APPENDIX D MSDSs for Constituents with Exposure Potential

URS
HEALTH AND SAFETY PLAN
COMPLIANCE AGREEMENT

Project Name: _____

Project Number: _____

Description of Activity: _____

Subsite Description: _____

I, _____, have read the Health and Safety Plan and hereby agree to abide by its provisions and to aid the Site Safety Officer in its implementation. I understand that it is in the best interest of myself and my co-workers to ensure that site operations are conducted in the safest manner possible. Therefore, I will be alert to site health and safety conditions at all times.

_____ _____
Signature Date

Clear liquid; aromatic odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
May be harmful if inhaled, swallowed, or absorbed through the skin. Vapor irritating to eyes and respiratory passages. Can cause headache, depression of Central Nervous System, coma, and respiratory failure.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: Get immediate medical attention.

5. FIRE FIGHTING MEASURES

Flash Point (F): 59F (cc)
Flammable Limits LEL (%): 1.00
Flammable Limits UEL (%): 6.70
Extinguishing Media:
CO_2, dry chemical, alcohol foam

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Vapor can travel distances to ignition source and flash back.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described

under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.
EM SCIENCE recommends Spill-X absorbent agents for various types of spills. Additional information on the Spill-X products can be provided through the EM SCIENCE Technical Service Department (609) 423-6300. The following EM SCIENCE Spill-X absorbent is recommended for this product:

SX0863 Solvent Spill Treatment Kit

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store in a cool, dry area away from ignition sources and oxidizers. Do not breathe vapor. Do not get in eyes, on skin, or on clothing. Electrically ground all equipment when handling this product.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves should be worn to prevent skin contact (Viton or equivalent) Safety glasses with side shields should be worn at all times. Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Ethylbenzene	100	435	125	545			

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Ethylbenzene	100	434	125	543			

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Please reduce your browser font size for better viewing and printing.

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

1,1,1-TRICHLOROETHANE

MSDS Number: T4914 — ***Effective Date: 09/14/00***

1. Product Identification

Synonyms: Methyl chloroform; trichloroethane; chloroetene
CAS No.: 71-55-6
Molecular Weight: 133.40
Chemical Formula: CH3CCl3
Product Codes: 5381, 9435, 9437, W509, W510

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Methyl Chloroform	71-55-6	96 - 100%	Yes
Dioxane	123-91-1	< 3%	Yes
1,2-Epoxybutane	106-88-7	< 0.5%	Yes

Actual concentrations proprietary

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, KIDNEYS, AND CARDIOVASCULAR SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. POSSIBLE CANCER HAZARD. CONTAINS DIOXANE WHICH MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)
Flammability Rating: 1 - Slight
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Inhalation of vapors will irritate the respiratory tract. Affects the central nervous system. Symptoms include headache, dizziness, weakness, nausea. Higher levels of exposure (> 5000 ppm) can cause irregular heart beat, kidney and liver damage, fall in blood pressure, unconsciousness and even death.
Ingestion:
Harmful if swallowed. Symptoms similar to inhalation will occur along with nausea, vomiting. Aspiration of material into the lungs can cause chemical pneumonitis which can be fatal. If aspirated, may be rapidly absorbed through the lungs and result in injury to other body systems.
Skin Contact:
Causes mild irritation and redness, especially on prolonged contact. Repeated contact may cause drying or flaking of the skin.
Eye Contact:
Liquids and vapors cause irritation. Symptoms include tearing, redness, stinging, swelling.
Chronic Exposure:
Prolonged or repeated skin contact may cause dermatitis. Chronic exposure may affect the kidneys and liver. Dioxane is a suspected human carcinogen based on animal data.
Aggravation of Pre-existing Conditions:
Personnel with CNS, kidney, liver or heart disease may be more susceptible to the effects of this substance. Use of alcoholic beverages may aggravate symptoms.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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5. Fire Fighting Measures

Fire:
Autoignition temperature: 500C (932F)
Flammable limits in air % by volume:
lel: 7.0; uel: 16.0
Vapors in containers can explode if subjected to high energy source.
Dioxane has a flash point below 16C (60F).
Explosion:
Can react with strong caustic, such as potash to form a flammable or explosive material. Air/vapor mixtures may explode when heated. Vapors can flow along surfaces to distant ignition source and flash back. Sealed containers may rupture when heated.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limited protection to the combustion products of this material.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! Do not use aluminum, magnesium or zinc metal for storage container. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. Do not use aluminum equipment or storage containers. Contact with aluminum parts in a pressurized fluid system may cause violent reactions.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
350 ppm (TWA) for trichloroethane

100 ppm (TWA) skin for dioxane
-ACGIH Threshold Limit Value (TLV):
350 ppm (TWA), 450 ppm (STEL) for trichloroethane
20 ppm (TWA) skin, A3 - Animal Carcinogen for dioxane
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has questionable warning properties. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Viton is a recommended material for personal protective equipment.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Mild chloroform-like odor.
Solubility:
4,400 ppm in water @ 20C (68F)
Specific Gravity:
1.34 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
74C (165F)
Melting Point:
-32C (-26F)
Vapor Density (Air=1):
4.63
Vapor Pressure (mm Hg):
100 @ 20C (68F)
Evaporation Rate (BuAc=1):
12.8

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10. Stability and Reactivity

Stability:
Requires inhibitor content to prevent corrosion of metals. Slowly hydrolyzes in water to form hydrochloric and acetic acid.
Hazardous Decomposition Products:
May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition. Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Hazardous polymerization can occur in contact with aluminum trichloride.
Incompatibilities:
Open flames, welding arcs, nitrogen tetroxide, oxygen, liquid oxygen, sodium, sodium hydroxide, and sodium-potassium alloy, strong alkalis, oxidizers, aluminum and other reactive metals.
Conditions to Avoid:
Insufficient inhibitor, incompatibles, heat, flame and ignition sources

11. Toxicological Information

Oral rat LD50: 9600 mg/kg; inhalation rat LC50: 18000 ppm/4H; investigated as a mutagen, tumorigen, reproductive effector; irritation eye rabbit, Standard Draize, 2mg/24H severe.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Methyl Chloroform (71-55-6)	No	No	3
Dioxane (123-91-1)	No	Yes	2B
1,2-Epoxybutane (106-88-7)	No	No	2B

12. Ecological Information

Environmental Fate:
When released into the soil, this material is not expected to biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released to water, this material is expected to quickly evaporate. This material is not expected to significantly bioaccumulate. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition. When released to the atmosphere, this material has an average global half-life of 6.0 - 6.9 years. When released into the air, this material may adversely affect the ozone layer.
Environmental Toxicity:
This material is expected to be slightly toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: 1,1,1-TRICHLOROETHANE
Hazard Class: 6.1
UN/NA: UN2831
Packing Group: III
Information reported for product/size: 20L

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\--------

Ingredient	TSCA	EC	Japan	Australia
Methyl Chloroform (71-55-6)	Yes	Yes	Yes	Yes
Dioxane (123-91-1)	Yes	Yes	Yes	Yes
1,2-Epoxybutane (106-88-7)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\--------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Methyl Chloroform (71-55-6)	Yes	Yes	No	Yes
Dioxane (123-91-1)	Yes	Yes	No	Yes
1,2-Epoxybutane (106-88-7)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\--------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Methyl Chloroform (71-55-6)	No	No	Yes	No
Dioxane (123-91-1)	No	No	Yes	No
1,2-Epoxybutane (106-88-7)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\--------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Methyl Chloroform (71-55-6)	1000	U226	No
Dioxane (123-91-1)	100	U108	No
1,2-Epoxybutane (106-88-7)	100	No	No

Chemical Weapons Convention: No TSCA 12(b): Yes CDTA: No

SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Mixture / Liquid)

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2[Z]
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: 2 Flammability: 1 Reactivity: 0
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, KIDNEYS, AND CARDIOVASCULAR SYSTEM. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. POSSIBLE CANCER HAZARD. CONTAINS DIOXANE WHICH MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.
Label Precautions:
Avoid breathing vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid contact with eyes, skin and clothing.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 8, 11.
Disclaimer:
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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

BENZENE- MATERIAL SAFETY DATA SHEET

TABLE OF CONTENTS:

1. Chemical Product and Company Identification
2. Composition, Information on Ingredients
3. Hazards Identification
4. First Aid Measures
5. Fire Fighting Measures
6. Accidental Release Measures
7. Handling and Storage
8. Exposure Controls, Personal Protection
9. Physical and Chemical Properties
10. Stability and Reactivity
11. Toxicological Information
12. Ecological Information
13. Disposal Considerations
14. Transport Information
15. Regulatory Information
16. Other Information

24 Hour EMERGENCY CONTACT

U.S- CHEMTREC 1-800-424-9300

CANADA- ANUTEC 613-996-6666

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION----------Up to Table of Contents

Matheson Tri-Gas, Inc.

The telephone numbers listed below are emergency numbers, please contact your local branch for routine inquiries.

USA
959 Route 46 East
Parsippany, New Jersey
07054-0624 USA
Phone: 973-257-1100

CANADA
530 Watson Street
Whitby, Ontario
L1N 5R9 Canada
Phone: 905-668-3570

SUBSTANCE: BENZENE

SYMBOL: C_6H_6

TRADE NAMES/SYNONYMS:
BENZOL; CYCLOHEXATRIENE; BENZOLE; PHENE; PYROBENZOL; PYROBENZOLE; CARBON OIL; COAL TAR NAPHTHA; PHENYL HYDRIDE; BENZOLENE; BICARBURET OF HYDROGEN; COAL NAPHTHA; MOTOR BENZOL; ANNULENE; (6)ANNULENE; RCRA U019; STCC 4908110; UN 1114; C6H6; MAT02610; RTECS CY1400000

CHEMICAL FAMILY: hydrocarbons, aromatic

CREATION DATE: Jan 24 1989
REVISION DATE: Mar 16 1999

2. COMPOSITION, INFORMATION ON INGREDIENTS----------Up to Table of Contents

COMPONENT: BENZENE

CAS NUMBER: 71-43-2

EC NUMBER (EINECS): 200-753-7

PERCENTAGE: >99

COMPONENT: THIOPHENE

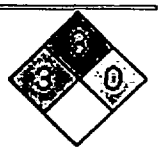
CAS NUMBER: 110-02-1

EC NUMBER (EINECS): 203-729-4

PERCENTAGE: 0.00010

3. HAZARDS IDENTIFICATION----------Up to Table of Contents

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



WHMIS CLASSIFICATION: BD2

EC CLASSIFICATION (ASSIGNED):
F Highly Flammable
T Toxic
Carcinogen Category 1

R 11-45-48/23/24/25

EC Classification may be inconsistent with independently-researched data.

EMERGENCY OVERVIEW:
Color: colorless to yellow

Physical Form: liquid

Major Health Hazards: respiratory tract irritation, skin irritation, eye irritation, central nervous system depression, cancer hazard (in humans)

Physical Hazards: Flammable liquid and vapor. Vapor may cause flash fire.

POTENTIAL HEALTH EFFECTS:

INHALATION:
Short Term Exposure: irritation, ringing in the ears, nausea, vomiting, chest pain, difficulty breathing, irregular heartbeat, headache, drowsiness, symptoms of drunkenness, disorientation, blurred vision, lung congestion, blood disorders, paralysis, convulsions, coma
Long Term Exposure: hearing loss, visual disturbances, reproductive effects, brain damage, cancer

SKIN CONTACT:
Short Term Exposure: irritation, blisters
Long Term Exposure: tingling sensation

EYE CONTACT:
Short Term Exposure: irritation
Long Term Exposure: no information on significant adverse effects

INGESTION:
Short Term Exposure: nausea, vomiting, chest pain, headache, drowsiness, symptoms of drunkenness, disorientation, visual disturbances, lung congestion, paralysis, convulsions, coma
Long Term Exposure: impotence, cancer

CARCINOGEN STATUS:
OSHA: Y
NTP: Y
IARC: Y

4. FIRST AID MEASURES----------Up to Table of Contents

INHALATION:
When safe to enter area, remove from exposure. Use a bag valve mask or similar device to perform artificial respiration

(rescue breathing) if needed. Keep warm and at rest. Get medical attention immediately.

SKIN CONTACT:
Remove contaminated clothing, jewelry, and shoes immediately. Wash with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). Get medical attention, if needed.

EYE CONTACT:
Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains. Get medical attention immediately.

INGESTION:
Contact local poison control center or physician immediately. Never make an unconscious person vomit or drink fluids. When vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention immediately.

NOTE TO PHYSICIAN:
For inhalation, consider oxygen. For ingestion, consider gastric lavage.

5. FIRE FIGHTING MEASURES----------Up to Table of Contents

FIRE AND EXPLOSION HAZARDS:
Severe fire hazard. Moderate explosion hazard. Vapor/air mixtures are explosive. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Electrostatic discharges may be generated by flow or agitation resulting in ignition or explosion.

EXTINGUISHING MEDIA:
regular dry chemical, carbon dioxide, water, regular foam

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING:
Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Evacuation radius: 800 meters (1/2 mile). Water may be ineffective.

FLASH POINT:
12 F (-11 C) (CC)
LOWER FLAMMABLE LIMIT:
1.2%
UPPER FLAMMABLE LIMIT:
7.8%
AUTOIGNITION:
928 F (498 C)
FLAMMABILITY CLASS (OSHA):
IB

6. ACCIDENTAL RELEASE MEASURES----------Up to Table of Contents

AIR RELEASE:
Reduce vapors with water spray. Stay upwind and keep out of low areas.

SOIL RELEASE:
Dig holding area such as lagoon, pond or pit for containment. Dike for later disposal. Absorb with sand or other non-combustible material.

WATER RELEASE:
Cover with absorbent sheets, spill-control pads or pillows. Apply detergents, soaps, alcohols or another surface active agent. Collect with absorbent into suitable container. Absorb with activated carbon. Remove trapped material with suction hoses. Collect spilled material using mechanical equipment. Subject to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Keep out of water supplies and sewers.

OCCUPATIONAL RELEASE:
Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Remove sources of ignition. Keep unnecessary people away,

isolate hazard area and deny entry. Reportable Quantity (RQ): Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE----------Up to Table of Contents

Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Grounding and bonding required. Protect from physical damage. Store outside or in a detached building. Store with flammable liquids. Keep separated from incompatible substances. Keep separated from incompatible substances.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION----------Up to Table of Contents

EXPOSURE LIMITS:
BENZENE:
1 ppm OSHA TWA
5 ppm OSHA STEL 15 minute(s)
0.5 ppm OSHA action level
0.5 ppm (1.6 mg/m3) ACGIH TWA
2.5 ppm (8 mg/m3) ACGIH STEL
0.1 ppm (0.32 mg/m3) NIOSH recommended TWA 8 hour(s)
1 ppm (3.2 mg/m3) NIOSH recommended ceiling 15 minute(s)

VENTILATION: Provide local exhaust or process enclosure ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves. OSHA REGULATED SUBSTANCES: U.S. OSHA 29 CFR 1910.1028.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.
10 ppm
Any air-purifying respirator with a full facepiece and an organic vapor canister.
50 ppm
Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).
Any air-purifying respirator with a full facepiece and a canister providing protection against this substance.
100 ppm
Any powered, air-purifying respirator with a full facepiece and organic vapor cartridge(s).
1000 ppm
Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode.
For Unknown Concentrations or Immediately Dangerous to Life or Health -
Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.
Escape -
Any air-purifying respirator with a full facepiece and an organic vapor canister.
Any self-contained breathing apparatus with a full facepiece.

