicity: The NTP, IARC, and OSHA list chromium as a carcinogen.

After first aid, get appropriate in-plant, paramedic, or community medical attention and support. Physician's Note: Acute toxicity causes a two-phase insult: 1) multisystem shock due to gastrointestinal corrosivity and 2) hepatic, renal, hematopoetic insult. Treatment should use ascorbic acid as a neutralizer with gastric lavage. If the ingestion is substantial, exchange transfusions and/or consider hemodialysis. Treat allergic dermatitis with local cortisone or 10% ascorbic acid to reduce Cr^{+6} to Cr^{+3}. Ten percent EDTA in a lanolin base applied every 24 hr helps heal skin ulcers.

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SECTION VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill / Leak procedures: Notify safety personnel of large spills. Cleanup personnel should wear protective clothing and approved respirators. Remove heat and ignition sources. Provide adequate ventilation. Keep airborne dust at a minimum. Remove spills quickly and place in appropriate containers for disposal or reuse.

Waste management / Disposal: Reclaim salvageable metal. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000 Table Z-1)
EPA Designations
RCRA Hazardous Waste (40 CFR 261.33): Not listed
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)

SECTION VIII. SPECIAL PROTECTION INFORMATION

Personal protective equipment:

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

Respirator: Wear a NIOSH-approved respirator if necessary. Wear an SCBA with a full facepiece when the particle concentration's upper limit is 50 mg/m³. Warning: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

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

Workplace considerations:

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA standard (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by eliminating it at its source (Genium ref. 103).

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. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment.

SPECIAL PROTECTION INFORMATION continues on page 6

SPECIAL PROTECTION INFORMATION continued from page 5

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 IX. SPECIAL PRECAUTIONS

Storage segregation: Store material in cool, dry, well-ventilated area separate from acids and oxidizing agents. Seal and protect containers from physical damage. Keep away from heat or ignition sources.

Engineering controls: Avoid dust inhalation. Practice good housekeeping (vacuuming and wet sweeping) to minimize airborne particulates and to prevent dust accumulation. Use nonsparking tools and ground electrical equipment and machinery.

Transportation Data (49 CFR 172.101, .102): Not listed

Data source code(s): 1, 2, 26, 38, 80, 87, 88, 89, 100, 109, 124, 126

Prepared/revised by: MJ Allison, BS

November, 1989

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: COPPER

MSDS No: Genium / 162
Revision: A
Date: August, 1990

National Paint and Coatings Association

Hazardous Material Identification System

HEALTH HAZARD	2 - Moderate
FLAMMABILITY HAZARD	0 - Minimal
REACTIVITY HAZARD	0 - Minimal
PERSONAL PROTECTION	SEE SECTION 8

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name: COPPER

Description: Widely distributed in nature in elemental state, arsenites, sulfides, chlorides, and carbonates. Prepared by crushing, grinding, and concentrating copper ores by flotation and leaching or by smelting copper ore concentrates to yield a blister (96 to 98%) copper which is electrolytically refined to yield 99.9+% copper. Copper is the most widely used structural metal, next to iron and aluminum.*

Other Designations: Cu; bronze powder; copper slag-airborne; copper slag-milled.

CAS: 7440-50-8

R 0
I 4
S 1
K 0

Manufacturer: Contact your supplier or distributor. Consult the latest <u>Chemicalweek Buyers' Guide</u>(73) for a suppliers list.

Cautions: Copper may be toxic through contact, inhalation, and ingestion. It may cause skin and eye irritation and metal fume fever. Copper is not considered a fire hazard, but fine particles may burn in air.

*Additional uses of copper are found in electric wiring; switches, heating, plumbing, roofing, and building construction; alloys (brass, bronze, Monel metal, beryllium-copper); coins; chemical and pharmaceucides; antifouling paints; and as a catalyst. Copper whiskers are used in thermal and electrical composites. Copper flakes are used as insulation for liquid fuels.

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:	CAS Number:	Percent:	Exposure Limits:
Copper	7440-50-8	ca 100	1989 OSHA PELs 8-hr TWA: 1 mg/m^{3*} 8-hr TWA: 0.1 mg/m^{3**}

INGREDIENTS AND HAZARDS continues on page 2

INGREDIENTS AND HAZARDS continued from page 1

1989-90 ACGIH TLVs
TLV-TWA: 1 mg/m^3*
TLV-TWA: 0.2 mg/m^3**
1988 NIOSH REL
None established
1985-86 Toxicity Data***
Human, oral, TD_{Lo}: 120 μg/kg affects the gastrointestinal tract (nausea or vomiting)
Rat, oral, TD_{Lo}: 1210 μg/kg (35 weeks prior to mating) affects fertility (pre- and post-implantation mortality

* Copper dusts and mists, as Cu.
**Copper fume.
*** See NIOSH, RTECS (GL5325000), for additional reproductive, tumorigenic, and toxicity data.

SECTION III. PHYSICAL DATA

Appearance & Odor: Solid, various shapes, odorless, red/brown-colored metal or powder. Copper is ductile, tough, and easily worked. It is very resistant to corrosion, but readily attacked by alkalies.

Boiling point: 4703°F (2595°C)
Vapor pressure: 1 mm Hg at 2962°F (1628°C)
Water solubility (%): Insoluble
Melting point: 1981°F (1083°C)
Molecular weight: 63.546

Density/Specific Gravity: 8.94

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (method): None reported
Limits: LEL %: None reported
UEL %: None reported

NFPA Fire Hazard Symbol Codes: Flammability: 0 Health: 2 Reactivity: 0 Special: --*

Extinguishing Media: Use extinguishing media appropriate to the surrounding fire since copper does not burn. Finely

FIRE AND EXPLOSION DATA continues on page 3

FIRE AND EXPLOSION DATA continued from page 2

divided copper burns in air, and in extreme cases ignites spontaneously.

Autoignition Temp:
None reported

Unusual fire or explosion hazards: Liquid copper explodes on contact with water. High concentrations of fine copper particles in the air may present an explosion hazard.

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 a fully encapsulating suit.

* Genium determined these hazard values because the NFPA Guidebook did not.

SECTION V. REACTIVITY DATA

Chemical incompatibilities: Copper reacts violently with ammonium nitrate, bromates, iodates, chlorates, ethylene oxide, hydrazoic acid, potassium oxide, dimethyl sulfoxide + trichloroacetic acid, hydrogen peroxide, sodium peroxide, sodium azide, sulfuric acid, hydrogen sulfide + air, and lead azide. A potentially explosive reaction occurs with actylenic compounds. Copper ignites on contact with chlorine, fluorine [above 250°F (121°C)], chlorine tribluoride, and hydrazinium nitrate [above 158°F (70°C)]. It is also incompatible with 1-bromo-2-propyne; and incandescent reaction occurs with potassium dioxide.

Conditions to avoid: Avoid prolonged exposure to air and moisture. On exposure to moist air, copper slowly converts to the carbonate.

Hazardous decomposition Products: Thermal oxidative decomposition of copper can produce metallic oxides (copper fumes).

Stability/Polymerization: Copper is stable at room temperature in closed containers under normal storage and handling conditions. However on long standing, a white, highly explosive peroxide deposit may form. Copper's vapors are uninhibited and may form polymers in vents and flame arresters.

SECTION VI. HEALTH HAZARD INFORMATION

Summary of risks: Copper is a necessary human nutrient, excessive intake levels of which the kidneys normally eliminate. In individuals with kidney disease or, rarely, Wilson's disease (abnormal retention and storage of copper in the body that damages the liver, kidneys, brain, blood, bones, and endocrine glands), copper levels may accumulate. Significant industrial exposure to copper occurs mainly though inhalation of fumes during welding, smelting, or refining operations; or through exposure to copper dusts and mists during mining, extracting, refining, or manufacturing processes. Copper particles may irritate, discolor, and damage eyes. Exposure to copper salts in many applications is potentially toxic. Copper dusts, fumes, and salts may irritate the upper respiratory tract. Long-term exposure may irritate the skin and discolor the skin or hair.

HEALTH HAZARD INFORMATION continued from page 3

Medical conditions which may be aggravated by contact: Individuals with imparied pulmonary or renal function should avoid exposure.

Target organs: Respiratory system, skin, eyes, liver, kidneys.

Primary entry route(s): Inhalation, ingestion.

Acute effects: Inhalation of copper fumes may give rise to metal fume fever (after an incubation period of about 5 hr), an allergic reaction with flu-like symptoms—high temperature, metallic taste, nausea, coughing, general weakness, muscle aches, and exhaustion. These symptoms usually disappear within 24 hr. Direct contact with copper causes skin and (less often) eye irritation, and itching of the linings of the nose, mouth, and respiratory tract. Exposure to copper dust may cause a greenish-black skin discoloration. Copper ingestion causes nausea, vomiting, abdominal pain, and diarrhea. Ingestion of large doses may cause stomach and intestine ulceration, jaundice, and kidney and liver damage.