9. PHYSICAL AND CHEMICAL PROPERTIES----------Up to Table of Contents

PHYSICAL STATE: liquid

COLOR: colorless to yellow

ODOR: distinct odor

MOLECULAR WEIGHT: 78.11

MOLECULAR FORMULA: C6-H6

BOILING POINT: 176 F (80 C)

FREEZING POINT: 43 F (6 C)

VAPOR PRESSURE: 75 mmHg @ 20 C

VAPOR DENSITY (air=1): 2.8

SPECIFIC GRAVITY (water=1): 0.8765 @ 20 C

WATER SOLUBILITY: 0.18% @ 25 C

PH: Not available

VOLATILITY: 100%

ODOR THRESHOLD: 4.68 ppm

EVAPORATION RATE: 5.1 (butyl acetate=1)

VISCOSITY: 0.6468 cP @ 20 C

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available

SOLVENT SOLUBILITY:
Soluble: acetone, alcohol, carbon disulfide, acetic acid, carbon tetrachloride, chloroform, ether, oils

10. STABILITY AND REACTIVITY----------Up to Table of Contents

REACTIVITY:
Stable at normal temperatures and pressure.

CONDITIONS TO AVOID:
Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat. Keep out of water supplies and sewers.

INCOMPATIBILITIES:
acids, bases, halogens, oxidizing materials, metal salts

HAZARDOUS DECOMPOSITION:
Thermal decomposition products: oxides of carbon

POLYMERIZATION:
Will not polymerize.

11. TOXICOLOGICAL INFORMATION----------Up to Table of Contents

BENZENE:

IRRITATION DATA:
15 mg/24 hour(s) open skin-rabbit mild; 20 mg/24 hour(s) skin-rabbit moderate; 88 mg eyes-rabbit moderate; 2 mg/24 hour(s) eyes-rabbit severe

TOXICITY DATA:
10000 ppm/7 hour(s) inhalation-rat LC50; >9400 ul/kg skin-rabbit LD50; 930 mg/kg oral-rat LD50

CARCINOGEN STATUS:
OSHA: Carcinogen; NTP: Known Human Carcinogen; IARC: Human Sufficient Evidence, Animal Sufficient Evidence, Group 1; ACGIH: A1 -Confirmed Human Carcinogen; EC: Category 1

LOCAL EFFECTS:
Irritant: inhalation, skin, eye

ACUTE TOXICITY LEVEL:
Highly Toxic: dermal absorption

Moderately Toxic: ingestion
Slightly Toxic: inhalation

TARGET ORGANS:
immune system (blood), central nervous system

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:
blood system disorders, immune system disorders or allergies

TUMORIGENIC DATA:
Available.

MUTAGENIC DATA:
Available.

REPRODUCTIVE EFFECTS DATA:
Available.

ADDITIONAL DATA:
May cross the placenta. Alcohol may enhance the toxic effects. Interactions with drugs may occur.

12. ECOLOGICAL INFORMATION----------Up to Table of Contents

ECOTOXICITY DATA:

FISH TOXICITY:
9200 ug/L 96 hour(s) LC50 (Mortality) Rainbow trout,donaldson trout (Oncorhynchus mykiss)

INVERTEBRATE TOXICITY:
10000 ug/L 48 hour(s) EC50 (Immobilization) Water flea (Daphnia magna)

ALGAL TOXICITY:
41000 ug/L 8 hour(s) EC50 (Growth) Green algae (Selenastrum capricornutum)

OTHER TOXICITY:
25 ug/L 24 day(s) (Residue) Wood frog (Rana sylvatica)

FATE AND TRANSPORT:

BIOCONCENTRATION:
4360 ug/L 24 day(s) BCF (Residue) Northern anchovy (Engraulis mordax) 97 ug/L

13. DISPOSAL CONSIDERATIONS----------Up to Table of Contents

Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): U019. Hazardous Waste Number (s): D018. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the Regulatory level. Regulatory level- 0.5 mg/L. Dispose in accordance with all applicable regulations.

14. TRANSPORT INFORMATION----------Up to Table of Contents

-/SELECTION-->U.S. DOT 49 CFR 172.101. SHIPPING NAME-UN NUMBER; HAZARD CLASS; PACKING GROUP; LABEL:
Benzene-UN1114; 3; II; Flammable liquid

15. REGULATORY INFORMATION----------Up to Table of Contents

U.S. REGULATIONS:
TSCA INVENTORY STATUS: Y

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CERCLA SECTION 103 (40CFR302.4): Y
Benzene: 10 LBS RQ

SARA SECTION 302 (40CFR355.30): N

SARA SECTION 304 (40CFR355.40): N

SARA SECTION 313 (40CFR372.65):Y
Benzene

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40CFR370.21):
ACUTE: Y
CHRONIC: Y
FIRE: Y
REACTIVE: N
SUDDEN RELEASE: N

OSHA PROCESS SAFETY (29CFR1910.119): N

STATE REGULATIONS:
California Proposition 65: Y
Known to the state of California to cause the following:
Benzene
Cancer (Feb 27, 1987)
Developmental toxicity (Dec 26, 1997)
Male reproductive toxicity (Dec 26, 1997)

EUROPEAN REGULATIONS:

EC NUMBER (EINECS): 200-753-7

EC RISK AND SAFETY PHRASES:

R 11	Highly flammable.
R 45	May cause cancer.
R 48/23/24/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
S 45	In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 53	Avoid exposure - obtain special instructions before use.

16. OTHER INFORMATION----------Up to Table of Contents

Matheson Tri-Gas makes no express or implied warranties, guarantees or representations regarding the product or the information herein, including but not limited to any implied warranty of merchantability or fitness for use. Matheson Tri-Gas shall not be liable for any personal injury, property or other damages of any nature, whether compensatory, consequential, exemplary, or otherwise, resulting from any publication, use or reliance upon the information herein.

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MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 4/28/93

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

6146 820820 MX1300 MX1301

Product Name:
4-Methyl-2-pentanone
Synonyms:
Hexone; Methyl Isobutyl Ketone
Chemical Family:
Ketone
Formula:
$CH_3COCH_2CH(CH_3)_2$
Molecular Weight.:
100.16

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
4-Methyl-2-pentanone	108-10-1	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
FLAMMABLE LIQUID AND VAPOR.
HARMFUL IF INHALED OR SWALLOWED.
IRRITATING TO SKIN, EYES AND MUCOUS MEMBRANES.

Appearance:
Colorless to pale yellow liquid; sharp, mint-like odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Harmful if inhaled or swallowed. Ingestion causes inflammation of digestive tract and narcosis. Vapors are extremely irritating to eyes, nose, throat and respiratory tract. Prolonged exposure or high vapor concentrations can cause nausea, headache, dizziness, upset stomach and unconsciousness. Skin contact causes drying and irritation.

Medical Cond. Aggravated by Exposure:
Persons with pre-existing skin or eye problems or impaired liver, kidney, or respiratory function may be more susceptible to the effects of this substance.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Immediately flush thoroughly with large amounts of water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.
Remove contaminated clothing and wash before reuse.

5. FIRE FIGHTING MEASURES

Flash Point (F): 64F
Flammable Limits LEL (%): 1.40
Flammable Limits UEL (%): 7.50
Extinguishing Media:
Use "alcohol" foam, carbon dioxide, dry chemical.
Water spray to cool fire-exposed containers.

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Dangerous fire and explosive hazard. Vapor can travel distances to ignition source and flash back. Ignites on contact with potassium-tert-butoxide.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.
EM SCIENCE recommends Spill-X absorbent agents for various types of spills. Additional information on the Spill-X products can be provided through the EM SCIENCE Technical Service Department (609) 423-6300. The following EM SCIENCE Spill-X absorbent is recommended for this product:

SX0863 Solvent Spill Treatment Kit

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed and protected against physical damage. Store in a cool area away from ignition sources and oxidizers. Do not breathe vapor. Do not get in eyes, on skin, or on clothing. Electrically ground all equipment when handling this product. Retained residue may make empty containers hazardous; use caution!

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves must be worn to prevent skin contact (PVA or equivalent). Safety glasses with side shields must be worn at all times. Impervious protective clothing should be worn to prevent skin contact.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
4-Methyl-2-pentanone							
	50	205	75	300			

ACGIH - TLV:

	TWA		STEL		CL		

Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
4-Methyl-2-pentanone							
	50	205	75	307			

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 118C
Melting Point (C) : -80C
Specific Gravity (H_20 = 1) : 0.80
Vapor Pressure (mm Hg) : 16 20C
Percent Volatile by vol (%): 100%
Vapor Density (Air = 1) : 3.5
Evaporation Rate (BuAc = 1): 1.64
Solubility in Water (%) : Slight
Appearance :
Colorless to pale yellow liquid; sharp, mint-like odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
CO_x

Conditions to Avoid:
Heat, spark, open flame

Materials To Avoid:

```
( ) Water
(X) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Halogens; alkaline materials; reducing
agents;  potassium t-butoxide
```

|11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-pig LD50: 1600 mg/kg
ihl-mus LC50: 23300 mg/cu.m.
```

ipr-mus LD50: 268 mg/kg

Toxicological Findings:
Tests on laboratory animals indicate material may produce adverse reproductive effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: U161 D001

Treatment:
Specified Technology - Incineration to a level below TCA (Total Constituent Analyses) levels. Contact your local permitted waste disposal company (TSD) for permissible treatment site.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

|13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Methyl Isobutyl Ketone

DOT ID Number :
UN1245

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
4-Methyl-2-pentanone			5000

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
4-Methyl-2-pentanone	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

```
Health          : 2
Flammability    : 3
Reactivity      : 0
Special Hazards :
```

Revision History: 11/1/81 2/1/84 10/27/87 9/29/89 2/23/90 3/1/91

| = Revised Section

N/A = Not Available

N/E = None Establised

The statements contained herein are offered for informational purposes only and are based upon technical data that EM Science believes to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make NO WARRANTY, EXPRESS OR IMPLIED, OR MERCHANTABILITY, FITNESS OR OTHERWISE.

AlliedSignal

Burdick & Jackson

Material Safety Data Sheet

Toluene

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Toluene

OTHER/GENERIC NAMES: Toluol, Methylbenzene

PRODUCT USE: Solvent

MANUFACTURER: Burdick & Jackson, Inc.
A Subsidiary of AlliedSignal Inc.
1953 S. Harvey Street
Muskegon, MI 49442

FOR MORE INFORMATION CALL:
(Monday-Friday, 9:00am-4:30pm)
Product Safety Department
800-368-0050
231-726-3171

IN CASE OF EMERGENCY CALL:
(24 Hours/Day, 7 Days/Week)
973-455-2000 (AlliedSignal, Morristown, NJ)
1 800 424-9300 (Chemtrec)

2. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT NAME	CAS NUMBER	WEIGHT %
Toluene	108-88-3	100

Trace impurities and additional material names not listed above may also appear in Section 15 towards the end of the MSDS. These materials may be listed for local "Right-To-Know" compliance and for other reasons.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: A clear, colorless liquid, with a sweet, pungent odor. Causes irritation to the eyes, skin and respiratory tract. Central nervous system depressant. Severe exposure may cause respiratory depression, unconsciousness, convulsions and death. Flammable.

POTENTIAL HEALTH HAZARDS

SKIN: Prolonged or repeated skin contact can cause irritation and dermatitis through defatting of the skin.

EYES: Liquid and high vapor concentration will cause irritation and possible corneal damage.

INHALATION: Causes headache, anesthesia, nausea, dizziness, loss of coordination and respiratory tract irritation.

INGESTION: Causes irritation of the gastrointestinal tract and may cause systemic effects from absorption.

DELAYED EFFECTS: Acute and chronic poisoning may affect the nervous system. Liver enlargement is possible. Prolonged exposures to high concentrations can cause liver, kidney and brain damage. Exposure during pregnancy may affect the growth and development of the fetus.

Ingredients found on one of the OSHA designated carcinogen lists are listed below.

INGREDIENT NAME	NTP STATUS	IARC STATUS	OSHA LIST
No ingredients listed in this section.			

4. FIRST AID MEASURES

SKIN: Wash with soap and water and flush with water. Remove contaminated clothing and wash before reuse. Get medical attention.

EYES: Immediately flush eyes with plenty of water for a least 15 minutes. Get medical attention.

INHALATION: Remove from exposure area to fresh air. If victim is not breathing administer artificial respiration according to your level of training and obtain professional medical assistance immediately.

INGESTION: Do not induce vomiting. Contact physician immediately.

ADVICE TO PHYSICIAN: Treat symptomatically.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT:	4°C
FLASH POINT METHOD:	Closed Cup
AUTOIGNITION TEMPERATURE:	480°C
UPPER FLAME LIMIT (volume % in air):	7.1
LOWER FLAME LIMIT (volume % in air):	1.1
FLAME PROPAGATION RATE (solids):	Not applicable
OSHA FLAMMABILITY CLASS:	1B

EXTINGUISHING MEDIA:
Carbon dioxide, dry chemical and foam.

UNUSUAL FIRE AND EXPLOSION HAZARDS:
Vapor may travel a considerable distance to a source of ignition and flash back. Explosion may result if vapors are ignited in a confined area. Volatile and flammable.

SPECIAL FIRE FIGHTING PRECAUTIONS/INSTRUCTIONS:
Water will not be effective in extinguishing a fire. Use water spray to cool fire-exposed containers and to reduce rate of burning, taking care not to spread the fire. Heat will build pressure and rupture closed storage containers. Wear NIOSH approved self-contained breathing apparatus, and full protective clothing.

6. ACCIDENTAL RELEASE MEASURES

IN CASE OF SPILL OR OTHER RELEASE: (Always wear recommended personal protective equipment.)
Eliminate sources of ignition. Isolate the spill area. Stop leak in a safe and practical manner. (If leak cannot be stopped easily and safely, advise trained emergency response personnel of the situation.) Using inert material (such as ground corncobs) dike the spilled solvent to prevent it from running into drains or waterways.

Spills and releases may have to be reported to Federal and/or local authorities. See Section 15 regarding reporting requirements.

7. HANDLING AND STORAGE

NORMAL HANDLING: (Always wear recommended personal protective equipment.)
Ground containers for transfer of contents. Keep away from sparks, open flames and ignition sources. Do not get in eyes, on skin or clothing. Use with adequate ventilation. No smoking in areas of use.

STORAGE RECOMMENDATIONS:
Store in an area designed for storage of flammable liquids. (OSHA 29 CFR 1910.106)
Store in a cool, well-ventilated area away from oxidizers and ignition sources. Protect against physical damage. Outside or detached storage is preferable. Inside storage should be in a standard flammable liquids storage room or cabinet. No smoking in storage areas. Once liquid solvent has been completely dispensed, containers which appear "empty" should be handled in the same manner as when they were "full" of liquid solvent.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

ENGINEERING CONTROLS:
Provide general or local exhaust ventilation systems to maintain airborne concentrations below exposure levels. Regularly inspect all electrical and mechanical equipment used with or near toluene. Ground and bond metal containers to minimize static sparks.

PERSONAL PROTECTIVE EQUIPMENT

SKIN PROTECTION: Protective gloves and clothing are recommended. Viton or nitrile rubber offers acceptable chemical resistance. Clothing should be static free.

EYE PROTECTION: Wear safety glasses with non-perforated sideshields for normal handling. Goggles or a full face shield may be necessary depending on quantity of material and conditions of use.

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

ADDITIONAL RECOMMENDATIONS: Emergency eyewash fountains and safety showers should be available in the vicinity of any potential exposure.

EXPOSURE GUIDELINES

INGREDIENT NAME	ACGIH TLV	OSHA PEL	OTHER LIMIT
Toluene	50 ppm TWA	100 ppm TWA 150 ppm STEL	None

* = Limit established by AlliedSignal.
** = Workplace Environmental Exposure Level (AIHA).
*** = Biological Exposure Index (ACGIH).

OTHER EXPOSURE LIMITS FOR POTENTIAL DECOMPOSITION PRODUCTS:
None

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Clear, Colorless
PHYSICAL STATE:	Liquid
MOLECULAR WEIGHT:	92.14
CHEMICAL FORMULA:	C_7H_8
ODOR:	Sweet, pungent
SPECIFIC GRAVITY (water = 1.0):	0.867 @ 20°C
SOLUBILITY IN WATER (weight %):	0.074% @ 20°C
pH:	Not applicable
BOILING POINT:	110.6°C, 760 mm Hg
MELTING POINT:	-95°C
VAPOR PRESSURE:	28.5 @ 20°C
VAPOR DENSITY (air = 1.0):	3.1
EVAPORATION RATE:	4.5 COMPARED TO: Ether = 1
% VOLATILES:	~100
FLASH POINT:	4°C

(Flash point method and additional flammability data are found in Section 5.)

10. STABILITY AND REACTIVITY

NORMALLY STABLE? (CONDITIONS TO AVOID):
May be ignited by heat, sparks or flame.

INCOMPATIBILITIES:
Strong oxidizing agents and strong acids.

HAZARDOUS DECOMPOSITION PRODUCTS:
Incomplete combustion can generate carbon monoxide and other toxic vapors.

HAZARDOUS POLYMERIZATION:
Not expected to occur.

11. TOXICOLOGICAL INFORMATION

IMMEDIATE (ACUTE) EFFECTS:
Oral LD_{50} (rat): 5500 mg/kg
Inhalation LC_{50} (rat): 8800 ppm/4h

DELAYED (SUBCHRONIC AND CHRONIC) EFFECTS:
Inhalation (rats) of 2500 ppm/6.5h/day for 15 weeks, produced changes in heart, liver, kidney, ureter and bladder.

OTHER DATA:
Mutagenicity:
- Non mutagenic in Ames salmonella/microsome assay
- Non mutagenic in CHO chromosome aberration assay

12. ECOLOGICAL INFORMATION

LC_{50} (Fathead minnow): 36.2 mg/L (96h)
LC_{50} (Bluegill): 13 mg/L (96 h)
LC_{50} (Daphnia magna): 313 mg/L (48h)

13. DISPOSAL CONSIDERATIONS

RCRA

Is the unused product a RCRA hazardous waste if discarded? Yes
If yes, the RCRA ID number is: U220, D001

OTHER DISPOSAL CONSIDERATIONS:
Dispose of material in accordance with all applicable local, state and federal regulations.

The information offered here is for the product as shipped. Use and/or alterations to the product such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

14. TRANSPORT INFORMATION

US DOT PROPER SHIPPING NAME:	Toluene
US DOT HAZARD CLASS:	3, Flammable Liquid
US DOT ID NUMBER:	UN 1294
US DOT PACKING GROUP:	II
NA EMERGENCY RESPONSE GUIDE:	130

For additional information on shipping regulations affecting this material, contact the information number found in Section 1.

15. REGULATORY INFORMATION

TOXIC SUBSTANCES CONTROL ACT (TSCA)

TSCA INVENTORY STATUS: Listed on the TSCA Inventory.

OTHER TSCA ISSUES: None

SARA TITLE III/CERCLA

"Reportable Quantities" (RQs) and/or "Threshold Planning Quantities" (TPQs) exist for the following ingredients.

INGREDIENT NAME	SARA/CERCLA RQ (lb)	SARA EHS TPQ (lb)
Toluene	1,000	None

Spills or releases resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center [(800) 424-8802] and to your Local Emergency Planning Committee.

SECTION 311 HAZARD CLASS: Immediate. Delayed. Fire.

SARA 313 TOXIC CHEMICALS:
The following ingredients are SARA 313 "Toxic Chemicals". CAS numbers and weight percents are found in Section 2.

INGREDIENT NAME	COMMENT
Toluene	None

STATE RIGHT-TO-KNOW

In addition to the ingredients found in Section 2, the following are listed for state right-to-know purposes.

INGREDIENT NAME	WEIGHT %	COMMENT
No ingredients listed in this section		

ADDITIONAL REGULATORY INFORMATION:
Toluene is subject to the Chemical Diversion & Trafficking Act of 1988 and subject to certain recordkeeping and reporting requirements. (21 CFR 1310 and 1313).
Toluene is listed on one of the California Proposition 65 lists; therefore, the following statement has been placed on the product label: "Warning: This product contains a chemical known to the State of California to cause cancer."

WHMIS CLASSIFICATION (CANADA):
Not determined.

FOREIGN INVENTORY STATUS:
Canadian DSL (Domestic Substances List).
EINECS (European Inventory of Existing Commercial Chemical Substances).

16. OTHER INFORMATION

CURRENT ISSUE DATE: November, 1997
PREVIOUS ISSUE DATE: December, 1996

NFPA Classification	
Health:	2
Flammability:	3
Reactivity:	0

CHANGES TO MSDS FROM PREVIOUS ISSUE DATE ARE DUE TO THE FOLLOWING:
New format

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 1/18/93

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

801791 CX0855 CX0855P

Product Name:
Chlorobenzene
Synonyms:
Benzene Chloride; Phenyl Chloride
Chemical Family:
Chlorinated Hydrocarbon
Formula:
C_6H_5Cl
Molecular Weight.:
112.56

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Chlorobenzene	108-90-7	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
FLAMMABLE LIQUID AND VAPOR.
HARMFUL IF INHALED OR SWALLOWED.
Suspected Animal Cancer Hazard.
May Cause Damage To Kidneys and Liver.

Appearance:

Colorless liquid; mothball-like odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Inhalation causes headache, dizziness, nausea, irritation of eyes and respiratory passages, narcosis. Prolonged or repeated overexposure can cause liver and kidney injury. Ingestion of large quantities can cause Central Nervous System (CNS) disturbances and other effects noted above. May cause irritation of eyes and skin on contact.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
Suspected animal cancer hazard.
NTP Carcinogenesis Studies (Gavage); Some Evidence: Rat

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: Do not induce vomiting; if conscious, give water freely and get medical attention.

5. FIRE FIGHTING MEASURES

Flash Point (F): 82F (tcc)
Flammable Limits LEL (%): 1.30
Flammable Limits UEL (%): 7.10
Extinguishing Media:
CO_2, dry chemical, foam

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Vapor can travel distances to ignition source and flash back.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal

Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.
EM SCIENCE recommends Spill-X absorbent agents for various types of spills. Additional information on the Spill-X products can be provided through the EM SCIENCE Technical Service Department (609) 423-6300. The following EM SCIENCE Spill-X absorbent is recommended for this product:

SX0863 Solvent Spill Treatment Kit

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store in a cool area away from ignition sources and oxidizers. Do not breathe vapor. Do not get in eyes, on skin, or on clothing. Electrically ground all equipment when handling this product. Retained residue may make empty containers hazardous; use caution!

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves must be worn to prevent skin contact (Viton or equivalent) Safety glasses with side shields must be worn at all times. Impervious protective clothing should be worn to prevent skin contact.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Chlorobenzene	75	350					

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Chlorobenzene	10	46					

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 132C
Melting Point (C) : -45C
Specific Gravity (H_20 = 1) : 1.107
Vapor Pressure (mm Hg) : 11.8 25C
Percent Volatile by vol (%): 99+%
Vapor Density (Air = 1) : 3.88
Evaporation Rate (BuAc = 1): <1
Solubility in Water (%) : 0.1%
Appearance :
Colorless liquid; mothball-like odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
HCl, Phosgene, CO_x

Conditions to Avoid:
Heat; contact with ignition source

Materials To Avoid:

```
( ) Water
( ) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Dimethyl Sulfoxide
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-rat LD50: 2290 mg/kg
ihl-mus LCLo: 15 gm/cu.m.
```

Toxicological Findings:
Test on laboratory animals indicate material may produce adverse mutagenic and reproductive effects.

Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: D021 U037 D001

Treatment:
Specified Technology - Incineration or fuels blending to less than the TCLP standard. Contact your local permitted waste disposal site (TSD) for permissible treatment sites.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Chlorobenzene

DOT ID Number :
UN1134

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Chlorobenzene			100

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Chlorobenzene	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 2
Flammability : 3
Reactivity : 0
Special Hazards :

Revision History: 11/1/81 1/31/87 10/27/87 2/13/89 3/1/91 10/18/91

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 1/4/94

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

EX0355

Product Name:
Ethylbenzene
Synonyms:
Phenylethane
Chemical Family:
Aromatic
Formula:
$C_2H_5C_6H_5$
Molecular Weight.:
106.17

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Ethylbenzene	100-41-4	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
FLAMMABLE LIQUID AND VAPOR.
VAPOR HARMFUL.
IRRITATING TO SKIN, EYES AND MUCOUS MEMBRANES.
May Cause Damage To Lungs, Thorax, Sense Organs, and Central Nervous System.

Appearance:

Boiling Point (C 760 mmHg) : 136C
Melting Point (C) : -95C
Specific Gravity (H_20 = 1) : 0.867
Vapor Pressure (mm Hg) : 10 20C
Percent Volatile by vol (%): 100%
Vapor Density (Air = 1) : 3.7
Evaporation Rate (BuAc = 1): 1
Solubility in Water (%) : Insoluble
Appearance :
Clear liquid; aromatic odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
CO_x

Conditions to Avoid:
Heat; contact with ignition sources

Materials To Avoid:

```
( ) Water
(X) Acids
(X) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: NH3
```

|11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-rat LD50: 3500 mg/kg
ihl-hmn TCLo:  100 ppm/8H
skn-rbt LD50: 17800 mg/kg
```

Toxicological Findings:
Test on laboratory animals indicate material may produce adverse mutagenic and reproductive effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: D001

Treatment:
Incineration, fuels blending or recycle. Contact your local permitted waste disposal site (TSD) for permissible treatment sites. ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

|13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Ethylbenzene

DOT ID Number :
UN1175

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Ethylbenzene			1000

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Ethylbenzene	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:

NFPA Hazard Ratings:

Health : 2
Flammability : 3
Reactivity : 0
Special Hazards :

Revision History: 11/1/81 6/5/87 10/27/87 1/27/89
3/1/91

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 3/5/99

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

0086808D 64754 XX0055 XX0055E XX0055P XX0055S XX0057
XX0060 XX0061

Product Name:
Xylene
Synonyms:
Xylol, Dimethylbenzene
Chemical Family:
Aromatic Hydrocarbon
Formula:
$C_6H_4(CH_3)_2$
Molecular Weight.:
106.17

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
m-Xylene	108-38-3	42%
o-Xylene	95-47-6	19%
p-Xylene	106-42-3	18%
Ethylbenzene	100-41-4	21%

Xylene has been assigned CAS# 1330-20-7.

Approx. % as wt/vol

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
HARMFUL OR FATAL IF SWALLOWED.
FLAMMABLE LIQUID AND VAPOR.
VAPOR HARMFUL.
May Cause Damage To Lungs, Thorax, Or Sense Organs.
IRRITATING TO SKIN, EYES AND MUCOUS MEMBRANES.

Appearance:
Colorless liquid; aromatic odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Harmful or fatal if swallowed. Vapor harmful. Causes tearing, blurred vision, dizziness, fatigue, loss of appetite, nausea, irritation of mucous membranes. Narcotic at high concentrations. Irritating to skin on prolonged contact causing flaky dermatitis and defatting. Liquid and vapor irritating to eyes.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: Call a physician immediately. ONLY induce vomiting at the instructions of a physician. Never give anything by mouth to an unconscious person.
Remove contaminated clothing and wash before reuse.

5. FIRE FIGHTING MEASURES

Flash Point (F): 85F (cc)
Flammable Limits LEL (%): 1.00
Flammable Limits UEL (%): 7.00
Extinguishing Media:
Use "alcohol" foam, carbon dioxide, dry chemical.
Water spray to cool fire-exposed containers.

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Vapor can travel distances to ignition source and flash back.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.
EM SCIENCE recommends Spill-X absorbent agents for various types of spills. Additional information on the Spill-X products can be provided through the EM SCIENCE Technical Service Department (609) 423-6300. The following EM SCIENCE Spill-X absorbent is recommended for this product:

SX0863 Solvent Spill Treatment Kit

7. HANDLING AND STORAGE

Handling & Storage:
Keep container tightly closed. Store in a cool, dry, well-ventilated area away from ignition sources. Do not breathe vapor. Do not get in eyes, on skin, or on clothing. Never use welding or cutting torch on or near drum (even empty) because product (or residue) may ignite explosively. Electrically ground all equipment when handling this product. Retained residue may make empty containers hazardous; use caution!

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves must be worn to prevent skin contact (Viton, PVA or equivalent) Safety glasses with side shields must be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin

m-Xylene				
	100	435	150	655
o-Xylene				
	100	435	150	655
p-Xylene				
	100	435	150	655
Ethylbenzene				
	100	435	125	545

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
m-Xylene							
	100	434	150	651			
o-Xylene							
	100	434	150	651			
p-Xylene							
	100	434	150	651			
Ethylbenzene							
	100	434	125	543			

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 138C
Melting Point (C) : N/A
Specific Gravity (H_20 = 1) : 0.872
Vapor Pressure (mm Hg) : 5.1 20C
Percent Volatile by vol (%): 99+%
Vapor Density (Air = 1) : 3.6
Evaporation Rate (BuAc = 1): 0.61
Solubility in Water (%) : 0.02%
Appearance :
Colorless liquid; aromatic odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
CO_x and various hydrocarbons

Conditions to Avoid:
Heat; contact with ignition sources.