Chronic effect(s): Continued exposure to copper may cause mild dermatitis and degeneration of the mucous membranes. Repeated or prolonged exposure to copper dusts and mists can discolor skin and hair and irritate the skin. Repeated inhalation can cause chronic respiratory disease. Individuals with Wilson's disease (1 in 200,000 individuals) are more susceptible to chronic copper poisoning. If undetected and untreated, this progressive condition is eventually fatal.

First aid:

Eye contact: 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 contact: 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 with articial respiration.

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.

Carcinogenicity: The NTP, IARC, and OSHA do not list copper as a carcinogen. Experimental studies show tumorigenic and teratogenic effects in laboratory animals.

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

Physician's Note: A blood count shows leucocytosis if an individual has metal fume

HEALTH HAZARD INFORMATION continued from page 4

fever. Consider chellation with penicillamine or BAL (British Anti-Lewisite or dimercaprol) for chronic intoxication.

SECTION VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill / Leak procedures: Notify safety personnel, remove all heat and ignition sources, and provide adequate ventilation. Avoid creating dusty conditions. Cleanup personnel should protect against vapor inhalation and skin and eye contact. Cleanup methods such as vacuuming (with the appropriate filter) or wet mopping minimizes dust dispersion. Absorb liquid containing copper with vermiculite, dry sand, or other inert materials. Place in appropriate containers for disposal. Follow applicable OSHA regulations (29 CFR 1910.120).

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

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)
EPA Designations
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 5000 lb (2270 kg) [* per Clean Water Act, 307(a)]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)

SECTION VIII. SPECIAL PROTECTION INFORMATION

Personal protective equipment:

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. Some recommendations follow. For copper dust and mists greater than 50 mg/m^3, wear a high-efficiency particulate respirator, a supplied-air respirator, or an SCBA, all with a full facepiece.* 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. Eye and face protection is required when grinding, welding, cutting, or remelting. Protect skin from molten metal and radiant heat when melting scrap. Machine turnings may also present a laceration hazard. When handling oil-contaminated copper, wear rubber gloves to prevent skin contact.

SPECIAL PROTECTION INFORMATION continues on page 6

SPECIAL PROTECTION INFORMATION continued from page 5

Workplace considerations:

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.(103)

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. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment.

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.

*For copper dust and mists greater than 2000 mg/m^3, wear a supplied-air respirator equipped either with a full facepiece operated in pressure-demand or positive-pressure mode or with a hood in continous-flow mode. For copper fumes over 100 mg/m^3, wear either a powered air-purifying respirator with a high-efficiency filter, or a supplied-air respirator equipped either with a full facepiece operated in pressure-demand or positive-pressure mode or with a hood in continuous-flow mode.

SECTION IX. SPECIAL PRECAUTIONS

Storage segregation: Store copper in tightly closed containers in a cool, dry, well-ventilated area. Avoid exposure to air and moisture.

Engineering controls: Avoid dust and fume inhalation and direct contact with skin and eyes. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures. Maintain exposures below the PEL/TLV. Monitor copper dust and mist levels in the air.

Other precautions: Provide placement and periodic examinations that emphasize the skin, eyes, and respiratory system. Prevent exposing individuals with chronic respiratory disease or Wilson's disease.

Transportation Data (49 CFR 172.101, .102): Not listed

Data source code(s): 26, 38, 73, 84, 88, 89, 100, 101, 103, 109, 124, 126, 127, 132, 133, 134, 136, 138, 139, 143, 144

SPECIAL PRECAUTIONS continued from page 6

Prepared/revised by: MJ Allison, BS

August, 1990

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: LEAD (INORGANIC)

MSDS No: Genium / 713
Date: August, 1990

National Paint and Coatings Association

Hazardous Material Identification System

HEALTH HAZARD	3 - Serious
FLAMMABILITY HAZARD	1 - Slight
REACTIVITY HAZARD	0 - Minimal
PERSONAL PROTECTION	SEE SECTION 8

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name: LEAD (INORGANIC)

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, drossing, or electrolytic refining. Lead is used mostly in manufacturing storage batteries. Other uses are in manufacturing tetraethyl lead and both organic and inorganic lead compounds in ceramics, plastics, and electronic devices; in producing ammunition, and solder.*

Other Designations: Pb; lead oxide; lead salts, inorganic; metallic lead; plumbum.

CAS: 7439-92-1

R 0
I 4
S -
K 0

Manufacturer: Contact your supplier or distributor. Consult the latest Chemicalweek Buyers' Guide(73) for suppliers list.

Cautions: Inorganic lead is a potent systemic poison. Organic lead (e.g., tetraethyl lead) has severe, but different, health effects. Occupational lead poisoning is due to dust and fumes inhalation. 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.

* Used to produce cable covering, sheet lead, and other metal product (brass, pipes, caulking); in metallurgy; in weights and as ballast; a chemical intermediate for lead alkyls and pigments; a construction material for tank linings, piping, and equipment used to handle corrosive gases and liquids used to manufacture sulfuric acid, petroleum refining, halogenation, sulfonation, extraction, and condensation; and for x-ray and atomic radiation protection.

Material Safety Data Sheet

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1145 Catalyn Street, Schenectady, NY 12303
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From Genium's collection, to be used as reference

Product: LEAD (INORGANIC)

MSDS No: Genium / 713
Date: August, 1990

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:	CAS Number:	Percent:	Exposure Limits:
Lead (inorganic) fumes and dusts, as Pb	7439-92-1	ca 100	1990 OSHA PELs (Lead, inorganic compounds) 8-hr TWA: 50 μg/m^3 Action Level TWA*: 30 μg/m^3 1989-90 ACGIH TLV (Lead, inorganic, fumes and dusts) TLV-TWA: 150 μg/m^3 1988 NIOSH REL 10-hr TWA: <100 μg/m^3 1985-86 Toxicity Data** Human, inhalation, TC$_{Lo}$: 10 μg/m^3 affects gastrointestinal tract and liver Human, oral, TD$_{Lo}$: 450 mg/kg ingested over 6 yr affects peripheral and central nervous systems. Rat, oral, TD$_{Lo}$: 790 mg/kg affects multigeneration reproduction 1988 NIOSH REL 10-hr TWA: <100 μg/m^3 29 CFR 1910.1025 Lead Standard Blood Lead Level: 40 μg/100 g

* Action level applies to employee exposure without regard to respirator use.
** See NIOSH, RTECS (OF7525000), for additional mutative, reproductive, and toxicity data.

MSDS 713 continues on page 3

SECTION III. PHYSICAL DATA

Appearance & Odor: Bluish-white, silvery, gray, very soft metal.

Boiling point: 3164°F (1740°C)
Vapor pressure: 1.77 mm Hg at 1832°F (1000°C)
Water solubility (%): Relatively insoluble in hot or cold water*
Specific gravity (H_2O=1): 11.34
Melting point: 621.3°F (327.4°C)
Molecular weight: 207.20

Viscosity: 3.2 cp at 621.3° (327.4°C)

* Lead dissolves more easily at a low pH.

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (method): None reported
Limits: LEL %: None reported
UEL %: None reported

NFPA Fire Hazard Symbol Codes: Flammability: 1 Health: 3 Reactivity: 0 Special: --*

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, or foam to extinguish fire.
Autoignition Temp: None reported

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.

* Genium determined these hazard values because the NFPA Guidebook did not.

SECTION V. REACTIVITY DATA

Chemical incompatibilities: Mixtures of hydrogen peroxide + trioxane explode on contact with lead. Lead is incompatible with sodium azide, zirconium, disodium acetylide, and oxidants. A violent reaction on ignition may occur with concentrated hydrogen peroxide, chlorine trifluoride, sodium acetylide, (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 decomposition Products: Thermal oxidative decomposition of lead can produce highly toxic fumes of lead.

REACTIVITY DATA continues on page 4

REACTIVITY DATA continued from page 3

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.

SECTION VI. HEALTH HAZARD INFORMATION

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 which may be aggravated by contact: 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.

Target organs: Blood, central and peripheral nervous systems, kidneys, and gastrointestinal (GI) tract.

Primary entry route(s): Inhalation, ingestion.

Acute effects: An acute, short-term dose of lead could cause acute encephalopathy with seizures, coma, and, rarely, death. Reversible kidney damage can occur from acute exposure, as well as anemia.

Chronic effect(s): 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 the wrist's and, less often, the ankle's 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.

HEALTH HAZARD INFORMATION continues on page 5

HEALTH HAZARD INFORMATION continued from page 4

First aid:

Eye contact: 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 contact: 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.

Carcinogenicity: Although the NTP and OSHA do not list lead as a carcinogen, 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.