Materials To Avoid:

```
( ) Water
( ) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
( ) Other:
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

orl-rat LD50: 4300 mg/kg ihl-hmn TCLo: 200 ppm

Toxicological Findings:
Tests on laboratory animals indicate material may produce adverse mutagenic effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: D001 U239

Treatment:
Incineration, fuels blending or recycle. Contact your local permitted waste disposal site (TSD) for permissible treatment sites. ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Xylenes

DOT ID Number :
UN1307

14. REGULATORY INFORMATION

TSCA Statement:
This product is a "Mixture". The CAS numbers of all components are listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)

m-Xylene	1000
o-Xylene	1000
p-Xylene	100
Ethylbenzene	1000

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
m-Xylene	Y	Y	1.0
o-Xylene	Y	Y	1.0
p-Xylene	Y	Y	1.0
Ethylbenzene	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 2
Flammability : 3
Reactivity : 0
Special Hazards :

Revision History: 3/1/78 3/7/86 12/8/86 6/9/87 10/27/87 8/25/88 3/1/91 7/15/91 9/8/95 10/10/95 6/6/97 8/30/97

| = Revised Section

N/A = Not Available

N/E = None Establised

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ACROS ORGANICS
HELP CATALOGS SEARCH ORDER LIST CONTENTS

MATERIAL SAFETY DATA SHEET

1,4-Dichlorobenzene, 97%
01149

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: 1,4-Dichlorobenzene, 97%

```
     p-DCB, 1,4-Dichlorobenzene, Dichlorocide, Paracide,
     Paradichlorobenzol, p-Chlorophenyl chloride.
Company Identification:  Acros Organics N.V.
                         One Reagent Lane
                         Fairlawn, NJ  07410
For information in North America, call:   800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300
```

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
106-46-7	P-DICHLOROBENZENE	>99%	203-400-5

Hazard Symbols: XN
Risk Phrases: 22 36/38

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: Not available. Flash Point: 67 deg C.
Warning! Cancer suspect agent. May cause eye and skin irritation. May cause respiratory and digestive tract irritation. May cause liver and kidney damage. May cause cancer in humans. May cause blood abnormalities.
Target Organs: Blood, kidneys, liver.

Potential Health Effects

Eye:
Exposure to solid may cause pain and redness. Exposure to high vapor concentrations may cause irritation.

Skin:
May cause skin irritation.

Ingestion:
May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May cause liver and kidney damage.

Inhalation:
May cause respiratory tract irritation. May cause liver and kidney

damage.

Chronic:

Overexposure may cause delayed kidney injury. Possible cancer hazard based on tests with laboratory animals. Chronic ingestion may cause liver damage. May cause anemia and other blood cell abnormalities.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid immediately.

Skin:

Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists.

Ingestion:

If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.

Inhalation:

Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid if cough or other symptoms appear.

Notes to Physician:

Treat symptomatically and supportively.

Antidote:

No specific antidote exists.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. Use water spray to keep fire-exposed containers cool.

Extinguishing Media:

In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.

Autoignition Temperature: 640 deg C (1,184.00 deg F)
Flash Point: 67 deg C (152.60 deg F)
NFPA Rating: health-2; flammability-2; reactivity-0
Explosion Limits, Lower: 2.20 vol %
Upper: 12.00 vol %

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Wear a self contained breathing apparatus and appropriate Personal protection. (See Exposure Controls, Personal Protection section). Remove all sources of ignition. Carefully scoop up and place into appropriate disposal container.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:

Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Do not get on skin or in eyes. Do not ingest or inhale. Do not pressurize, cut, weld, braze,

solder, drill, grind, or expose empty containers to heat, sparks or open flames.

Storage:
Keep away from sources of ignition. Store in a cool, dry, well-ventilated area away from incompatible substances.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
P-DICHLOROBENZENE	10 ppm ; 60 mg/m3	NIOSH Potential Occupational Carcinogen - see Appendix A Potential NIOSH carcinogen.	75 ppm TWA; 450 mg/m3 TWA

OSHA Vacated PELs:
P-DICHLOROBENZENE:
75 ppm TWA; 450 mg/m3 TWA

Personal Protective Equipment

Eyes:
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:
Wear impervious gloves.

Clothing:
Wear appropriate protective clothing to prevent skin exposure.

Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Solid
Appearance:	Not available.
Odor:	Distinctive mothball-like.
pH:	Not available.
Vapor Pressure:	1.18 mm Hg @25C
Vapor Density:	5.07 (air=1)
Evaporation Rate:	Negligible.
Viscosity:	Not available.
Boiling Point:	174 deg C @ 760.00mm Hg
Freezing/Melting Point:	53.0 - 56.0 deg C
Decomposition Temperature:	Not available.
Solubility:	insoluble
Specific Gravity/Density:	1.2410g/cm3
Molecular Formula:	C6H4Cl2
Molecular Weight:	147.00

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable at room temperature in closed containers under normal storage and handling conditions.
Conditions to Avoid:
High temperatures, incompatible materials, ignition sources.
Incompatibilities with Other Materials:
Aluminum, oxidizing agents.
Hazardous Decomposition Products:
Hydrogen chloride, chlorine, carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 106-46-7: CZ4550000
LD50/LC50:
CAS# 106-46-7: Oral, mouse: LD50 = 2950 mg/kg; Oral, rabbit: LD50 = 2830 mg/kg; Oral, rat: LD50 = 500 mg/kg; Skin, rabbit: LD50 = >2 gm/kg; Skin, rat: LD50 = >6 gm/kg.
Carcinogenicity:
P-DICHLOROBENZENE -
ACGIH: A3-animal carcinogen
California: carcinogen - initial date 1/1/89
NIOSH: occupational carcinogen
NTP: Suspect carcinogen
OSHA: Possible Select carcinogen
IARC: Group 2B carcinogen
Epidemiology:
No information available.
Teratogenicity:
No information available.
Reproductive Effects:
No information available.
Neurotoxicity:
No information available.
Mutagenicity:
No information available.
Other Studies:
None.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
Fish (fresh water) 50ppm lethal (no time interval specified) Rainbow trout (fresh water) TLm= 880mg/48H
Environmental Fate:
Substance can be adsorbed in soil, and leaching is possible.
Substance is volatile from water, but has potential for sediment adsorption.
Physical/Chemical:
Substance (in soil and water) has low probability for chemical transformation by hydrolysis, oxidation, or direct photolysis.
Other:
Please refer to the Handbook of Environmental Fate and Exposure Data (Vol I) for additional information.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants:

CAS# 106-46-7: waste number D027; regulatory level = 7.5 mg/L.
RCRA D-Series Chronic Toxicity Reference Levels: CAS# 106-46-7: chronic toxicity reference level = 0.075 mg/L.
RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 106-46-7: waste number U072.
CAS# 106-46-7 is banned from land disposal according to RCRA.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
Shipping Name: TOXIC SOLID, ORGANIC, N.O.S. (1,4-DICHLOROBENZENE)
Hazard Class: 6.1
UN Number: UN2811
Packing Group: III

IMO
No information available.

IATA
Not regulated as a hazardous material.

RID/ADR
Not regulated as a hazardous material.

Canadian TDG
No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA
CAS# 106-46-7 is listed on the TSCA inventory.

Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules
CAS# 106-46-7: Testing required by manufacturers; processors (40 CFR 7

Section 12b
None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.

SARA

Section 302 (RQ)
CAS# 106-46-7: final RQ = 100 pounds (45.4 kg)

Section 302 (TPQ)
None of the chemicals in this product have a TPQ.

SARA Codes
CAS # 106-46-7: acute, chronic, flammable.

Section 313
This material contains P-DICHLOROBENZENE (CAS# 106-46-7, 99%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:
CAS# 106-46-7 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:
CAS# 106-46-7 is listed as a Hazardous Substance under the CWA.
CAS# 106-46-7 is listed as a Priority Pollutant under the Clean Water Act.
CAS# 106-46-7 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

P-DICHLOROBENZENE can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains P-DICHLOROBENZENE, a chemical known to the state of California to cause cancer.

California No Significant Risk Level:

CAS# 106-46-7: no significant risk level = 20 ug/day

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN

Risk Phrases:

R 22 Harmful if swallowed.

R 36/38 Irritating to eyes and skin.

Safety Phrases:

S 2 Keep out of reach of children.

S 22 Do not inhale dust.

S 24/25 Avoid contact with skin and eyes.

S 46 If swallowed, seek medical advice immediately and show this container or label.

WGK (Water Danger/Protection)

CAS# 106-46-7: 2

Canada

CAS# 106-46-7 is listed on Canada's DSL/NDSL List.

WHMIS: Not available.

CAS# 106-46-7 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 106-46-7:. OEL-AUSTRALIA:TWA 75 ppm (450 mg/m3);STEL 110 ppm (675 mg/m3). OEL-BELGIUM:TWA 75 ppm (451 mg/m3);STEL 110 ppm (661 mg/m3)

);STEL 115 ppm (690 mg/m3);Skin. OEL-FRANCE:TWA 75 ppm (450 mg/m3);STEL 110 ppm (675 mg/m3). OEL-GERMANY:TWA 75 ppm (450 mg/m3). OEL-JAPAN:TWA 50 ppm (300 mg/m3). OEL-THE NETHERLANDS:TWA 75 ppm (450 mg/m3). OEL-THE PHILIPPINES:TWA 75 ppm (450 mg/m3). OEL-POLAND:TWA 20 mg/m3. OEL-RUSSIA:TWA 50 ppm. OEL-SWEDEN:TWA 75 ppm (450 mg/m3);STEL 110 ppm (700 mg/m3). OEL-SWITZERLAND:TWA 75 ppm (450 mg/m3);STEL 150 ppm (900 mg/m3). OEL-TURKEY:TWA 75 ppm (450 mg/m3). OEL-UNITED KINGDOM:TWA 75 ppm (450 mg/m3);STEL 11 ppm. OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV. OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 2/07/1996 Revision #1 Date: 9/17/1997

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Back to product information.

ACROS ORGANICS
HELP CATALOGS SEARCH ORDER LIST CONTENTS

MATERIAL SAFETY DATA SHEET

Dioctyl Phthalate, 98%
95099

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Dioctyl Phthalate, 98%

Synonyms:
Bis(2-ethylhexyl) Phthalate, Di-2-Ethylhexyl Phthalate, DOP
Company Identification: Acros Organics N.V.
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
117-81-7	Dioctyl Phthalate	98	204-211-0

Hazard Symbols: XN
Risk Phrases: 40

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: colourless.
Warning! May cause eye and skin irritation. May cause respiratory and digestive tract irritation. May cause cancer based on animal studies.
Target Organs: None.

Potential Health Effects

Eye:
Causes eye irritation.

Skin:
May cause skin irritation.

Ingestion:
May cause gastrointestinal irritation with nausea, vomiting and diarrhea.

Inhalation:
May cause respiratory tract irritation.

Chronic:
Not available.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid immediately.

Skin:
Get medical aid immediately. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion:
If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation:
Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:
Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media:
Use agent most appropriate to extinguish fire. In case of fire use water spray, dry chemical, carbon dioxide, or appropriate foam.

Autoignition Temperature: 390 deg C (734.00 deg F)
Flash Point: 199 deg C (390.20 deg F)
(estimated) Health: ; Flammability: ; Reactivity:
Explosion Limits, Lower: .10 vol %
Upper: .00 vol %

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:
Absorb spill with inert material, (e.g., dry sand or earth), then place into a chemical waste container. Clean up spills immediately, observing precautions in the Protective Equipment section. Provide ventilation.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well ventilated area. Avoid contact with eyes, skin, and clothing. Avoid ingestion and inhalation.

Storage:
Keep container closed when not in use. Store in a cool, dry, well-ventilated area away from incompatible substances.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Dioctyl Phthalate	5 mg/m3; 10 mg/m3 STEL	5 mg/m3 TWA; NIOSH Potential Occupational Carcinogen - see Appendix A Potential NIOSH carcinogen.	5 mg/m3 TWA

OSHA Vacated PELs:
Dioctyl Phthalate:
5 mg/m3 TWA

Personal Protective Equipment

Eyes:
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:
Wear appropriate protective gloves to prevent skin exposure.

Clothing:
Wear appropriate protective clothing to prevent skin exposure.

Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Liquid
Appearance:	colourless
Odor:	slight odor
pH:	Not available.
Vapor Pressure:	0.01 mbar @ 200
Vapor Density:	16
Evaporation Rate:	Not available.
Viscosity:	80 cPs 20 deg C
Boiling Point:	384 deg C @ 760.00mm Hg
Freezing/Melting Point:	-50 deg C
Decomposition Temperature:	Not available.
Solubility:	IN WATER: 0.1 G/L (20°C)
Specific Gravity/Density:	.9810g/cm3
Molecular Formula:	C24H38O4
Molecular Weight:	390.55

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Incompatible materials, strong oxidants.
Incompatibilities with Other Materials:
Strong oxidizing agents.

Hazardous Decomposition Products:
Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 117-81-7: TI0350000
LD50/LC50:
CAS# 117-81-7: Oral, mouse: LD50 = 30 gm/kg; Oral, rabbit: LD50 = 34 gm/kg; Oral, rat: LD50 = 30600 mg/kg; Skin, rabbit: LD50 = 25 gm/kg.
Carcinogenicity:
Dioctyl Phthalate -
ACGIH: A3 - Animal Carcinogen
California: carcinogen - initial date 1/1/88
NIOSH: occupational carcinogen
NTP: Suspect carcinogen
OSHA: Possible Select carcinogen
IARC: Group 2B carcinogen
Epidemiology:
No data available.
Teratogenicity:
No data available.
Reproductive Effects:
No data available.
Neurotoxicity:
No data available.
Mutagenicity:
No data available.
Other Studies:
Studies involving groups of 10 male and female mice were fe d high does of chemical (0 -25,000ppm) for 7 days for at least four weeks. Observations in the liver included:cyto plasmic enlargement, moderate focal coagulative necrosis (in both male and females at the highest dose). Kidney's show ed acute inflamation with lesions characterized by necrosi s, dilation and regeneration. Moderate to severe thymic atrophywas observed in some male and females, a slight decre ase in or absence of cells involved in spermatogenesis was o bserved in some male given 25,000 ppm.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
Not available.
Environmental Fate:
Not available.
Physical/Chemical:
Not available.
Other:
Not available.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants:
None listed.
RCRA D-Series Chronic Toxicity Reference Levels: None listed.
RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 117-81-7: waste number U028.

CAS# 117-81-7 is banned from land disposal according to RCRA.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
No information available
IMO
Not regulated as a hazardous material.
IATA
Not regulated as a hazardous material.
RID/ADR
Not regulated as a hazardous material.
Canadian TDG
No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL
TSCA
CAS# 117-81-7 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
CAS# 117-81-7: export notification required - Section 4
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA
Section 302 (RQ)
CAS# 117-81-7: final RQ = 100 pounds (45.4 kg)
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 117-81-7: acute, chronic.
Section 313
This material contains Dioctyl Phthalate (CAS# 117-81-7, 98%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
CAS# 117-81-7 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 117-81-7 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
Dioctyl Phthalate can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.
The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:
WARNING: This product contains Dioctyl Phthalate, a chemical known to the state of California to cause cancer.
California No Significant Risk Level:

CAS# 117-81-7: no significant risk level = 80 ug/day

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN

Risk Phrases:

R 40 Possible risks of irreversible effects.

Safety Phrases:

S 45 In case of accident of if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)

CAS# 117-81-7: 1

Canada

CAS# 117-81-7 is listed on Canada's DSL/NDSL List.
This product has a WHMIS classification of D2A.
CAS# 117-81-7 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 117-81-7:. OEL-AUSTRALIA:TWA 10 mg/m3. OEL-AUSTRALIA:TWA 5 mg/m3 ;STEL 10 mg/m3. OEL-BELGIUM:TWA 5 mg/m3;STEL 10 mg/m3. OEL-CZECHOSLOVAKIA:TWA 5 mg/m3;STEL 10 mg/m3 JAN9. OEL-DENMARK:TWA 5 mg/m3. OEL-DENMARK:TWA 5 mg/m3;Carcinogen. OEL-FINLAND:TWA 5 mg/m3;STEL 10 mg/m3;Skin

g/m3;STEL 10 mg/m3;Skin. OEL-THE NETHERLANDS:TWA 5 mg/m3. OEL-THE PHILIPPINES:TWA 5 mg/m3. OEL-RUSSIA:STEL 1 mg/m3. OEL-SWEDEN WA 3 mg/m3;STEL 5 mg/m3. OEL-SWITZERLAND:TWA 5 mg/m3. OEL-UNITED KINGDOM:TWA 5 mg/m3;STEL 10 mg/m3 JAN9. OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV. OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 8/01/1991 Revision #3 Date: 8/03/1998

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Back to product information.

Material Safety Data Sheet

acc. to OSHA and ANSI

Printing date 06/23/1999 Reviewed on 04/15/1999

1 Identification of substance:

- **Product details:**
- **Trade name:** Di-n-butyl phthalate
- **Stock number:** 31244
- **Manufacturer/Supplier:**
  Alfa Aesar, A Johnson Matthey Company Johnson Matthey Catalog Company, Inc. 30 Bond Street Ward Hill, MA 01835-8099 Emergency Phone: (978) 521-6300 CHEMTREC: (800) 424-9300 Web Site: www.alfa.com
- **Information department:** Health, Safety and Environmental Department
- **Emergency information:**
  During normal hours the Health, Safety and Environmental Department. After normal hours call Chemtrec at (800) 424-9300.

2 Composition/Data on components:

- **Chemical characterization:**

Description: (CAS#)
Di-n-butyl phthalate (CAS# 84-74-2), 100%

- **Identification number(s):**
- **EINECS Number:** 2015574

3 Hazards identification

- **Hazard description:** Xn Harmful
- **Information pertaining to particular dangers for man and environment**

R 62	Possible risk of impaired fertility
R 63	Possible risk of harm to the unborn child
R 36/37/38	Irritating to eyes, respiratory system and skin.

4 First aid measures

- **After inhalation**
  Supply fresh air. If required, provide artificial respiration. Keep patient warm.
  Seek immediate medical advice.
- **After skin contact**
  Immediately wash with water and soap and rinse thoroughly.
  Seek immediate medical advice.
- **After eye contact**

Rinse opened eye for several minutes under running water. Then consult a doctor.

- **After swallowing** Seek immediate medical advice.

5 Fire fighting measures

- **Suitable extinguishing agents**
  Carbon dioxide, extinguishing powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
- **Special hazards caused by the material, its products of combustion or resulting gases:**
  In case of fire, the following can be released:
  Carbon monoxide (CO)
- **Protective equipment:**
  Wear self-contained respirator.
  Wear fully protective impervious suit.

6 Accidental release measures

- **Person-related safety precautions:**
  Wear protective equipment. Keep unprotected persons away.
  Ensure adequate ventilation
- **Measures for environmental protection:**
  Do not allow material to be released to the environment without proper governmental permits.
- **Measures for cleaning/collecting:**
  Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
  Dispose contaminated material as waste according to item 13.
  Ensure adequate ventilation.
- **Additional information:**
  See Section 7 for information on safe handling
  See Section 8 for information on personal protection equipment.
  See Section 13 for disposal information.

7 Handling and storage

- **Handling**
- **Information for safe handling:**
  Keep container tightly sealed.
  Store in cool, dry place in tightly closed containers.
  Ensure good ventilation at the workplace.
- **Information about protection against explosions and fires:**
  No special measures required.

- **Storage**
- **Requirements to be met by storerooms and receptacles:**
  No special requirements.
- **Information about storage in one common storage facility:**
  Store away from oxidizing agents.
  Do not store together with acids.

o **Further information about storage conditions:**
Keep container tightly sealed.
Store in cool, dry conditions in well sealed containers.

8 Exposure controls and personal protection

o **Additional information about design of technical systems:**
Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute.

Components with limit values that require monitoring at the workplace:

Di-n-butyl phthalate mg/m3 ACGIH TLV
5 Belgium TWA 5 Denmark TWA 5 France TWA 5 Hungary TWA 5; 4-STEL Ireland TWA
5; 10-STEL Netherlands TWA 5 Russia TWA
0.5-STEL Sweden TWA 3; 5-STEL Switzerland TWA
5 United Kingdom TWA 5; 10-STEL USA PEL 5

o **Additional information:** No data

o **Personal protective equipment**
o **General protective and hygienic measures**
The usual precautionary measures for handling chemicals should be followed.
Keep away from foodstuffs, beverages and feed.
Remove all soiled and contaminated clothing immediately.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
o **Breathing equipment:**
Use suitable respirator when high concentrations are present.
o **Protection of hands:** Impervious gloves
o **Eye protection:**
Safety glasses
Tightly sealed goggles
Full face protection
o **Body protection:** Protective work clothing.

9 Physical and chemical properties:

o **Form:** Liquid
o **Color:** Colorless
o **Odor:** Odorless

o	Value/Range	Unit	Method
o **Change in condition**			
o **Melting point/Melting range:**	-35	° C	
o **Boiling point/Boiling range:**	340	° C	
o Sublimation temperature / start:	Not determined		
o **Flash point:**	171	° C	
o Ignition temperature:	389	° C	

- **Decomposition temperature:** Not determined

- **Danger of explosion:**
  Product does not present an explosion hazard.

- **Explosion limits:**
- **Lower:** Not determined
- **Upper:** Not determined

- **Vapor pressure:** at 147 ° C 1.3 hPa

- **Density:** at 20 ° C 1.043 g/cm3

- **Solubility in / Miscibility with**
- **Water:** Not miscible or difficult to mix

10 Stability and reactivity

- **Thermal decomposition / conditions to be avoided:**
  Decomposition will not occur if used and stored according to specifications.
- **Materials to be avoided:**
  Oxidizing agents
  Acids
  Bases
  Chlorine
- **Dangerous reactions** No dangerous reactions known
- **Dangerous products of decomposition:** Carbon monoxide and carbon dioxide

11 Toxicological information

- **Acute toxicity:**
  LD/Lc50 values that are relevant for classification:

  Di-n-butyl phthalate (CAS# 84-74-2), 100%
  Oral: LD50: 10000 mg/kg (gpg)
  LD50: 5000 mg/kg (mam)
  LD50: 5289 mg/kg (mus)
  LD50: 8000 mg/kg (rat)
  Dermal: LD50: >20000 µl/kg (rbt)
- **Primary irritant effect:**
- **on the skin:** Irritant to skin and mucous membranes.
- **on the eye:** Irritating effect.
- **Sensitization:** No sensitizing effects known.
- **Other information (about experimental toxicology):**
  Reproductive effects have been observed on tests with laboratory animals.
  Mutagenic effects have been observed on tests with laboratory animals.
  Mutagenic effects have been observed on tests with bacteria.
- **Subacute to chronic toxicity:**

Inhalation of di-n-butyl phthalate may cause nausea, dizziness and headache. Reproductive, mutagenic and teratogenic effects in laboratory animals have been reported.

- **Additional toxicological information:**
  Possible risk of impaired fertility.
  Possible risk of harm to the unborn child.
  To the best of our knowledge the acute and chronic toxicity of this substance is not fully known.
  EPA-D: Not classifiable as to human carcinogenicity: inadequate human and animal evidence of carcinogenicity or no data are available.

12 Ecological information:

- **General notes:**
  Do not allow material to be released to the environment without proper governmental permits.

13 Disposal considerations

- **Product:**
- **Recommendation**
  Consult state, local or national regulations for proper disposal.

- **Uncleaned packagings:**
- **Recommendation:**
  Disposal must be made according to official regulations.

14 Transport information

Not a hazardous material for transportation.

- **DOT regulations:**
- **Hazard class:** None
- **Hazardous substance:** 10 lbs, 4.54 kg

- **Land transport ADR/RID (cross-border)**
- **ADR/RID class:** None

- **Maritime transport IMDG:**
- **IMDG Class:** None

- **Air transport ICAO-TI and IATA-DGR:**
- **ICAO/IATA Class:** None

- **Transport/Additional information:**
  Not dangerous according to the above specifications.

15 Regulations

- Product related hazard informations:

- **Hazard symbols:** Xn Harmful

- **Risk phrases:**
  62 Possible risk of impaired fertility
  63 Possible risk of harm to the unborn child
  36/37/38 Irritating to eyes, respiratory system and skin.

- **Safety phrases:**
  26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
  36 Wear suitable protective clothing.

- **National regulations**
  All components of this product are listed in the U.S. Environmental Protection Agency Toxic Substances Control Act Chemical Substance Inventory.

- **Information about limitation of use:**
  For use only by technically qualified individuals.
  This product is subject to the reporting requirements of section 313 of the Emergency Planning and Community Right to Know Act of 1986 and 40CFR372.

16 Other information:

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

- **Department issuing MSDS:** Health, Safety and Environmental Department.

- **Contact:** Darrell R. Sanders

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 1/18/94

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

XX0017 XX0020

Product Name:
o-Xylene
Synonyms:
o-Xylol; 1,2-Dimethylbenzene
Chemical Family:
Aromatic Hydrocarbon
Formula:
$C_6H_4(CH_3)_2$
Molecular Weight.:
106.17

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
o-Xylene	95-47-6	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
HARMFUL OR FATAL IF SWALLOWED.
FLAMMABLE LIQUID AND VAPOR.
VAPOR HARMFUL.
May Cause Damage To Lungs, Liver, Kidneys and Central Nervous System.
IRRITATING TO SKIN, EYES AND MUCOUS MEMBRANES.

Appearance:
Colorless liquid; aromatic odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Harmful if swallowed or inhaled. Irritating on contact with skin, eyes or mucous membranes. Vapor irritating to eyes and respiratory passages. May cause damage to central nervous system (CNS), liver, lungs, kidneys.

Medical Cond. Aggravated by Exposure:
Kidney, liver, respiratory and nervous systems

Routes of Entry:
Inhalation, ingestion

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: Call a physician immediately. ONLY induce vomiting at the instructions of a physician. Never give anything by mouth to an unconscious person.
Remove contaminated clothing and wash before reuse.

5. FIRE FIGHTING MEASURES

Flash Point (F): 90F (cc)
Flammable Limits LEL (%): 1.00
Flammable Limits UEL (%): 7.00
Extinguishing Media:
Foam, carbon dioxide, dry chemical

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Dangerous fire and explosive hazard. Vapor can travel distances to ignition source and flash back.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.
EM SCIENCE recommends Spill-X absorbent agents for various types of spills. Additional information on the Spill-X products can be provided through the EM SCIENCE Technical Service Department (609) 423-6300. The following EM SCIENCE Spill-X absorbent is recommended for this product:

SX0863 Solvent Spill Treatment Kit

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed and protected against physical damage. Store in a cool, well-ventilated area, away from heat and sources of ignition. Do not breathe vapor. Do not get in eyes, on skin, or on clothing. Electrically ground all equipment when handling this product. Retained residue may make empty containers hazardous; use caution!

|8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves (Viton, PVA or equivalent) should be worn to prevent skin contact. Safety glasses with side shields must be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
o-Xylene	100	435	150	655			

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
o-Xylene	100	434	150	651			

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 144C
Melting Point (C) : -25C
Specific Gravity (H_20 = 1) : 0.88
Vapor Pressure (mm Hg) : 5.2 25C
Percent Volatile by vol (%): 99.9+%
Vapor Density (Air = 1) : 3.7
Evaporation Rate (BuAc = 1): 0.7
Solubility in Water (%) : Insoluble
Appearance :
Colorless liquid; aromatic odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
CO_x

Conditions to Avoid:
Heat, sparks, open flame

Materials To Avoid:

```
( ) Water
( ) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
( ) Other:
```

|11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-rat LDLo: 5000 mg/kg
ihl-rat LCLo: 6125 ppm/12H
```

Toxicological Findings:

Tests on laboratory animals indicate material may produce adverse reproductive effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: D001 U239

Treatment:
Incineration, fuels blending or recycle. Contact your local permitted waste disposal site (TSD) for permissible treatment sites. ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Xylene

DOT ID Number :
UN1307

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
o-Xylene			1000

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
o-Xylene	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 2
Flammability : 3
Reactivity : 0
Special Hazards :

Revision History: 6/1/84 6/24/87 10/27/87 8/25/88 3/1/91

| = Revised Section

N/A = Not Available

N/E = None Establised

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ACROS ORGANICS

HELP CATALOGS SEARCH ORDER LIST CONTENTS

MATERIAL SAFETY DATA SHEET

1,2-Dichlorobenzene, 99%
96324

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: 1,2-Dichlorobenzene, 99%

```
     Dichlorobenzene, Ortho, Liquid; O-Dichlorbenzol
Company Identification:  Acros Organics N.V.
                         One Reagent Lane
                         Fairlawn, NJ  07410.
For information in North America, call:   800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300
```

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
95-50-1	1,2-Dichlorobenzene	99	202-425-9

Hazard Symbols: XN N
Risk Phrases: 22 36/37/38 50/53

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: colorless to light yellow. Flash Point: 67 deg C.
Warning! Combustible liquid. Light sensitive. This substance has caused adverse reproductive and fetal effects in animals. May cause central nervous system depression. Harmful if swallowed. Causes eye and skin irritation. Causes digestive and respiratory tract irritation.
Target Organs: Kidneys, central nervous system, liver.

Potential Health Effects

Eye:
Contact produces irritation, tearing, and burning pain. Vapors cause eye irritation.

Skin:
Causes irritation with burning pain, itching, and redness.

Ingestion:
Harmful if swallowed. May cause central nervous system depression, kidney damage, and liver damage.

Inhalation:
May cause respiratory tract irritation. May cause liver and kidney

damage. May cause drowsiness, unconsciousness, and central nervous system depression.

Chronic:

Prolonged or repeated exposure may cause adverse reproductive effects. May cause liver and kidney damage. May cause fetal effects.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:

Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid.

Skin:

Get medical aid. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion:

If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation:

Get medical aid immediately. Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Notes to Physician:

Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Vapors can travel to a source of ignition and flash back. Combustion generates toxic fumes. Vapors may be heavier than air. They can spread along the ground and collect in low or confined areas.

Extinguishing Media:

In case of fire, use water fog, dry chemical, carbon dioxide, or regular foam.

Autoignition Temperature: 640 deg C (1,184.00 deg F)
Flash Point: 67 deg C (152.60 deg F)
NFPA Rating: health-2; flammability-2; reactivity-0
Explosion Limits, Lower: 2.20 vol %
Upper: 12.00 vol %

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Absorb spill with inert material, (e.g., dry sand or earth), then place into a chemical waste container. Remove all sources of ignition.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:

Wash thoroughly after handling. Use only in a well ventilated area. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.

Storage:
Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
1,2-Dichlorobenzene	25 ppm ; 150 mg/m3; 50 ppm STEL; 301 mg/m3 STEL	200 ppm IDLH	C 50 ppm; C 300 mg/m3

OSHA Vacated PELs:
1,2-Dichlorobenzene:
No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:
Wear appropriate protective gloves to prevent skin exposure.

Clothing:
Wear appropriate protective clothing to prevent skin exposure.

Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Liquid
Appearance:	colorless to light yellow
Odor:	Aromatic.
pH:	Not available.
Vapor Pressure:	1.15 mm Hg @ 20C
Vapor Density:	5.05 (air=1)
Evaporation Rate:	<1 (butyl acetate=1)
Viscosity:	Not available.
Boiling Point:	179.0 - 180.0 deg C @ 760.00m
Freezing/Melting Point:	-15 deg C
Decomposition Temperature:	Not available.
Solubility:	IN WATER: 0.13 G/L (20°C)
Specific Gravity/Density:	1.3060g/cm3
Molecular Formula:	C6H4Cl2
Molecular Weight:	147.00

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable at room temperature in closed containers under normal storage and handling conditions.
Conditions to Avoid:
High temperatures.
Incompatibilities with Other Materials:
Strong oxidizing agents, acids, aluminum.
Hazardous Decomposition Products:
Hydrogen chloride, chlorine, carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 95-50-1: CZ4500000
LD50/LC50:
CAS# 95-50-1: Oral, mouse: LD50 = 4386 mg/kg; Oral, rabbit: LD50 = 500 mg/kg; Oral, rat: LD50 = 500 mg/kg.
Carcinogenicity:
1,2-Dichlorobenzene -
ACGIH: A4 - Not Classifiable as a Human Carcinogen
IARC: Group 3 carcinogen
Epidemiology:
No information available.
Teratogenicity:
Specific Developmental Abnormalities: Musculoskeletal, inhalation-rat TCLo=200ppm/6H.
Reproductive Effects:
Paternal Effects: Spermatogenesis, intraperitoneal-rat TDLo=50mg/kg.
Neurotoxicity:
No information available.
Mutagenicity:
No information available.
Other Studies:
None.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
No information available.
Environmental Fate:
On soil, substance can be adsorbed to a significant extent. Leaching to groundwater can occur. In water, substance will adsorb to sediment. In air, substance will exist in the vapor phase and will react with photochemically-produced hydroxyl radicals.
Physical/Chemical:
No information available.
Other:
Please refer to the Handbook of Environmental Fate and Exposure Data (vol. I) for additional information.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants:
None listed.
RCRA D-Series Chronic Toxicity Reference Levels: None listed.
RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 95-50-1: waste number U070.
CAS# 95-50-1 is banned from land disposal according

to RCRA.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
Shipping Name: O-DICHLOROBENZENE
Hazard Class: 6.1
UN Number: UN1591
Packing Group: III

IMO
Shipping Name: O-DICHLOROBENZENE
Hazard Class: 6.1
UN Number: 1591
Packing Group: III

IATA
Shipping Name: O-DICHLOROBENZENE
Hazard Class: 6.1
UN Number: 1591
Packing Group: III

RID/ADR
Shipping Name: O-DICHLOROBENZENE
Dangerous Goods Code: 6.1(15C)
UN Number: 1591

Canadian TDG
Shipping Name: O-DICHLOROBENZENE
Hazard Class: 6.1(9.2)
UN Number: UN1591

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA
CAS# 95-50-1 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
CAS# 95-50-1: Testing required by: manufacturers; processors (40 CFR 7
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.

SARA
Section 302 (RQ)
CAS# 95-50-1: final RQ = 100 pounds (45.4 kg)
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 95-50-1: acute, chronic, flammable.
Section 313
This material contains 1,2-Dichlorobenzene (CAS# 95-50-1, 99%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:
CAS# 95-50-1 is listed as a Hazardous Substance under the CWA.
CAS# 95-50-1 is listed as a Priority Pollutant under the Clean Water Act.
CAS# 95-50-1 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

1,2-Dichlorobenzene can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

California No Significant Risk Level:

None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN N

Risk Phrases:

R 22 Harmful if swallowed.

R 36/37/38 Irritating to eyes, respiratory system and skin.

R 50/53 Very toxic to aquatic organisms; may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 23 Do not inhale gas/fumes/vapour/spray.

S 60 This material and/or its container must be disposed of as hazardous waste.

S 61 Avoid release to the environment. Refer to special instructions/Safety data sheets.

WGK (Water Danger/Protection)

CAS# 95-50-1: 2

Canada

CAS# 95-50-1 is listed on Canada's DSL/NDSL List.

This product has a WHMIS classification of B3, D1B, D2B.

CAS# 95-50-1 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 95-50-1:. OEL-AUSTRALIA:TWA 50 ppm (300 mg/m3). OEL-AUSTRIA:TWA 50 ppm (300 mg/m3). OEL-BELGIUM:STEL 50 ppm (301 mg/m3);Skin. OEL-DENMARK:STEL 50 ppm (300 mg/m3). OEL-FINLAND:TWA 50 ppm (300 mg/m3);STEL 75 ppm (450 mg/m3);Skin. OEL-FRANCE:STEL 50 ppm (300 mg/m3). OEL-GERMANY:TWA 50 ppm (300 mg/m3);Skin. OEL-HUNGARY:TWA 50 mg/m3;STEL 100 mg/m3;Skin JAN9. OEL-JAPAN:STEL 50 ppm (300 mg/m3). OEL-THE NETHERLANDS:TWA 50 ppm (300 mg/m3). OEL-THE PHILIPPINES:TWA 50 ppm (300 mg/m3). OEL-POLAND:TWA 20 mg/m3. OEL-RUSSIA:STEL 50 mg/m3. OEL-SWEDEN:STEL 50 ppm (300 mg/m3). OEL-SWITZERLAND:TWA 50 ppm (300 mg/m3);STEL 100 ppm (600 mg/m3). OEL-THAILAND:TWA 50 ppm (300 mg/m3). OEL-TURKEY:TWA 50 ppm (300 mg/m3). OEL-UNITED KINGDOM:TWA 50 ppm (300 mg/m3);STEL 50 ppm. OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV. OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 2/01/1996 Revision #3 Date: 11/14/1997

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Back to product information.

ACROS ORGANICS

HELP CATALOGS SEARCH ORDER LIST CONTENTS

MATERIAL SAFETY DATA SHEET

1,4-Dichlorobenzene, 97%
01149

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: 1,4-Dichlorobenzene, 97%

p-DCB, 1,4-Dichlorobenzene, Dichlorocide, Paracide,
Paradichlorobenzol, p-Chlorophenyl chloride.

Company Identification: Acros Organics N.V.
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
106-46-7	P-DICHLOROBENZENE	>99%	203-400-5

Hazard Symbols: XN
Risk Phrases: 22 36/38

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: Not available. Flash Point: 67 deg C.
Warning! Cancer suspect agent. May cause eye and skin irritation. May cause respiratory and digestive tract irritation. May cause liver and kidney damage. May cause cancer in humans. May cause blood abnormalities.
Target Organs: Blood, kidneys, liver.

Potential Health Effects

Eye:
Exposure to solid may cause pain and redness. Exposure to high vapor concentrations may cause irritation.

Skin:
May cause skin irritation.

Ingestion:
May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May cause liver and kidney damage.

Inhalation:
May cause respiratory tract irritation. May cause liver and kidney

damage.

Chronic:

Overexposure may cause delayed kidney injury. Possible cancer hazard based on tests with laboratory animals. Chronic ingestion may cause liver damage. May cause anemia and other blood cell abnormalities.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:

Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid immediately.

Skin:

Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists.

Ingestion:

If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately.

Inhalation:

Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid if cough or other symptoms appear.

Notes to Physician:

Treat symptomatically and supportively.

Antidote:

No specific antidote exists.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. Use water spray to keep fire-exposed containers cool.

Extinguishing Media:

In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.

Autoignition Temperature: 640 deg C (1,184.00 deg F)
Flash Point: 67 deg C (152.60 deg F)
NFPA Rating: health-2; flammability-2; reactivity-0
Explosion Limits, Lower: 2.20 vol %
Upper: 12.00 vol %

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Wear a self contained breathing apparatus and appropriate Personal protection. (See Exposure Controls, Personal Protection section). Remove all sources of ignition. Carefully scoop up and place into appropriate disposal container.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:

Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Do not get on skin or in eyes. Do not ingest or inhale. Do not pressurize, cut, weld, braze,

solder, drill, grind, or expose empty containers to heat, sparks or open flames.

Storage:
Keep away from sources of ignition. Store in a cool, dry, well-ventilated area away from incompatible substances.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
P-DICHLOROBENZENE	10 ppm ; 60 mg/m3	NIOSH Potential Occupational Carcinogen - see Appendix A Potential NIOSH carcinogen.	75 ppm TWA; 450 mg/m3 TWA

OSHA Vacated PELs:
P-DICHLOROBENZENE:
75 ppm TWA; 450 mg/m3 TWA

Personal Protective Equipment

Eyes:
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:
Wear impervious gloves.

Clothing:
Wear appropriate protective clothing to prevent skin exposure.

Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Solid
Appearance:	Not available.
Odor:	Distinctive mothball-like.
pH:	Not available.
Vapor Pressure:	1.18 mm Hg @25C
Vapor Density:	5.07 (air=1)
Evaporation Rate:	Negligible.
Viscosity:	Not available.
Boiling Point:	174 deg C @ 760.00mm Hg
Freezing/Melting Point:	53.0 - 56.0 deg C
Decomposition Temperature:	Not available.
Solubility:	insoluble
Specific Gravity/Density:	1.2410g/cm3
Molecular Formula:	C6H4Cl2
Molecular Weight:	147.00

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable at room temperature in closed containers under normal storage and handling conditions.
Conditions to Avoid:
High temperatures, incompatible materials, ignition sources.
Incompatibilities with Other Materials:
Aluminum, oxidizing agents.
Hazardous Decomposition Products:
Hydrogen chloride, chlorine, carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 106-46-7: CZ4550000
LD50/LC50:
CAS# 106-46-7: Oral, mouse: LD50 = 2950 mg/kg; Oral, rabbit: LD50 = 2830 mg/kg; Oral, rat: LD50 = 500 mg/kg; Skin, rabbit: LD50 = >2 gm/kg; Skin, rat: LD50 = >6 gm/kg.
Carcinogenicity:
P-DICHLOROBENZENE -
ACGIH: A3-animal carcinogen
California: carcinogen - initial date 1/1/89
NIOSH: occupational carcinogen
NTP: Suspect carcinogen
OSHA: Possible Select carcinogen
IARC: Group 2B carcinogen
Epidemiology:
No information available.
Teratogenicity:
No information available.
Reproductive Effects:
No information available.
Neurotoxicity:
No information available.
Mutagenicity:
No information available.
Other Studies:
None.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
Fish (fresh water) 50ppm lethal (no time interval specified) Rainbow trout (fresh water) TLm= 880mg/48H
Environmental Fate:
Substance can be adsorbed in soil, and leaching is possible.
Substance is volatile from water, but has potential for sediment adsorption.
Physical/Chemical:
Substance (in soil and water) has low probability for chemical transformation by hydrolysis, oxidation, or direct photolysis.
Other:
Please refer to the Handbook of Environmental Fate and Exposure Data (Vol I) for additional information.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants:

CAS# 106-46-7: waste number D027; regulatory level = 7.5 mg/L.
RCRA D-Series Chronic Toxicity Reference Levels: CAS# 106-46-7: chronic toxicity reference level = 0.075 mg/L.
RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 106-46-7: waste number U072.
CAS# 106-46-7 is banned from land disposal according to RCRA.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
Shipping Name: TOXIC SOLID, ORGANIC, N.O.S. (1,4-DICHLOROBENZENE)
Hazard Class: 6.1
UN Number: UN2811
Packing Group: III
IMO
No information available.
IATA
Not regulated as a hazardous material.
RID/ADR
Not regulated as a hazardous material.
Canadian TDG
No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL
TSCA
CAS# 106-46-7 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
CAS# 106-46-7: Testing required by manufacturers; processors (40 CFR 7
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA
Section 302 (RQ)
CAS# 106-46-7: final RQ = 100 pounds (45.4 kg)
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 106-46-7: acute, chronic, flammable.
Section 313
This material contains P-DICHLOROBENZENE (CAS# 106-46-7, 99%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
CAS# 106-46-7 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
CAS# 106-46-7 is listed as a Hazardous Substance under the CWA.
CAS# 106-46-7 is listed as a Priority Pollutant under the Clean Water Act.
CAS# 106-46-7 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

P-DICHLOROBENZENE can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains P-DICHLOROBENZENE, a chemical known to the state of California to cause cancer.

California No Significant Risk Level:

CAS# 106-46-7: no significant risk level = 20 ug/day

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN

Risk Phrases:

R 22 Harmful if swallowed.

R 36/38 Irritating to eyes and skin.

Safety Phrases:

S 2 Keep out of reach of children.

S 22 Do not inhale dust.

S 24/25 Avoid contact with skin and eyes.

S 46 If swallowed, seek medical advice immediately and show this container or label.

WGK (Water Danger/Protection)

CAS# 106-46-7: 2

Canada

CAS# 106-46-7 is listed on Canada's DSL/NDSL List.

WHMIS: Not available.

CAS# 106-46-7 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 106-46-7:. OEL-AUSTRALIA:TWA 75 ppm (450 mg/m3);STEL 110 ppm (675 mg/m3). OEL-BELGIUM:TWA 75 ppm (451 mg/m3);STEL 110 ppm (661 mg/m3)

);STEL 115 ppm (690 mg/m3);Skin. OEL-FRANCE:TWA 75 ppm (450 mg/m3);STEL 110 ppm (675 mg/m3). OEL-GERMANY:TWA 75 ppm (450 mg/m3). OEL-JAPAN:TWA 50 ppm (300 mg/m3). OEL-THE NETHERLANDS:TWA 75 ppm (450 mg/m3). OEL-THE PHILIPPINES:TWA 75 ppm (450 mg/m3). OEL-POLAND:TWA 20 mg/m3. OEL-RUSSIA:TWA 50 ppm. OEL-SWEDEN:TWA 75 ppm (450 mg/m3);STEL 110 ppm (700 mg/m3). OEL-SWITZERLAND:TWA 75 ppm (450 mg/m3);STEL 150 ppm (900 mg/m3). OEL-TURKEY:TWA 75 ppm (450 mg/m3). OEL-UNITED KINGDOM:TWA 75 ppm (450 mg/m3);STEL 11 ppm. OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV. OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 2/07/1996 Revision #1 Date: 9/17/1997

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Back to product information.

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 7/6/93

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

820846 NX0005 NX0007 NX0010

Product Name:
Naphthalene
Synonyms:
Napthalin
Chemical Family:
Aromatic Hydrocarbon
Formula:
$C_{10}H_8$
Molecular Weight.:
128.16

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Naphthalene	91-20-3	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
HARMFUL IF INHALED, SWALLOWED OR ABSORBED THROUGH SKIN.
COMBUSTIBLE LIQUID AND VAPOR.
May Cause Damage To Liver and Respiratory System.

Appearance:
White/off-white crystals, mothball odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Can irritate eyes and skin. Toxic by ingestion, inhalation or skin absorption. Can cause headache, confusion, malaise, nausea, vomiting, abdominal pains, irritated bladder, profuse sweating, jaundice, hematuria, hemoglobinuria, liver damage, convulsions and coma.

Medical Cond. Aggravated by Exposure:
Respiratory and liver

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.
Remove contaminated clothing and wash before reuse.

5. FIRE FIGHTING MEASURES

Flash Point (F): 174F (CC)
Flammable Limits LEL (%): 0.90
Flammable Limits UEL (%): 5.90
Extinguishing Media:
CO_2, Dry chemical, Foam, Water spray

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:
Moderate fire and explosion hazard.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:

Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container tightly closed. Store in a cool, dry area away from ignition sources and oxidizers. Do not breathe dust or vapor. Do not get in eyes, on skin, or on clothing. Retained residue may make empty containers hazardous; use caution!