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 VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill / Leak procedures: Notify safety personnel and evacuate all unnecessary personnel immediately. Cleanup personnel should protect against inhalation of dusts 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)

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

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

SPILL, LEAK AND DISPOSAL PROCEDURES continued from page 5

Listed as a RCRA Hazardous Waste (40 CFR 251.33, 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)

SECTION VIII. SPECIAL PROTECTION INFORMATION

Personal protective equipment:

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. Protective clothing made of man-made fibers and lacking turn-ups, pleats, or pockets retain less dust from lead.

Workplace considerations:

Ventilation: Provide general and local explosion-proof 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.(103)

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. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment.

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 IX. SPECIAL PRECAUTIONS

Storage segregation: 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: Educate worker 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 preplacement and periodic medical examinations emphasizing blood, nervous system, gastrointestinal tract, and kidneys, including complete blood count and urinalysis. Receive a complete history including previous surgeries and hospitalization, 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 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.

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. Andrews Cross (X, Stow away from foodstuffs)
IMDG Packaging Group: III

* 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.

Data source code(s): 26, 38, 73, 84, 85, 88, 89, 90, 100, 101, 103, 109, 124, 126, 132, 133, 134, 136, 138, 139, 142, 143

Prepared/revised by: MJ Allison, BS

August, 1990

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: **MERCURY**

MSDS No: Genium / 25
Revision: C
Date: August, 1988

National Paint and Coatings Association
Hazardous Material Identification System

HEALTH HAZARD	3 - Serious
FLAMMABILITY HAZARD	0 - Minimal
REACTIVITY HAZARD	0 - Minimal
PERSONAL PROTECTION	SEE SECTION 8

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name: MERCURY

Description: Used in barometers, thermometers, hydrometers, pyrometers; in mercury arc lamps producing ultraviolet rays; in switches and fluorescent lamps; as a catalyst in oxidations of organic compounds; in alloys; in explosives; and for extracting gold and silver from ore.

Other Designations: Colloidal Mercury; Metallic Mercury; Quicksilver; Hg; Hydrargyrum

CAS: 7439-97-6

R 1
I 4
S 1
K 0

Comments: Inorganic and organic mercury compounds are highly toxic, as is pure mercury.

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the Chemicalweek Buyers' Guide (Genium ref. 73) for a list of suppliers.

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:	CAS Number:	Percent:	Exposure Limits:
Mercury	7439-97-6	Ca 100	OSHA PEL Ceiling: 1 mg per 10 m^3 ACGIH TLV (Skin*), 1987-88 TLV-TWA: 0.05 mg/m^3 as Hg (Mercury Vapor) Toxicity Data** Rabbit, Inhalation, LC_{Lo}: 29 mg/m^3 (30 Hrs)

* Mercury can be absorbed through intact skin, which contributes to overall exposure.

INGREDIENTS AND HAZARDS continues on page 2

INGREDIENTS AND HAZARDS continued from page 1

** See NIOSH ,<u>RTECS</u> (OV4550000), for additional data with references to reproductive, mutagenic, and tumorigenic effects.

SECTION III. PHYSICAL DATA

Appearance & Odor: A silver, heavy liquid; odorless. Danger: Mercury vapor has no warning properties.

Boiling point: 673°F (357°C)
Vapor pressure: 0.0018 Torr at 77°F (25°C)
Water solubility (%): Insoluble
Specific gravity ($H_2O=1$): 13.546 at 68°F (20°C)
Melting point: −37.93°F (−38.85°C)
Molecular weight: 201 Grams/Mole

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (method): * Limits: LEL %: * UEL %: *

NFPA Fire Hazard Symbol Codes: Flammability: 0 Health: 3 Reactivity: 0 Special: **

Extinguishing Media: * Mercury does not burn. Use extinquishing agents that will put out the surrounding fire.

Autoignition Temp: *

Unusual fire or explosion hazards: When exposed to the high temperatures that occur during a fire, mercury can vaporize to form extremely toxic fumes.

Special fire-fighting procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

** Values determined by Genium. Not found in NFPA Guidebook.

SECTION V. REACTIVITY DATA

Material is stable in closed containers at room temperature under normal storage and handling conditions. Hazardous polymerization cannot occur

Chemical incompatibilities: Hazardous reactions involving mercury and acetylene, ammonia, boron phosphodiiodide, chlorine, chlorine dioxide, methyl azide, sodium carbide, nitric acid, oleum, and sulfuric acid are reported (Genium ref. 84).

REACTIVITY DATA continues on page 3

REACTIVITY DATA continued from page 2

Conditions to avoid: Do not expose mercury to incompatible chemicals.

Hazardous decomposition Products: Extremely toxic mercury metal fumes are likely to be produced during fires.

SECTION VI. HEALTH HAZARD INFORMATION

This product is not considered a carcinogen by the NTP, IARC, or OSHA.

Summary of risks: Mercury is very toxic due to its liquid and fat solubility, lack of charge, and membrane permeability. It is a slowly cumulative poison that concentrates in the brain, kidneys, and liver. It is very hazardous when spilled or heated. Mercury and its vapor are rapidly absorbed by the membranes lining the respiratory tract, the gastrointestinal (GI) tract, and the skin. Mercury is a teratogen (causes physical defects in embryos).

Medical conditions which may be aggravated by contact: Preexisting problems of the target organs can be worsened. Provide preplacement and periodic medical exams emphasizing the target organs.

Target organs: Skin, eyes, respiratory system, central nervous system (CNS), kidneys.

Primary entry route(s): Skin absorption/contact, inhalation.

Acute effects: Erosion of the respiratory/GI tracts, nausea, vomiting, bloody diarrhea, shock, headache, metallic taste. Inhalation of high concentrations for short periods can cause pneumonitis, chest pain, dyspnea, coughing, stomatitis, gingivitis, and salivation.

Chronic effect(s): Tremors, emotional problems, loss of concentration, depression, drowsiness, fatigue, insomnia, weakness, loss of memory, kidney problems, eye lesions, vision disturbances, sore mouth and throat, problems with the sense of taste or smell, nosebleeds, nasal inflammation, loss of weight or appetite, poor hand-eye coordination, awkwardness, and unsteadiness as well as dermatitis.

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 exposure from skin absorption.

Inhalation: Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have medical personnel administer oxygen to treat the chemical pneumonitis that may develop.

HEALTH HAZARD INFORMATION continues on page 4

HEALTH HAZARD INFORMATION continued from page 3

Ingestion: Never give anything by mouth to someone who is unconscious or convulsing. Note to physician: If indicated by degree of ingestion, saline cathartics and cahrcoal should be used. Chelation therapy with d-pencillamine may also be indicated.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid. Treatment of chronic mercury poisoning requires expert medical care. At the first signs, immediately remove the exposed person from further exposure and have him or her examined and treated by a physician trained in occupational mercury poisoning.

SECTION VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill / Leak procedures: Notify safety personnel, restrict access to the spill area to necessary personnel, and provide adequate ventilation. Clean up spills promptly. Specialized equipment and/or techniques may be required to safely deal with large mercury spills; if large quantities of mercury are used in the workplace, detailed, prior spill-management planning is recommended. Collect spilled mercury by using a suction pump and an aspirator bottle with a long capillary tube. For finaly divided mercury in inaccessible cracks, corners, etc., treatmeny with calcium polysulfide and excess sulfur is recommended to convert the mercury globules into mercury sulfide. Vacuum cleaners may be used if they are equipped with specially designed mercury-absorbent exhaust filters. Collect the mercury into tightly sealed containers for later disposal or reclamation. Cleanup personnel must use the recommended personal protective equipment (see sect. 8).

Waste management / Disposal: Consider reclamation, recyclying, or destruction rather than disposal in a landfill. Do not pour mercury down a drain. Mercury is very harmful to the environment. 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. U151
CERCLA Hazardous Substance, Reportable Quantity: 1 lb (0.454 kg)*

* Per the Clean Water Act, Section 407 (a); Clean Air Act, Section 112; and Resource Conservation and Recovery Act, Section 3001

SECTION VIII. SPECIAL PROTECTION INFORMATION

Personal protective equipment:

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing of mercury may occur, wear a full faceshield or splash guard. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Wear 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 OSHA respirator regulations (29 CFR 1910.134).

Other: Wear impervious gloves, boots, aprons, gauntlets, etc., to prevent any contact with mercury and the skin.

Workplace considerations:

Ventilation: Install and operate general and local ventilation systems powerful enough to continuously maintain airborne levels of mercury below the OSHA PEL standard cited in section 2.

Safety stations:
Make emergency eyewash stations, washing facilities, and safety/quick-drench showers 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 mercury from shoes and equipment. Separate work and street clothes; store work clothes in special lockers and always shower before changing to street clothes.

Practice good personal hygiene; always wash thoroughly after using this material. Keep it off of 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.

SECTION IX. SPECIAL PRECAUTIONS

Storage segregation: Store mercury in a cool, dry, well-ventilated area in tightly closed unbreakable polyethylene containers. Protect these containers from physical damage.