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves must be worn to prevent skin contact (Viton or equivalent) Safety glasses with side shields must be worn at all times. Impervious protective clothing should be worn to prevent skin contact.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Naphthalene	10	50	15	75			

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Naphthalene	10	52	15	79			

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 218C
Melting Point (C) : 78-82C
Specific Gravity (H_20 = 1) : 1.162
Vapor Pressure (mm Hg) : 1 53C
Percent Volatile by vol (%): 95+%
Vapor Density (Air = 1) : 4.4
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :
White/off-white crystals, mothball odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
CO_x

Conditions to Avoid:
Heat; contact with ignition source

Materials To Avoid:

```
( ) Water
( ) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: CrO3, N2O5
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-mus LD50: 533 mg/kg    orl-chd LDLo: 100 mg/kg
```

Toxicological Findings:
Tests on laboratory animals indicate material may cause tumors
and produce adverse mutagenic and reproductive effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

```
EPA Waste Numbers:  U165
```

Treatment:
Specified Technology - Incineration to a level below TCA (Total Constituent Analyses) levels. Contact your local permitted waste disposal company (TSD) for permissible treatment site.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Naphthalene, Refined

DOT ID Number :
UN1334

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Naphthalene			100

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Naphthalene	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 2
Flammability : 2
Reactivity : 0
Special Hazards :

Revision History: 10/23/84 10/27/87 1/6/88 3/1/91

| = Revised Section

N/A = Not Available

N/E = None Establised

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Material Safety Data Sheet

2-METHYLNAPHTHALENE

November 15, 1991

PHILLIPS CHEMICAL COMPANY
A Division of Phillips Petroleum Company
Bartlesville, Oklahoma 74004

PHONE NUMBERS
Emergency: (918) 661-8118
Technical Services: (918) 661-9091
For Additional MSDSs: (918) 661-7297

A. Product Identification

Synonyms: beta-Methylnaphthalene; 2-Methyl-1-Naphthalene
Chemical Name: 2-Methylnaphthalene
Chemical Family: Naphthalenes
Chemical Formula: C11H10
CAS Reg. No.: 91-57-6
Product No.: Not Established

Product and/or Components Entered on EPA's TSCA Inventory: YES

This product is in U.S. commerce, and is listed in the Toxic Substances Control Act (TSCA) Inventory of Chemicals; hence, it is subject to all applicable provisions and restrictions of 40 CFR, section 721 and 723.250.

B. Components

Ingredients	CAS Number	% By Wt.	OSHA PEL	ACGIH TLV
2-Methylnaphthalene	91-57-6	98	NE	NE
Related Compounds	Various	2	NE	NE

C. Personal Protection Information

Ventilation: Use adequate ventilation.

Respiratory Protection: Not generally required unless needed to prevent respiratory irritation. In case of spill or leak resulting in unknown concentration, or entry into confined spaces or other poorly ventilated areas, use NIOSH/MSHA approved air supplied respirator.

Eye Protection: Use safety glasses with side shield and face

shield.

Skin Protection: Use full-body, long sleeved garments impervious to the material. Use gloves impervious to the material being used (rubber or neoprene).

NOTE: Personal protection information shown in Section C is based upon general information as to normal uses and conditions. Where special or unusual uses or conditions exist, it is suggested that the expert assistance of an industrial hygienist or other qualified professional be sought.

D. Handling and Storage Precautions

Do not get in eyes, on skin or on clothing. Avoid breathing dusts. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Wash thoroughly after handling. Launder contaminated clothing before reuse. Use only with adequate ventilation.

Store in a cool, well-ventilated area. Provide means of controlling spills. Store in closed container.

E. Reactivity Data

Stability:	Stable
Conditions to Avoid:	Not Applicable
Incompatibility (Materials to Avoid):	Oxygen and strong oxidizing agents
Hazardous Polymerization:	Will Not Occur
Conditions to Avoid:	Not Applicable
Hazardous Decomposition Products:	Carbon oxides and various hydrocarbons formed when burned.

F. Health Hazard Data

Recommended Exposure Limits:

Not Established.

The toxicological properties of this product have not been tested or have not been tested completely and its handling or use may be hazardous. EXERCISE DUE CARE. The following effects of overexposure may be expected.

Acute Effects of Overexposure:

Eye: May be mildly to severely irritating.

Skin: May be severely irritating. May cause photosensitization; sunlight may react with contaminated skin to produce adverse reactions; i.e., sunburn, premature aging, immediate darkening. Extended exposure could lead to skin cancer.

Inhalation: May be irritating to mucous membranes and upper respiratory tract.

Ingestion: No known applicable information.

Subchronic and Chronic Effects of Overexposure:

No known applicable information.

Other Health Effects:

No known applicable information.

Health Hazard Categories:

	Animal	Human		Animal	Human
Known Carcinogen	___	___	Toxic	___	___
Suspect Carcinogen	___	___	Corrosive	___	___
Mutagen	___	___	Irritant	_X_	_X_
Teratogen	___	___	Target Organ Toxin	_X_	_X_
Allergic Sensitizer	___	___	Specify - Skin Hazard-Photosensitization		
Highly Toxic	___	___			

First Aid and Emergency Procedures:

Eye: Immediately flush eyes with running water for at least fifteen minutes. If irritation develops, seek medical attention.

Skin: Immediately wash skin with soap and water for at least fifteen minutes. If irritation develops, seek medical attention.

Inhalation: Remove from exposure. If breathing becomes labored or irritation develops, seek medical attention.

Ingestion: Immediately induce vomiting, only if subject is conscious. Seek medical attention.

G. Physical Data

Appearance:	White Solid
Odor:	Mild
Boiling Point:	466F (242C)
Vapor Pressure:	Not Established
Vapor Density (Air = 1):	Not Established
Solubility in Water:	Not Established
Specific Gravity (H2O = 1):	1.00
Percent Volatile by Volume:	Not Established
Evaporation Rate (Butyl Acetate = 1):	Not Established
Viscosity:	Not Established

H. Fire and Explosion Data

Flash Point (Method Used):	208F (98C) (Estimate)
Flammable Limits (% by Volume in Air):	LEL - Not Established UEL - Not Established
Fire Extinguishing Media:	Dry chemical, foam or carbon dioxide (CO2)
Special Fire Fighting Procedures:	Evacuate area of all unnecessary personnel. Shut off source, if possible. Use NIOSH/MSHA approved self-contained breathing apparatus (SCBA) and other protective equipment and/or garments described in Section C if exposure conditions warrant. Water fog or spray may be used to cool exposed equipment and containers.
Fire and Explosion Hazards:	Carbon oxides and various hydrocarbons formed when burned.

I. Spill, Leak and Disposal Procedures

Precautions Required if Material is Released or Spilled:

Evacuate area of all unnecessary personnel. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Contain spill and control dusts. Keep out of water sources and sewers. Vacuum up or spray with water and scoop up and place in impervious bags or containers.

Waste Disposal (Insure Conformity with all Applicable Disposal Regulations):

Incinerate or otherwise manage at a RCRA permitted waste management facility.

J. DOT Transportation

Shipping Name:	Not Applicable
Hazard Class:	Not Applicable
ID Number:	Not Applicable
Packing Group:	Not Applicable
Marking:	Not Applicable
Label:	Not Applicable
Placard:	Not Applicable
Hazardous Substance/RQ:	Not Applicable
Shipping Description:	Not Applicable
Packaging References:	Not Applicable

K. RCRA Classification - Unadulterated Product as a Waste

Prior to disposal, consult your environmental contact to determine if the TCLP (Toxicity Characteristic Leaching Procedure, EPA Test Method 1311) is required. Reference 40 CFR part 261.

L. Protection Required for Work on Contaminated Equipment

Contact immediate supervisor for specific instructions before work is initiated. Wear protective equipment and/or garments described in Section C if exposure conditions warrant.

M. Hazard Classification

_X_ This product meets the following hazard definition(s) as defined by the Occupational Safety and Health Hazard Communication Standard (29 CFR Section 1910.1200):

___ Combustible Liquid	___ Flammable Aerosol	___ Oxidizer
___ Compressed Gas	___ Explosive	___ Pyrophoric
___ Flammable Gas	_X_ Health Hazard (Section F)	___ Unstable
___ Flammable Liquid	___ Organic Peroxide	___ Water Reactive
___ Flammable Solid		

___ Based on information presently available, this product does not meet any of the hazard definitions of 29 CFR Section 1910.1200.

N. Additional Comments

SARA 313

As of the preparation date, this product did not contain a chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and

Reauthorization Act of 1986 and 40 CFR Part 372.

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SIGMA CHEMICAL -- N-NITROSODIPHENYLAMINE, N5882
MATERIAL SAFETY DATA SHEET
NSN: 681000N058859
Manufacturer's CAGE: 21076
Part No. Indicator: A
Part Number/Trade Name: N-NITROSODIPHENYLAMINE, N5882

General Information

Company's Name: SIGMA CHEMICAL CO
Company's P. O. Box: 14508
Company's City: ST LOUIS
Company's State: MO
Company's Country: US
Company's Zip Code: 63178
Company's Emerg Ph #: 800-325-5052
Company's Info Ph #: 800-325-3010
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 03SEP93
Safety Data Review Date: 03MAY95
MSDS Serial Number: BXGHR

Ingredients/Identity Information

Proprietary: NO
Ingredient: DIPHENYLAMINE, N-NITROSO-; (N-NITROSODIPHENYLAMINE) (SARA 313) (CERCLA)
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: JJ9800000
CAS Number: 86-30-6
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Physical/Chemical Characteristics

Appearance And Odor: SOLID.
Solubility In Water: SLIGHTLY SOLUBLE

Fire and Explosion Hazard Data

Extinguishing Media: CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.
Special Fire Fighting Proc: USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): AVOID USE W/MORPHOLINE BASED ACCELERATORS.
Materials To Avoid: OXIDIZING AGENTS.
Hazardous Decomp Products: THERMAL DECOMPOSITION MAY PRODUCE CARBON MONOXIDE, CARBON DIOXIDE & NITROGEN OXIDES.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

Health Hazard Data

LD50-LC50 Mixture: LD50:(ORAL,RAT) 2170 MG/KG.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES

Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: ACUTE:MAY BE HARMFUL BY INHALATION, INGESTION OR SKIN ABSORPTION. MAY CAUSE IRRITATION. CHRONIC:CARCINOGEN. MUTAGEN. NITROSAMINES ARE SUSPECTED OF CAUSING CANCERS OF THE LUNGS, NASAL SINUSES, BRAIN, ESOPHAGUS, STOMACH, LIVER, BLADDER & KIDNEYS. TARGET ORGAN DATA:LUNGS, THORAX/RESP (TUMORS, BRONCHOGENIC(EFTS OF OVEREXP)
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT RELEVANT
Signs/Symptoms Of Overexp: HLTH HAZ:CARCINOMA); TUMORIGENIC (EQUIVOCAL TUMORIGENIC AGENT BY RTECS CRITERIA, INCR INCIDENCE OF TUMORS IN SUSCEPTIBLE STRAIN).
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: INGEST:WASH OUT MOUTH W/WATER PROVIDE PERSON IS CONSCIOUS. CALL MD. SKIN:FLUSH W/COPIOUS AMTS OF WATER FOR AT LST 15 MINS. REMOVE CONTAM CLTHG & SHOES. CALL MD. INHAL:REMOVE TO FRESH AIR. IF BRTHG BECOMES DFCLT, CALL MD. EYE:FLUSH W/COPIOUS AMTS OF WATER FOR AT LEAST 15 MINUTES. ASSURE ADEQ FLUSHING BY SEPARATING EYELIDS W/FINGERS. CALL MD.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: WEAR NIOSH/MSHA APPRVD SCBA, RUBBER BOOTS & HEAVY RUBBER GLOVES. SWEEP UP, PLACE IN A BAG & HOLD FOR WASTE DISPOSAL. AVOID RAISING DUST. VENTILATE AREA & WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: DISSOLVE OR MIX MATERIAL W/COMBUSTIBLE SOLVENT & BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AFTERBURNER & SCRUBBER. OBSERVE ALL FEDERAL, STATE & LOCAL ENVIRONMENTAL REGULATIONS.
Precautions-Handling/Storing: KEEP TIGHTLY CLOSED. STORE IN A COOL, DRY PLACE. HANDLE IN A CLOSED SYSTEM. TOXIC. MAY CAUSE CANCER. MAY CAUSE HERITABLE GENETIC DAMAGE.
Other Precautions: DO NOT BREATHE DUST. IF YOU FEEL UNWELL, SEEK MEDICAL ADVICE (SHOW LABEL WHERE POSSIBLE). KEEP CONTAINER TIGHTLY CLOSED & IN A COOL WELL VENTILATED PLACE.

Control Measures

Respiratory Protection: NIOSH/MSHA APPROVED SELF-CONTAINED BREATHING APPARATUS SHOULD BE WORN.
Ventilation: MECHANICAL EXHAUST.
Protective Gloves: LONG RUBBER OR NEOPRENE GAUNTLET GLOVES.
Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS (ING 3)
Other Protective Equipment: EYE WASH FOUNTAIN & DELUGE SHOWER WHICH MEET ANSI DESIGN CRITERIA (FP N).
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

Transportation Data

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 03MAY95
Label Date: 01MAY95
Label Status: G
Common Name: N-NITROSODIPHENYLAMINE, N5882
Chronic Hazard: YES
Signal Word: WARNING!

Acute Health Hazard-Slight: X
Contact Hazard-Moderate: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: ACUTE:MAY BE HARMFUL BY INHALATION, INGESTION OR SKIN ABSORPTION. MAY CAUSE IRRITATION. CHRONIC:CARCINOGEN. MUTAGEN. NITROSAMINES ARE SUSPECTED OF CAUSING CANCERS OF THE LUNGS, NASAL SINUSES, LUNGS, THORAX OR RESPIRATION (TUMORS, BRONCHOGENIC CARCINOGEN); TUMORIGENIC (EQUIVOCAL TUMORIGENIC AGENT BY RTECS CRITERIA, INCREASE INCIDENCE OF TUMORS IN SUSCEPTIBLE STRAIN).
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: SIGMA CHEMICAL CO
Label P.O. Box: 14508
Label City: ST LOUIS
Label State: MO
Label Zip Code: 63178
Label Country: US
Label Emergency Number: 800-325-5052

ICN Biochemicals

1263 S. Chillicothe Road Aurora, OH 44202

216-562-1500

Quality Control Fax # 216 562 2642

MSDS

Material Safety Data Sheet

General Properties

Product: Pentachlorophenol

Synonym: Chlorophen; Lauxtol; 2,3,4,5,6-Pentachlorophenol; Pentachlorophenate

Catalog Number: 156068

Chemical Formula: C_6HCl_5O

Physical Description: Tan Powder

Melting Point: 170-181°C

Boiling Point: 310°C

Specific Gravity: 1.978

Vapor Pressure: 40 mm(211.2°C)

Solubility in Water: Slight

TLV of the Substance: 0.5 mg/m^3 (skin)

Storage: ROOM TEMPERATURE

Remarks UN 3155 Pentachlorophenol (II)

ORL-RAT LD50: 27 mg/kg

SKN-RAT LD50: 96 mg/kg

IHL-RAT LC50: 355 mg/m^3

ORL-HMN LDLo: 29 mg/kg

IPR-RAT LD50: 56 mg/kg

ORL-MUS LD50: 117 mg/kg

IPR-RBT LDLo: 135 mg/kg

CAS # 87-86-5 **RTECS #** SM6300000 **UN #** 3155

WHMIS # D1B

Dangerous Reactions

Flammability: No Unusual Hazard

Flash Point (method): Not Available

Minimum Ignition Temperature: Not Available

Risk of explosion? No unusual hazard

Decomposition of the substance when heated or burned: YES.