Special handling / storage: Construct storage areas to have smooth, hard, nonporous floors with no cracks or spaces so that spilled mercury globules do not form in inaccessible areas.

Mercury evaporates slowly, but if it is spilled it can form many tiny globules that evaporate much faster than a single pool of it will. In an unventilated area, significant concentration of mercury vapor can develop from this enhanced evaporation

SPECIAL PRECAUTIONS continues on page 6

SPECIAL PRECAUTIONS continued from page 5

effect. This poisonous vapor is particularly hazardous if breathed over a long period of time, so spills or releases of mercury require very meticulous cleaning procedures.

Transportation Data (49 CFR 172.101-2)
DOT Shipping Name: Mercury, Metal
DOT Label: None
IMO Label: Corrosive
IMO Class: 8

DOT Class: ORM-B UN Register: NA2809
Data source code(s): 1, 2, 8, 26, 38, 84-94, 100.

Prepared/revised by: Genium Publishing Corporation

August, 1988

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name

ENTER CHEMICAL NAME
r   :e:      Nickel

TYPE WHAT INFORMATION YOU REQUIRE
/ALL/, SPECIFIC INFORMATION (BY 4-LETTER COMMAND, /HELP/, OR /NONE/,
expo tolh prop resp symp fira orga


PERMISSIBLE EXPOSURE LIMIT
  1 MG/M3 OSHA TWA
  1 MG/M3 ACGIH TWA
  15 UG/M3 NIOSH RECOMMENDED TWA
  ANIMAL CARCINOGEN (IARC)
  HUMAN CARCINOGEN (NTP)(REFINING)
  TERATOGENIC DATA (RTEC)
  MUTAGENIC DATA (RTEC)
  CERCLA HAZARD RATINGS - TOXICITY 3 - IGNITABILITY 3 - REACTIVITY 0 -
    PERSISTENCE 3

 TOXICOLOGY:  NICKEL METAL IS A PULMONARY SENSITIZER, PRIMARY SKIN IRRI-
  TANT AND SKIN SENSITIZER.  EXPOSURE TO NICKEL DURING REFINING CAUSES
  LUNG CANCER.
    CONTACT WITH NICKEL COMPOUNDS CAUSES "NICKEL ITCH", A FORM OF SENSITI-
  ZATION WITH ITCHING, BURNING, ERYTHEMA, AND ECZEMA.
    INHALATION OF NICKEL SALTS IRRITATES THE RESPIRATORY TRACT, CAUSING
  PNEUMONITITIS AND FEVER.  INGESTION OF ASTRINGENT NICKEL SALTS PRODUCES
    MITING AND COLLAPSE.  OTHER SYMPTOMS INCLUDE CORROSION, WATERY OR
   LOODY DIARRHEA, HEMOLYSIS, HEMATURIA, ANURIA, JAUNDICE, & CONVULSIONS.
    EPIDEMIOLOGICAL STUDIES SHOW AN INCREASED INCIDENCE OF CANCER OF THE
  NASAL CAVITY, LUNG, AND POSSIBLY THE LARYNX IN NICKEL REFINERY WORKERS.

  THE SPECIFIC NICKEL COMPOUND(S) RESPONSIBLE HAVE NOT BEEN IDENTIFIED.
    THE THRESHOLD LIMIT VALUE IS PROBABLY NOT LOW ENOUGH TO PREVENT DERM-
  ATITIS OR SENSITIZATION FROM SOLUBLE SALTS AND MISTS.
  ORL-GPG LDLO:  5 MG/KG
  SCU-GPG LDLO:500 MG/KG
  IVN-MUS LDLO: 50 MG/KG
  IVN-DOG LDLO: 10 MG/KG
  ITR-RAT LDLO: 12 MG/KG

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONCENTRATION
  NOT APPLICABLE
  LDLO

CHEMICAL AND PHYSICAL PROPERTIES
  MOLECULAR WEIGHT: 58.7
  BOILING POINT AT 1 ATM, F: 4946 F
  SOLUBILITY IN WATER, G/100 G WATER AT 20C: INSOLUBLE
  FLASH POINT, CLOSED CUP, F (OR OPEN CUP IF OC): NA
  VAPOR PRESSURE @ 20 C, MMHG: 0.00
  MELTING POINT, F: 2651 F
  UPPER EXPLOSIVE LIMIT IN AIR, % BY VOLUME: NA
   WER EXPLOSIVE LIMIT IN AIR, % BY VOLUME: NA
   ECIFIC GRAVITY: 8.90


RESPIRATOR SELECTION (UPPER LIMIT DEVICES PERMITTED)
```

10 MG/M3

- FUME OR HIGH-EFFICIENCY PARTICULATE RESPIRATOR
- SUPPLIED-AIR RESPIRATOR
- SELF-CONTAINED BREATHING APPARATUS

50 MG/M3

- HIGH-EFFICIENCY PARTICULATE RESPIRATOR
  WITH A FULL FACE-PIECE
- SUPPLIED-AIR RESPIRATOR
  WITH A FULL FACE-PIECE, HELMENT, OR HOOD
- SELF-CONTAINED BREATHING APPARATUS
  WITH A FULL FACE-PIECE

1000 MG/M3

- POWERED AIR-PURIFYING RESPIRATOR
  WITH A HIGH-EFFICIENCY PARTICULATE FILTER
- TYPE 'C' SUPPLIED-AIR RESPIRATOR
- SUPPLIED-AIR RESPIRATOR

  OPERATED IN PRESSURE-DEMAND, POSITIVE-PRESSURE, OR CONTINUOUS-FLOW MODE

2000 MG/M3

- TYPE 'C' SUPPLIED-AIR RESPIRATOR
- SUPPLIED-AIR RESPIRATOR
  WITH A FULL FACE-PIECE
  OPERATED IN PRESSURE-DEMAND OR POSITIVE-PRESSURE MODE
- TYPE 'C' SUPPLIED-AIR RESPIRATOR
- SUPPLIED-AIR RESPIRATOR
  WITH A FULL FACE-PIECE, HELMENT, OR HOOD
  OPERATED IN PRESSURE-DEMAND, POSITIVE-PRESSURE, OR CONTINUOUS-FLOW MODE

[illegible]CAPE

- SELF-CONTAINED BREATHING APPARATUS
  WITH A FULL FACE-PIECE
  OPERATED IN PRESSURE-DEMAND OR POSITIVE-PRESSURE MODE
- TYPE 'C' SUPPLIED-AIR RESPIRATOR
- SUPPLIED-AIR RESPIRATOR
  WITH A FULL FACE-PIECE

  OPERATED IN PRESSURE-DEMAND, POSITIVE-PRESSURE, OR CONTINUOUS-FLOW MODE
- AUXILIARY SELF-CONTAINED BREATHING APPARATUS
  OPERATED IN PRESSURE-DEMAND OR POSITIVE-PRESSURE MODE

FIREFIGHTING

- SELF-CONTAINED BREATHING APPARATUS
  WITH A FULL FACE-PIECE
  OPERATED IN PRESSURE-DEMAND OR POSITIVE-PRESSURE MODE

SYMPTOMS

DERMATITIS
ASTHMA
SENSITIZATION DERMATITIS
DIARRHEA
NAUSEA
VOMITING
RESPIRATORY HEMORRHAGE
LARYNGEAL CANCER

RESPIRATORY EDEMA
PARANASAL SINUS CANCER
LUNG CANCER
PNEUMONITIS
ECZEMA
ERYTHEMA
STOMATITIS
FEVER
ANOSMIA
HEMOLYSIS
HEMATURIA
KIDNEY DAMAGE
ANURIA
LIVER DAMAGE
JAUNDICE
COLLAPSE
CONVULSIONS
GINGIVITIS
FACE/NECK FLUSHED
SKIN PIGMENTATION
SOMNOLENCE
REPRODUCTIVE EFFECTS IN EXPERIMENTAL ANIMALS

FIRST AID PROCEDURES FOLLOWING EXPOSURE

IF THIS CHEMICAL GETS INTO THE EYES, IMMEDIATELY WASH THE EYES WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING THE LOWER AND UPPER LIDS. GET MEDICAL ATTENTION IMMEDIATELY. CONTACT LENSES SHOULD NOT BE WORN WHEN WORKING WITH THIS CHEMICAL.

IF THIS CHEMICAL GETS ON THE SKIN, IMMEDIATELY WASH CONTAMINATED SKIN WITH SOAP OR MILD DETERGENT & WATER. IF THIS CHEMICAL SOAKS CLOTHING, IMMEDIATELY REMOVE CLOTHING & WASH SKIN WITH SOAP OR MILD DETERGENT & WATER. GET MEDICAL ATTENTION PROMPTLY.

IF A PERSON BREATHES IN LARGE AMOUNTS OF THIS CHEMICAL, MOVE THE EXPOSED PERSON TO FRESH AIR AT ONCE. IF BREATHING HAS STOPPED PERFORM ARTIFICIAL RESPIRATION. KEEP THE AFFECTED PERSON WARM AND AT REST. GET MEDICAL ATTENTION AS SOON AS POSSIBLE.

WHEN THIS CHEMICAL HAS BEEN SWALLOWED, DO NOT INDUCE VOMITING. REMOVE BY GASTRIC LAVAGE AND CATHARSIS.

INGESTED SALTS OF ALUMINUM, COPPER, NICKEL, TIN, AND ZINC:

EMERGENCY TREATMENT - DILUTE WITH WATER OR MILK. REMOVE BY GASTRIC LAVAGE UNLESS PATIENT IS VOMITING.

ANTIDOTE - FOR COPPER AND ZINC SALTS, GIVE CALCIUM DISODIUM

EDETATE ORALLY AND INTRAVENOUSLY. PENICILLAMINE IS EFFECTIVE FOR COPPER POISONING.

FURTHER TREATMENT - TREAT HYPOTENSION. RELIEVE IRRITATION BY GIVING MILK OR CORNSTARCH BY DISSOLVING 10 GRAMS CORNSTARCH OR

FLOUR IN 1 LITER OF WATER. REPLACE FLUIDS WITH 5% DEXTROSE IN SALINE. KEEP PATIENT WARM AND QUIET. RELIEVE PAIN WITH MEPERIDINE OR MORPHINE.

(MEDICATION MUST BE GIVEN BY QUALIFIED MEDICAL PERSONNEL)

SPECIAL TREATMENT - TREAT ANURIA AND LIVER DAMAGE.

(DREISBACH, HANDBOOK OF POISONING, 11TH ED.)

GASTRIC LAVAGE - GIVE PATIENT GLASS OF WATER PRIOR TO PASSING OF STOMACH TUBE. LAY PATIENT ON ONE SIDE, WITH HEAD LOWER THAN WAIST. IMMOBILIZE A STRUGGLING PATIENT WITH A SHEET OR BLANKET. MEASURE DISTANCE ON TUBE FROM MOUTH TO EPIGASTRIUM, MARK TUBE WITH INDELIBLE MARKING OR TAPE. REMOVE DENTURES AND OTHER FOREIGN OBJECTS FROM MOUTH. OPEN MOUTH, USE GAG IF NECESSARY. EXTEND HEAD BY LIFTING THE CHIN. PASS TUBE OVER TONGUE AND TOWARD BACK OF THROAT WITHOUT EXTENDING HEAD OR NECK. IF OBSTRUCTION IS MET BEFORE THE MARK ON TUBE REACHES LEVELS OF TEETH, DO NOT FORCE, BUT REMOVE TUBE AND REPEAT PROCEDURE UNTIL TUBE PASSES TO MARK. PLACE END OF TUBE IN GLASS OF WATER.

IF TUBE IS OBSTRUCTED WHEN INTRODUCED ABOUT HALFWAY TO THE MARK, IT MAY HAVE ENTERED TRACHEA.

AFTER TUBE IS PLACED IN STOMACH, ASPIRATE FIRST TO REMOVE STOMACH CONTENTS BY IRRIGATION SYRINGE. SAVE STOMACH CONTENTS FOR EXAMINATION, AND REPEAT INTRODUCTION AND WITHDRAWAL OF 100-300 ML WARM WATER UNTIL AT LEAST 3 LITERS OF CLEAR RETURN ARE OBTAINED. USE ACTIVATED CHARCOAL AT BEGINNING OF LAVAGE TO AID IN POISON INACTIVATION. LEAVE [illegible] GRAMS OF CHARCOAL SUSPENDED IN WATER IN THE STOMACH. IF INTRODUCTION AND REMOVAL OF LAVAGE FLUID BY GRAVITY REQUIRES MORE THAN FIVE MINUTES, ASSIST WITH ASEPTO SYRINGE. PREVENT ASPIRATION WITH CUFFED ENDOTRACHEAL TUBE. AVOID GIVING LARGE QUANTITIES OF WATER.

MASSAGE OF EPIGASTRIUM WHILE STOMACH TUBE IS BEING ASPIRATED MAY AID IN POISON REMOVAL.

IF PATIENT COMATOSE, INTUBATE TRACHEA WITH CUFFED ENDOTRACHEAL TUBE. SUCCINYLCHLORINE MAY BE ADMINISTERED BY QUALIFIED MEDICAL PERSONNEL TO EASE INSERTION OF TRACHEAL CATHETER PRIOR TO PASSAGE OF STOMACH TUBE.

(DREISBACH, HANDBOOK OF POISONING, 11TH ED.)

PAIN - MORPHINE SULFATE, 5-15 MG SUBCUTANEOUSLY, ORALLY, OR SLOWLY INTRAVENOUSLY. MORPHINE CAN CAUSE NAUSEA AND VOMITING,

CENTRAL NERVOUS SYSTEM DEPRESSION, AND SLOWING OF RESPIRATION. USE CAUTIOUSLY OR NOT AT ALL IN CENTRAL NERVOUS SYSTEM DEPRESSION, RESPIRATORY DIFFICULTY, HYPEREXCITABILITY, AND HEPATIC DISEASE.

- MEPERIDINE HYDROCHLORIDE (DEMEROL, DOLANTIN), 50-150 MG ORALLY OR INTRAMUSCULARLY.

(MEDICATION MUST BE GIVEN BY QUALIFIED MEDICAL PERSONNEL)

(DREISBACH, HANDBOOK OF POISONING, 11TH ED.)

ACUTE RENAL FAILURE - TREAT SHOCK. FOR HEMOLYTIC REACTIONS, GIVE SODIUM BICARONATE, 5 G EVERY 1-2 HOURS AS NECESSARY TO MAINTAIN AN ALKALINE URINE.

(MEDICATION MUST BE GIVEN BE QUALIFIED MEDICAL PERSONNEL)

(DREISBACH, HANDBOOK OF POISONING, 11TH ED.)

LIVER DAMAGE - REMOVE FROM EXPOSURE TO ALL CHEMICALS AND

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    DRUGS. MAINTAIN COMPLETE BED REST. AVOID ANESTHESIA OR
    SURGICAL PROCEDURES. AVOID DEHYDRATION OR OVERHYDRATION.
    IF VOMITING SEVERE AND ORAL FLUIDS NOT RETAINED, REPLACE
     VOMITUS WITH AN EQUAL QUANTITY OF 100% DEXTROSE IN NORMAL
     SALINE. IN RENAL FUNCTION ADEQUATE, GIVE 1 LITER OF 5%
    DEXTROSE OR INVERT SUGAR IN NORMAL SALINE PLUS 1-3 LITERS
    OF 10% DEXTROSE OR INVERT SUGAR IN DISTILLED WATER INTRA-

    VENOUSLY EVERY TWENTY-FOUR HOURS.
    (DREISBACH, HANDBOOK OF POISONING, 11TH ED.)


 ORGANS
    NASAL SEPTUM
    LUNGS
    SKIN

 TYPE WHAT INFORMATION YOU REQUIRE
 /ALL/, SPECIFIC INFORMATION (BY 4-LETTER COMMAND, /HELP/, OR /NONE/.
```

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: ZINC METAL/POWDER

MSDS No: Genium / 73
Revision: A
Date: November, 1989

National Paint and Coatings Association

Hazardous Material Identification System

HEALTH HAZARD	0 - Minimal
FLAMMABILITY HAZARD	1 - Slight
REACTIVITY HAZARD	1 - Slight
PERSONAL PROTECTION	SEE SECTION 8

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name: ZINC METAL/POWDER

Description: A metallic element extracted from ores which are first roasted to form zinc oxide and then: 1) the zinc oxide is leached from the roasted material with sulfuric acid to form a zinc sulfate solution which is electrolyzed in cells to deposit zinc on cathodes and 2) the zinc oxide is reduced with carbon in retorts (distilling vessels) to yield distilled and condensed zinc. Used as ingredient in alloys such as brass, bronze, and die-casting alloys.*

Other Designations: Blue powder; spelter; granular zinc; jasad; merrillite; pasco; Zn.

CAS: 7440-66-6

R - 1
I - 1
S - 1
K - 1

Manufacturer: Contact your supplier or distributor. Consult the latest <u>Chemicalweek Buyers' Guide</u> (Genium ref. 73) for a suppliers list.

* Also used as ingredient in galvanizing sheet iron; for electrical apparatus, especially castings, building materials, dry cell batteries, automotive equipment, household utensils, railroad car linings; as a fungicide; in nutrition (essential growth element); as reagent in analytical chemistry; in bleaching bone glue, manufacturing sodium hydrosulfite, and insulin zinc salts.

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:	CAS Number:	Percent:	Exposure Limits:
Zinc metal/powder	7440-66-6	ca 99	OSHA PEL None established* ACGIH TLV, 1989-90 None established* NIOSH REL, 1987 None established*

INGREDIENTS AND HAZARDS continues on page 2

INGREDIENTS AND HAZARDS continued from page 1

Toxicity Data**
Human, inhalation,
TC_{Lo}: 124
mg/m^3/50 min,
pulmonary system
effects.

* The current OSHA standard and ACGIH (1989-1990) TWA for zinc oxide (ZnO) fumes is 5 mg/m^3. The ACGIH TWA for zinc oxide dust is 10 mg/m^3, providing that total contains no asbestos and is <1% crystalline silica. NIOSH has recommended a 10-hr TWA of 5 mg/m^3 and a ceiling level of 15 mg/m^3 (15-min sample) for zinc oxide fume. The TLV-TWA level was set to prevent metal fume fever.

** See NIOSH, RTECS (ZG8600000), for additional data with references to irritative effects.

SECTION III. PHYSICAL DATA

Appearance & Odor: Bluish-white lustrous metal, also finely divided forms.

Boiling point: 907°F (1663°C)
Vapor pressure: 1 mm Hg at 909°F (487°C)
Water solubility (%): Insoluble
Specific gravity (H_2O=1): 7.13 at 77°F (25°C)*
Melting point: 419°F (787°C)

Brinell Hardness: 31
Atomic Weight: 65.37 g/mol
Index of Explosibility, Zn Powder (<0.1 weak, >10 severe): 0.1

* Water's specific gravity is 1 at 39°F (4°C)

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (method): None reported
Limits: LEL %: Dust cloud explosion*
UEL %: None reported

NFPA Fire Hazard Symbol Codes: Flammability: 0 Health: 1 Reactivity: 1 Special: --

Extinguishing Media: Use special dry chemical or clean dry sand. Never use CO_2. Using a direct stream of water may scatter the fire or disperse dust, creating a potentially explosive mixture if exposed to heat or ignition sources. A water spray may be used to cool fire-exposed containers and disperse vapors.

Autoignition Temp: **

Unusual fire or explosion hazards: Flammable hydrogen gas is liberated by reaction

FIRE AND EXPLOSION DATA continues on page 3

FIRE AND EXPLOSION DATA continued from page 2

with alkali hydroxides (sodium, potassium, and calcium hydroxides), acids, or even water (when material is in dust form) and is an explosion hazard in a confined space. In a fire, zinc may melt, vaporize, and burn to form ZnO fumes (Sec. 2).

Special fire-fighting procedures: For major fires, or if large quantities of this material are involved, fire fighters should wear appropriate protective clothing and respiratory protection. Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

* 0.5 oz/ft^3

** Cloud, 1256°F (680°C);*** dust layer, 860 °F (460°C);*** powder, 650 mJ***

*** Zinc dust refers to the product of zinc vapor condensation, and zinc powder to the product of molten zinc atomization (*Zinc Dust and Zinc Powder: Their Production, Properties, and Applications*, B.C. Hafford, W.E. Pepper, and T.B. Lloyd, 1982). Just 100% thru 74-μm sieve; a 0.96-J spark can ignite a cloud. The ignition temperature in CO_2 is 896°F (480°C). The reaction temperature in a nitrogen atmosphere is 1112°F (600°C).

SECTION V. REACTIVITY DATA

Chemical incompatibilities: Zinc dust is an explosion hazard when reacted with acids, chlorates, oxidizing agents (sulfur and oxygen), halogenated hydrocarbons, hydrazine mononitrate, hydroxylamine, amonium nitrate, barium dioxide, barium nitrate, cadmium, performic acid, manganese chloride, nitric acid, ethyl acetoacetate and tribromoneopentyl alcohol, tellurium, carbon disulfide, lead azide, magnesium and barium nitrate and barium dioxide, selenium, sodium peroxide, potassium nitrate, and water. In humans, a toxic effect results from inhaling 124 mg/m^3 of zinc metal/powder for 50 min.

Hazardous decomposition Products: Thermal oxidative decomposition of zinc can produce highly toxic fumes. Above 999°F (537°C) vaporized zinc burns in air with a blue-green flame to produce zinc oxide fumes.

Stability/Polymerization: Zinc is stable at room temperature. Moist zinc dust can react exothermically and ignite spontaneously in air. Hazardous polymerization cannot occur.

MSDS 73 continues on page 4

SECTION VI. HEALTH HAZARD INFORMATION

Summary of risks: Zinc is relatively nontoxic, but when combined with other materials such as oxygen or mineral acids, the resulting compounds can have toxic effects. It is not readily absorbed through the skin, gastrointestinal (GI tract), or lungs. Although most inorganic zinc compounds are potential causes of gastroenteric irritation, a high-level dose is relatively nontoxic when ingested. Zinc is considered essential to life. Ingestion of soluble salts may cause nausea and vomiting, sluggishness, and light-headedness. Inhalation of zinc fumes normally generated by zinc and extreme heat may cause metal fume fever, which is accompanied by throat dryness and irritation, coughing, weakness, dyspnea, and generalized aching that generally passes within 24 hr. These symptoms usually begin 3 to 10 hr after exposure and resolve within 24 to 48 hr. Inhalation of zinc dust may cause mild irritation to the upper respiratory tract. Prolonged skin contact with zinc may cause a mild, drying dermatitis.

Medical conditions which may be aggravated by contact: Since metallic zinc particulates can be considered a nuisance dust, repeated inhalation of zinc dust could lead to respiratory complications.

Target organs: Respiratory system.

Primary entry route(s): Inhalation, ingestion.

Acute effects: Metal fume fever is an acute, self-limiting condition, without recognized complications, aftereffects, or chronic forms. Symptoms appear several hours after exposure. Removal from exposure normally alleviates symptoms with no residual or chronic effects. A degree of tolerance may result from continued exposure, but is quickly lost after a day or two of nonexposure.

Chronic effect(s): Zinc and zinc powder have little history of causing chronic effects.

First aid:

Eye contact: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin contact: After rinsing affected area with flooding amounts of water, wash it 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 repeated vomiting until vomit is clear. Physician's Note: Calcium disodium edetate ($CaNa_2$-EDTA) has been used medically to increase the rate of zinc removal from the body; however, this usually results from chronic fume exposure or exposure to zinc salts, not to zinc metal powders.

HEALTH HAZARD INFORMATION continues on page 5

HEALTH HAZARD INFORMATION continued from page 4

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists zinc as a carcinogen.

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

SECTION VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill / Leak procedures: Notify safety personnel of powder spills. Eliminate all heat and ignition sources. Cleanup personnel should protect against dust inhalation and eye contact. Use nonsparking tools for cleanup. Sweep or otherwise place the spilled material in an appropriate, pressure-vented, dry-metal container (with lid) for later disposal. Avoid creating airborne dust conditions.

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

OSHA Designations
Air Contaminant (29 CFR 1910.1000 Subpart Z): Not listed
EPA Designations
RCRA Hazardous Waste (40 CFR 251.33): Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Reportable Quantity (RQ): 1000 lb (454 kg) [454 kg) [* per Clean Water Act, Sec. 307(a)]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Zinc (fume or dust) is listed as SARA Toxic Chemical (40 CFR 372.65)

SECTION VIII. SPECIAL PROTECTION INFORMATION

Personal protective equipment:

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

Respirator: For zinc oxide dust or fume concentrations up to 50 mg/m³ and 250 mg/m³, use, respectively, a fume (high-efficiency particulate) respirator or an air-supplied or self-contained respirator with a full facepiece. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (cleaning spills, reactor vessels or storage tanks), wear an SCBA. Warning: Air-purifying respirators do <u>not</u> protect workers in oxygen-deficient atmospheres.

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

SPECIAL PROTECTION INFORMATION continued from page 5

Workplace considerations:

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below established TLVs-TWAs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by eliminating it at its source (Genium ref. 103).

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. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment. Wash thoroughly before changing to street clothes.

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 IX. SPECIAL PRECAUTIONS

Storage segregation: Store in covered metal containers in a dry, well-ventilated, low fire risk area. Protect containers from physical damage. Never store with acids, halogenated hydrocarbons, or strong alkalis.

Engineering controls: Avoid breathing dust or fumes. Use good housekeeping and cleaning techniques to minimize airborne particulates and to prevent dust accumulation. Provide suitable training in personal hygiene and in the cause and effect of metal fume fever. Prevent exposure of workers with respiratory problems or gastrointestinal disorders.

Transportation Data (49 CFR 172.102)

IMO Shipping Name: Zinc, powder or dust, nonpyrophoric
IMO Hazard Class: 4.3
IMO Label: Dangerous when wet

IMO Shipping Name: Zinc, powder or dust, pyrophoric
IMO Hazard Class: 4.2
IMO Label: Spontaneously combustible
IMDG Packaging Group: II

Data source code(s): 2, 4-11, 24, 31, 39-41, 80, 81, 84, 85, 91, 109

Prepared/revised by: MJ Allison, BS

SPECIAL PRECAUTIONS continued from page 6

November, 1989

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: ARSENIC AND COMPOUNDS

MSDS No: Genium / 296
Date: April, 1990

National Paint
and Coatings
Association

Hazardous Material
Identification
System

HEALTH HAZARD	3 - Serious
FLAMMABILITY HAZARD	2 - Moderate
REACTIVITY HAZARD	2 - Moderat
PERSONAL PROTECTION	SEE SECTION 8

SECTION I. MATERIAL IDENTIFICATION

Trade/Material Name: ARSENIC AND COMPOUNDS

Description: Obtained from flue dust of copper and lead smelters as white arsenic (arsenic trioxide). Reduction with charcoal and sublimation in an N_2 current yields pure arsenic. Metallic arsenic is used for hardening copper, lead, and alloys; as a doping agent in germanium and silicon solid-state products, special solders, and medicine; and to make gallium arsenide for dipoles and other electronic devices.*

Other Designations: *arsen; arsenic black; As; gray arsenic; metallic arsenic.*

CAS: 7440-38-2

R 1
I 4
S 2
K 0

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

* Arsenic compounds are used in manufacturing certain types of glass; in textile printing, tanning, taxidermy, pharmaceuticals, insecticides and fungicides, pigment production, and antifouling paints; and to control sludge formation in lubricating oils. Arsenic trioxide is the source for 97% of all arsenic products.

SECTION II. INGREDIENTS AND HAZARDS

Ingredient Name:	CAS Number:	Percent:	Exposure Limits:
Arsenic and soluble coumpounds, as As	7440-38-2	50µg/m^3	OSHA PEL 8-hr TWA: 0.5 mg/m^3, * 0.01 mg/m^3** ACGIH TLV, 1989-90 TLV-TWA: 0.2 mg/m^3 NIOSH REL, 1987 Ceiling: 0.002 mg/m^3

INGREDIENTS AND HAZARDS continues on page 2

INGREDIENTS AND HAZARDS continued from page 1

Toxicity Data***
Man, oral, TD_{Lo}: 76 mg/kg administered intermittently over a 12-year period affects the liver (tumors) and blood (hemorrhage)
Man, oral: 7857 mg/kg administered over 55 years produces gastrointestinal (in the structure or function of the esophagus), blood (hemorrhage), and skin and appendage (dermatitis) changes
Rat, oral, TC_{Lo}: 605 μg/kg administered to a 35-week pregnant rat affects fertility (pre- and post-implantation mortality)

* Organic compounds
** Inorganic compounds
*** See NIOSH, RTECS (CG0525000), for additional mutative, reproductive, tumorigenic, and toxicity data.

SECTION III. PHYSICAL DATA

Appearance & Odor: A brittle, crystalline, silvery to black metalloid. Odorless.

Boiling point: sublimes at 1134°F/612°C*
Vapor pressure: 1 mm at 702°F/372°C (sublimes)*
Water solubility (%): Insoluble**
Melting point: 1497°F/814°C*

Atomic Weight: 74.92
Density: 5.724 at 57°F/14°C

* This data pertains to arsenic only
** Arsenic is soluble in nitric acid (HNO_3)

Material Safety Data Sheet

Genium Publishing Corporation
1145 Catalyn Street, Schenectady, NY 12303
(518) 377-8854
From Genium's collection, to be used as reference

Product: ARSENIC AND COMPOUNDS

MSDS No: Genium / 296
Date: April, 1990

SECTION IV. FIRE AND EXPLOSION DATA

Flash Point (method): None reported Limits: LEL %: None reported UEL %: None reported

NFPA Fire Hazard Symbol Codes: Flammability: 3 Health: 3 Reactivity: 2 Special: —*

Extinguishing Media: Use dry chemical, CO_2, water spray, or foam to fight fires. Autoignition Temp: None reported

Unusual fire or explosion hazards: Flammable and slightly explosive in the form of dust when exposed to heat or flame.

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. Do not release to sewers or waterways.

* Genium determined these hazard values because the NFPA Guidebook did not.

SECTION V. REACTIVITY DATA

Chemical incompatibilities: Arsenic can react vigorously on contact with powerful oxidizers such as bromates, peroxides, chlorates, iodates, lithium, silver nitrate, potassium nitrate, potassium permanganate, and chromium (VI) oxide. This material is also incompatible with halgens, bromine azide, palladium, dirubidium acetylide, zinc, and platinum.

Hazardous decomposition Products: Thermal oxidative decomposition of arsenic and its compounds produces irritating or poisonous gases.

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

SECTION VI. HEALTH HAZARD INFORMATION

*This product is considered a human (Group 1) carcinogen by OSHA, IARC, and NTP.**

Summary of risks: Arsenic compounds are irritants of the skin, mucous membranes, and eyes. The moist mucous membranes are most sensitive to irritation. Prolonged contact results in local hyperemia (blood congestion) and later vesicular or pustular eruption. Epidermal carcinoma is a reported risk of exposure. Peripheral neuropathy (degenerative state of the nervous system) is common after either acute or chronic arsenic poisoning. Symptoms include decreased sensation to touch, pinprick, and temperature; loss of vibration sense; and profound muscle weakness and wasting. Other complications of acute and chronic arsenic poisoning are encephalopathy (alterations of brain structure) and toxic delirium.

Medical conditions which may be aggravated by contact: Damage to the liver, nervous, and hematopoietic (responsible for the formation of blood or blood cells in the body) system may be permanent. Pulmonary and lymphatic cancer may also occur.

HEALTH HAZARD INFORMATION continues on page 4

HEALTH HAZARD INFORMATION continued from page 3

Target organs: Liver, kidneys, skin, lungs, lymphatic system.

Primary entry route(s): Inhalation, ingestion of dust and fumes, via skin absorption.

Acute effects: Acute industrial intoxication is more likely to arise from inhalation of arsine. However, with corrosive arsenical vapors, conjunctivitis, eyelid edema, and ever corneal erosion may result. Inhalation may result in nasal irritation with performation of the septum, cough, chest pain, hoarseness, pharyngitis, and inflammation of the mouth. If ingested, metallic or garlic taste, intense thirst, nausea, vomiting, abdominal pain, diarrhea, and cardiovascular arrhythmias (heartbeat irregularities) may occur. Symptoms generally occur within 30 minutes, but may be delayed for several hours if ingested with food. Acute poisoning may result in acute hemolysis (breakdown of red blood cells).

Chronic effect(s): Chronic symptoms include weight loss, hair loss, nausea, and diarrhea alternating with constipation, palmar and plantar hyperkeratoses (thickening of the corneous layer of skin on palms and soles of feet), and skin eruptions, and peripheral neuritis (inflammation of the nerves). Leukemia, bone marrow depression, or aplastic anemia (dysfunctioning of blood-forming organs) may occur after chronic exposure.

First aid:

Eye contact: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin contact: Quickly remove contaminated clothing. After rinsing affected skin with flooding amounts of water, wash it 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 a conscious person drink 1 to 2 glasses of water, then induce repeated vomiting until vomit is clear.

* This evaluation applies to arsenic and its compounds as a whole, not necessarily to individual chemicals within the group. Studies report both the tri- and pentavalent compounds are strongly implicated as causes of skin, lung, and lymphatic cancers. Experimental studies show arsenic has tumorigenic and teratogenic effects in laboratory animals.

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

Physician's Note: If emesis is unsuccessful after two does of Ipecac, consider gastric lavage. Monitor urine arsenic level. Alkalinizing urine may prevent disposition of red cell breakdown products in renal tubular cells. If acute exposure is significant, maintain high urine output and monitor volume status, preferably with central venous pressure line. Abdominal X-ray should be done routinely for all

HEALTH HAZARD INFORMATION continues on page 5

HEALTH HAZARD INFORMATION continued from page 4

ingestions. Chelation therapy w/BAL, followed by n-penicillamine, is recommended, but specific dosing guidelines are not clearly established.

SECTION VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Spill / Leak procedures: Notify safety personnel of spill, evacuate all unnecessary personnel, remove all heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and contact with skin and eyes. Use nonsparking tools. With a clean shovel, scoop material into a clean, dry container and cover. Absorb liquid material with sand or noncombustible inert material and place in disposal containers. Do not release to sewers, drains, or waterways. Follow applicable OSHA regulations (29 CFR 1910.120).

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

OSHA Designations*
Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed
EPA Designations**
RCRA Hazardous Waste (40 CFR 261.33): Not listed
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)*; per Clean Air Act, Sec. 112]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)

* *Listed as arsenic organic compounds (as As)*
** Designations for arsenic only.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Personal protective equipment:

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

Respirator: 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.

SPECIAL PROTECTION INFORMATION continued from page 5

Workplace considerations:

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PELs, ACGIH TLV, and NIOSH REL (Sec. 2). Local exhaust ventilation is preferred since 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:
Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Launder contaminated clothing before wearing. Remove this material from your shoes and equipment.

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 IX. SPECIAL PRECAUTIONS

Storage segregation: Store in closed, properly labeled containers, in a cool, well-ventilated area away from all incompatible materials (Sec. 5) and heat and ignition sources. Protect containers from physical damage.

Engineering controls: Avoid inhalation or ingestion of dust and fumes, and skin or eye contact. Practice good personal hygiene and housekeeping procedures. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program with training, maintenance, inspection, and evaluation. All engineering systems should be of maximum explosion-proof design and electrically grounded and bonded. Provide preplacement and annual physical examination with emphasis on the skin, respiratory system, and blood.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Arsenic, solid
DOT Hazard Class: Poison B
ID No.: UN1558
DOT Label: Poison
DOT Packaging Requirements: 173.366
DOT Packaging Exceptions: 173.364

IMO Shipping Name: Arsenic, metallic
IMO Hazard Class: 6.1
IMO Label: Poison
IMDG Packaging Group: II
ID No.: UN1558

SPECIAL PRECAUTIONS continues on page 7

SPECIAL PRECAUTIONS continued from page 6

Data source code(s): 7, 26, 38, 53, 73, 85, 87, 88, 89, 100, 103, 109, 123, 124, 126, 127, 130, 136, 138

Prepared/revised by: MJ Allison, BS

April, 1990

Trichloroethylene ClCH=CCl$_2$ 79 01 6 KX4560000 1710 74	Ethylene trichloride, Triclene Trichloroethene 1 ppm = 5.46 mg/m^3	NIOSH Ca See Appendix A 25 ppm OSHA 50 ppm (270 mg/m^3) ST 200 ppm (1080 mg/m^3)	Ca [1000 ppm]	Colorless liquid (unless dyed blue) with a chloroform-like odor	MW: 131.4 BP: 189°F Sol(77°F): 0.1% Fl.P: 90°F IP: 9.45 eV Sp.Gr: 1.46 Class IC Flammable Liquid, but burns with difficulty	VP: 58 mm FRZ: -99°F UEL(77°F): 10.5% LEL(77°F): 8%	Strong caustics & alkalis; chemically-active metals such as barium, lithium, sodium, magnesium, titanium & beryllium	Char; CS$_2$; GC/FID; III [#1022]	Clothing: Repeat Goggles: Reason prob Wash: Prompt wet Change: N.R. Remove: Prompt non-imperv wet	NIOSH ¶: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh Ing Con Head, vert; vis dist; tremors, som, nau, vomit; irrit eyes, derm; card arrhy, pares; [carc]	Eye: Irr immed Skin: Soap wash prompt Breath: Resp support Swallow: Medical attention immed	Resp sys, heart, liver, kidneys, CNS, skin
Thallium (soluble compounds as Tl) 7440 28 0 XG3425000 1707 53 (cmpds)	Synonyms vary depending upon the specific soluble compound	NIOSH/OSHA 0.1 mg/m^3 [skin]	20 mg/m^3	Appearance and odor vary depending upon the specific soluble compound	Properties vary depending upon the specific soluble compound		None reported	Filter; Acid; AA; II(3) [#S306]	Clothing: Reason prob Goggles: Reason prob Wash: Prompt contam Change: After work if reason prob contam Remove: Prompt non-imperv contam	NIOSH/OSHA 0.5 mg/m^3: DM 1 mg/m^3: DMXSQ*/SA/SCBA 2.5 mg/m^3: PAPRDM*/SA:CF 5 mg/m^3: HiEF/SCBAF/SAF/PAPRTHiE/SA:T:CF 20 mg/m^3: SAF:PD,PP §: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: HiEF/SCBAE	Inh Abs Ing Con Nau, diarr, abdom pain, vomit; ptosis, strabismus; peri neuritis, tremor; retster tight, chest pain, pulm edema; seiz, chorea, psychosis; liver, kidney damage; alopecia; pares legs	Eye: Irr immed Skin: Water flush prompt Breath: Resp support Swallow: Medical attention immed	Eyes, CNS, lungs, liver, kidneys, GI tract, body hair
Phenol C$_6$H$_5$OH 108 95 2 SJ3325000 1671 55 (solid) 2312 55 (molten) 2821 55 (soln)	Carbolic acid Hydroxybenzene Monohydroxy benzene, Phenyl alcohol Phenyl hydroxide	NIOSH 5 ppm (19 mg/m^3) C 15.6 ppm (60 mg/m^3) [15 min] [skin] OSHA 5 ppm (19 mg/m^3) [skin]	250 ppm	Colorless to light pink, crystalline solid with a sweet, acrid odor [Note: Phenol liquefies by mixing with about 8% water.]	MW: 94.1 BP: 359°F Sol(77°F): 9% Fl.P: 175°F IP: 8.50 eV Sp.Gr: 1.06 Combustible Solid	VP: 0.4 mm MLT: 109°F UEL: ? LEL: 1.8%	Strong oxidizers, calcium hypochlorite, aluminum chloride, acids	XAD-7; Methanol; HPLC/UVD; OSHA [#32]	Clothing: Any poss Goggles: Any poss Wash: Immed contam Change: After work if any poss contam Remove: Immed non-imperv contam Provide: Eyewash, quick drench	NIOSH/OSHA 50 ppm: CCROVDM/SA/SCBA 125 ppm: SA:CF/PAPROVDM 250 ppm: SCBAF/SAF/CCRFOVHiE/GMFOVHiE/PAPRTOVHiE §: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOVHiE/SCBAE	Inh Abs Ing Con Irrit eyes, nose, throat; anor, low-wgt, weak, musc ache, pain; dark urine, cyan; liver, kidney damage; skin burns; derm; ochronosis; tremor, convuls, twitch	Eye: Irr immed Skin: Soap wash immed Breath: Resp support Swallow: Medical attention immed	Liver, kidneys, skin
Cyanides (as CN) 1. KCN 2. NaCN 1. 151 50 8 TS8750000 2. 143 33 9 VZ7530000 1680 55 (KCN soln) 1689 55 (NaCN)	1. Potassium cyanide Potassium salt of hydrocyanic acid 2. Sodium cyanide Sodium salt of hydrocyanic acid Synonyms of other compounds vary depending upon the specific compound	NIOSH C 5 mg/m^3 (4.7 ppm) [10 min] OSHA 5 mg/m^3	50 mg/m^3	KCN & NaCN are white granular or crystalline solids with a faint almond-like odor	MW: 65.1/49.0 BP: ?/2725°F Sol(77°F): 72/58% Fl.P: NA/NA IP: NA/NA Sp.Gr: 1.55 (KCN)/1.60 (NaCN) Noncombustible Solids, but contact with acids releases highly flammable hydrogen cyanide	VP: 0/0 mm (approx) MLT: 1173/1047°F UEL: NA/NA LEL: NA/NA	Strong oxidizers such as acids, acid salts, chlorates & nitrates	Filter/Bub; KOH; ISE; III [#7904]	Clothing: Any poss Goggles: Any poss Wash: Immed contam Change: After work if any poss contam Remove: Immed non-imperv contam Provide: Eyewash, quick drench	NIOSH/OSHA 50 mg/m^3: SA/SCBA §: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFSHiE/SCBAE	Inh Abs Ing Con Asphy and death can occur; weak, head, conf; nau, vomit; incr resp rate, slow gasping resp; irrit eyes, skin	Eye: Irr immed Skin: Soap wash immed Breath: Resp support Swallow: Medical attention immed	CVS, CNS, liver, kidneys, skin
2-Butanone CH$_3$COCH$_2$CH$_3$ 78 93 3 EL6475000 1193/1232 26	Ethyl methyl ketone MEK Methyl acetone Methyl ethyl ketone 1 ppm = 3.00 mg/m^3	NIOSH/OSHA 200 ppm (590 mg/m^3) ST 300 ppm (885 mg/m^3)	3000 ppm	Colorless liquid with a moderately sharp, fragrant, mint- or acetone-like odor	MW: 72.1 BP: 175°F Sol: 28% Fl.P: 16°F IP: 9.54 eV Sp.Gr: 0.81 Class IB Flammable Liquid	VP: 71 mm FRZ: -123°F UEL(200°F): 11.4% LEL(200°F): 1.4%	Strong oxidizers, amines, ammonia, inorganic acids, caustics, copper, isocyanates, pyridines	Ambersorb; CS$_2$; GC/FID; III [#2500]	Clothing: Repeat Goggles: Reason prob Wash: N.R. Change: N.R. Remove: Prompt non-imperv contam Provide: Eyewash	NIOSH/OSHA 1000 ppm: PAPROV*/CCRFOV 3000 ppm: GMFOV/SA:CF*/SCBAF/SAF §: SCBAF:PD,PP/SAF:PD,PP:ASCBA Escape: GMFOV/SCBAE	Inh Ing Con Irrit eyes, nose; head; dizz; vomit	Eye: Irr immed Skin: Water wash immed Breath: Fresh air Swallow: Medical attention immed	CNS, lungs