Toxic fumes of HCl, and $COCl_2$

Any Dangerous Reactions? Strong oxidizing agents, strong bases, acid chlorides, acid anhydrides.

Extinguishing Media: CO_2, dry chemical, or foam

Toxicological Data

Route(s) of Entry:

Inhalation: YES

Skin: YES

Ingestion: YES

Health Hazards - Acute and Chronic: Toxic-may be fatal if ingested, inhaled or absorbed through the skin. Irritant to skin, eyes, mucous membranes and upper respiratory tract. Carcinogen, possible teratogen.

Signs and Symptoms of Exposure: Burning sensation, coughing, laryngitis or vomiting. May cause reproductive disorders. May cause damage to liver and kidneys. Convulsions, dermatitis.

Safe Handling and Safe Use of Materials

Spill or Release of Material

[ ] Absorb the liquid in dry sand, diatomite, vermiculite or other drying agent then shovel into suitable containers for disposal.

[ ] Acid Spills - Depending upon the situation neutralize with soda ash then use one of the following methods; soak up in an absorbent then shovel into suitable container for disposal, or flush away with a liberal amount of water.

[ ] Alkaline Spills - Depending upon the situation neutralize with $NaHSO_4$ and then use one of the following methods; soak up in an absorbent then shovel into suitable container for disposal, or flush away with a liberal amount of water.

[X] Other procedures: Sweep into suitable container for disposal.

Waste Disposal Method:

Incinerate or landfill as complies with state and local laws.

Handling

Always wear gloves, mask, goggles or other protective clothing and use a hood. Follow proper laboratory procedures.

Personal Protection

Respiratory Protection: YES

Eye Protection: YES

Protective Gloves: YES

Is a local exhaust system required when the substance is used for its normal purpose? YES

First Aid Procedures

Substance in Contact with Skin

[X] Remove contaminated clothing and rinse with copious amounts of soap and water for a considerable amount of time

[ ] Produces severe caustic burns or general disorders, call a physician

[X] Call a physician

[ ] Not Hazardous

Substance has been Swallowed

[ ] Rinse mouth several times with water, do not swallow

[X] Drink 1 or 2 glasses of water within 15 minutes

[ ] Induce vomiting

[ ] In the case of imminent unconsciousness clear the respiratory tract and lay patient on side in a stable position

[X] Always Call a physician or take patient to hospital

[ ] Not Hazardous

Substance in Contact with Eyes

[X] Rinse liberally with water for a considerable amount of time

[X] Always call a physician or take to a hospital

[ ] Not Hazardous

Substance has been Inhaled

[X] Take patient into the fresh air and allow to rest

[ ] In the case of imminent unconsciousness clear the respiratory tract and lay patient on side in a stable position

[X] Always Call a physician or take patient to hospital

Additional Instructions:

Observe proper laboratory procedures when handling material.

Date of Preparation: 1-5-94, Revised 2-27-95

The information provided with this MSDS is furnished in good faith and without warranty of any kind. Personnel handling this material must consider these data only as supplemental to other information gathered by them and must make independent determinations of this suitability and completeness of information from all sources to assure proper use and disposal of the materials and the safety and health of employees and customers. ICN assumes no additional liability or responsibility resulting from the use of, or reliance on this information.

CHEMTREC **1-800-424-9300**

NATIONAL RESPONSE CENTER **1-800-424-8802**

ACROS ORGANICS
HELP CATALOGS SEARCH ORDER LIST CONTENTS

MATERIAL SAFETY DATA SHEET

Phenanthrene, 98+%
96981

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Phenanthrene, 98+%

Company Identification: Acros Organics N.V.
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
85-01-8	Phenanthrene	>98.0	201-581-5

Hazard Symbols: T
Risk Phrases: 45

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: brown.
Caution! May cause respiratory tract irritation. May cause allergic skin reaction. May cause digestive tract irritation. Cancer suspect agent. May cause eye and skin irritation. Powdered material may form explosive dust-air mixtures.
Target Organs: None.

Potential Health Effects

Eye:
May cause eye irritation.

Skin:
May cause skin irritation. May cause photosensitization in certain individuals.

Ingestion:
May cause irritation of the digestive tract.

Inhalation:
Inhalation of dust may cause respiratory tract irritation.

Chronic:
No information found.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid immediately.

Skin:
Get medical aid. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion:
If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation:
Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:
Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media:
Use water spray or dry chemical.

Autoignition Temperature: Not available.

Flash Point: Not available.

(estimated) Health: 1; Flammability: 1; Reactivity: 0

Explosion Limits, Lower: Not available.
Upper: Not available.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:
Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

Storage:
Keep container closed when not in use. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

+----------+----------+----------+----------+

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Phenanthrene	as benzene solubles: 0.2 mg/m3 (listed under COAL TAR PITCHES).	none listed	benzene soluble fraction: 0.2 mg/m3 TWA (includes anthracene, BaP, phenanthrene, acridine, chrysene, and pyrene) (listed under COAL TAR PITCHES).

OSHA Vacated PELs:
Phenanthrene:
benzene soluble fraction: 0.2 mg/m3 TWA (anthracene, BaP, phenathrene, acridine, (listed under COAL TAR PITCHES)

Personal Protective Equipment

Eyes:
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:
Wear appropriate protective gloves to prevent skin exposure.

Clothing:
Wear appropriate protective clothing to prevent skin exposure.

Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Solid
Appearance:	brown
Odor:	None reported
pH:	Not available.
Vapor Pressure:	1 mm Hg @116c
Vapor Density:	Not available.
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	340 deg C
Freezing/Melting Point:	101 deg C
Decomposition Temperature:	Not available.
Solubility:	insoluble
Specific Gravity/Density:	1.0630g/cm3
Molecular Formula:	C14H10
Molecular Weight:	178.23

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:

Incompatible materials, dust generation, strong oxidants.
Incompatibilities with Other Materials:
Strong oxidizing agents.
Hazardous Decomposition Products:
Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 85-01-8: SF7175000
LD50/LC50:
CAS# 85-01-8: Oral, mouse: LD50 = 700 mg/kg.
Carcinogenicity:
Phenanthrene -
ACGIH: Benzene solubles: A1-confirmed human carcinogen (listed as
NIOSH: occupational carcinogen (listed as COAL TAR PITCHES)
NTP: Known carcinogen (listed as COAL TAR PITCHES).
OSHA: Select carcinogen (listed as COAL TAR PITCHES).
IARC: Group 3 carcinogen
Epidemiology:
No data available.
Teratogenicity:
No data available.
Reproductive Effects:
No data available.
Neurotoxicity:
No data available.
Mutagenicity:
No data available.
Other Studies:
No data available.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
Not available.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants:
None listed.
RCRA D-Series Chronic Toxicity Reference Levels: None
listed.
RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: None listed.
Not listed as a material banned from land disposal
according to RCRA.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
No information available
IMO
Not regulated as a hazardous material.
IATA
Not regulated as a hazardous material.
RID/ADR
Not regulated as a hazardous material.
Canadian TDG
No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA

CAS# 85-01-8 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA

Section 302 (RQ)

CAS# 85-01-8: final RQ = 5000 pounds (2270 kg)

Section 302 (TPQ)

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 85-01-8: acute.

Section 313

This material contains Phenanthrene (CAS# 85-01-8, 98 0%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 85-01-8 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

Phenanthrene can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, (listed as COAL TAR PITCHES), Massachusetts.

California No Significant Risk Level:

None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T

Risk Phrases:

R 45 May cause cancer.

Safety Phrases:

S 24/25 Avoid contact with skin and eyes.

WGK (Water Danger/Protection)

CAS# 85-01-8: No information available.

Canada

CAS# 85-01-8 is listed on Canada's DSL/NDSL List.
This product has a WHMIS classification of D2B.
CAS# 85-01-8 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 85-01-8 (listed as coal tar pitches): OEL-UNITED KINGDOM:TWA 0.14 mg/m3 JANUARY 1993. OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check A CGIH TLV. OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 2/01/1996 Revision #1 Date: 7/14/1998

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Back to product information.

ACROS ORGANICS
HELP CATALOGS SEARCH ORDER LIST CONTENTS

MATERIAL SAFETY DATA SHEET

Fluoranthene, 98%
80991

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Fluoranthene, 98%

Company Identification: Acros Organics N.V.
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
206-44-0	Fluoranthene, 98%		205-912-4

Hazard Symbols: XN
Risk Phrases: 21/22

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW
Appearance: yellow fine fluffy powder.

Target Organs: None.

Potential Health Effects
The toxicological properties of this material have not been investigated. Use appropriate procedures to prevent opportunities for direct contact with the skin or eyes and to prevent inhalation.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids.
Skin:
Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.
Ingestion:

Do NOT induce vomiting. Allow the victim to rinse his mouth and then to drink 2-4 cupfuls of water, and seek medical advice.

Inhalation:
Remove from exposure to fresh air immediately.

Notes to Physician:
Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media:
In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.

Autoignition Temperature: Not available.
Flash Point: Not available.
NFPA Rating: Not published.
Explosion Limits, Lower: Not available.
Upper: Not available.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:
Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Avoid contact with eyes, skin, and clothing. Avoid ingestion and inhalation.

Storage:
Store in a cool, dry place. Keep container closed when not in use.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits. Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Fluoranthene, 98%	none listed	none listed	none listed

OSHA Vacated PELs:
Fluoranthene, 98%:
No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:

Wear safety glasses and chemical goggles if splashing is possible.

Skin:

Wear appropriate protective gloves and clothing to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to minimize contact with skin.

Respirators:

Wear a NIOSH/MSHA or European Standard EN 149 approved full-facepiece airline respirator in the positive pressure mode with emergency escape provisions.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Not available.
Appearance:	yellow
Odor:	None reported.
pH:	Not available.
Vapor Pressure:	Not available.
Vapor Density:	Not available.
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	384 deg C @ 760.00mmHg
Freezing/Melting Point:	107.00 - 110.00 deg C
Decomposition Temperature:	Not available.
Solubility:	insoluble
Specific Gravity/Density:	Not available.
Molecular Formula:	C16H10
Molecular Weight:	202.25

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Incompatible materials, strong oxidants.
Incompatibilities with Other Materials:
Strong oxidizing agents.
Hazardous Decomposition Products:
Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 206-44-0: LL4025000
LD50/LC50:
CAS# 206-44-0: Oral, rat: LD50 = 2 gm/kg; Skin, rabbit: LD50 = 3180 mg/kg.
Carcinogenicity:
Fluoranthene, 98% -
IARC: Group 3 carcinogen

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
Not available.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants:
None listed.
RCRA D-Series Chronic Toxicity Reference Levels: None listed.
RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 206-44-0: waste number U120.
CAS# 206-44-0 is banned from land disposal according to RCRA.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
No information available
IMO
Not regulated as a hazardous material.
IATA
Not regulated as a hazardous material.
RID/ADR
Not regulated as a hazardous material.
Canadian TDG
No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL
TSCA
CAS# 206-44-0 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA
Section 302 (RQ)
CAS# 206-44-0: final RQ = 100 pounds (45.4 kg)
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 206-44-0: acute.
Section 313
No chemicals are reportable under Section 313.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 206-44-0 is listed as a Priority Pollutant under the Clean Water Act.
CAS# 206-44-0 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
Fluoranthene, 98% can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.

California No Significant Risk Level:
None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN

Risk Phrases:

R 21/22 Harmful in contact with skin and if swallowed.

Safety Phrases:

S 22 Do not inhale dust.

S 24/25 Avoid contact with skin and eyes.

WGK (Water Danger/Protection)

CAS# 206-44-0: No information available.

Canada

None of the chemicals in this product are listed on the DSL/NDSL list.

WHMIS: Not available.

CAS# 206-44-0 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 3/01/1994 Revision #2 Date: 9/02/1997

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Back to product information.

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 8/11/93

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

821051

Product Name:
Pyrene
Synonyms:
N/A
Chemical Family:
Aromatic
Formula:
$C_{16}H_{10}$
Molecular Weight.:
202.26

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Pyrene	129-00-0	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
IRRITATING TO SKIN, EYES AND MUCOUS MEMBRANES.
MAY BE HARMFUL IF SWALLOWED.

Appearance:
Colorless-yellowish powder with practically no odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
May be harmful if swallowed. Irritating on contact with skin, eyes or mucous membranes.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.
IARC Cancer Review: Animal, No Evidence

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Immediately flush thoroughly with large amounts of water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flash Point (F): N/A
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Water spray jet, CO_2, foam, dry powder

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:
Thermal decomposition produces toxic fumes.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described

under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store at controlled room temperature. Do not breathe dust or vapor. Do not get in eyes, on skin, or on clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves should be worn to prevent skin contact (Neoprene or equivalent) Safety glasses with side shields should be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Pyrene							

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Pyrene							

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 360C
Melting Point (C) : 150C
Specific Gravity (H_20 = 1) : 1.3
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%): N/A
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A

Solubility in Water (%) : Insoluble
Appearance :
Colorless-yellowish powder with practically no odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
CO_x

Conditions to Avoid:
None indicated

Materials To Avoid:

```
( ) Water
( ) Acids
( ) Bases
( ) Corrosives
( ) Oxidizers
(X) Other: none indicated
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-mus LD50: 800 mg/kg
```

Toxicological Findings:
Tests on laboratory animals indicate material may produce adverse mutagenic effects and cause tumors.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

```
EPA Waste Numbers:
```

Treatment:
Material does not have an EPA Waste number and is not a listed waste, however consultation with a permitted waste disposal site (TSD) should be accomplished.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

|13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Environmentally Hazardous Substance, Solid, n.o.s. (Pyrene)

DOT ID Number :
UN3077

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Pyrene	Y	1000/10000	5000

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Pyrene	Y		

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 1
Flammability : 0
Reactivity : 0
Special Hazards :

Revision History: 4/28/88 3/1/91 8/15/91

| = Revised Section

N/A = Not Available

N/E = None Establised

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ACROS ORGANICS

HELP CATALOGS SEARCH ORDER LIST CONTENTS

MATERIAL SAFETY DATA SHEET

1,2-Benzanthracene, 99%
50930

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: 1,2-Benzanthracene, 99%

```
     Tetraphene, Benz[a]anthracene
Company Identification:  Acros Organics N.V.
                         One Reagent Lane
                         Fairlawn, NJ  07410 .
For information in North America, call:   800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300
```

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
56-55-3	1,2-Benzanthracene, 99%		200-280-6

Hazard Symbols: T
Risk Phrases: 45

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: slightly beige.
Cancer suspect agent.
Target Organs: None.

Potential Health Effects
The toxicological properties of this material have not been investigated. Use appropriate procedures to prevent opportunities for direct contact with the skin or eyes and to prevent inhalation.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids.
Skin:
Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.
Ingestion:
Do NOT induce vomiting. Allow the victim to rinse his mouth and then

to drink 2-4 cupfuls of water, and seek medical advice.

Inhalation:
Remove from exposure to fresh air immediately.

Notes to Physician:
Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.

Extinguishing Media:
In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.

Autoignition Temperature: Not available.
Flash Point: Not available.
NFPA Rating: Not published.
Explosion Limits, Lower: Not available.
Upper: Not available.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:
Sweep up, then place into a suitable container for disposal.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Not available.

Storage:
Not available.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
1,2-Benzanthracene, 99%	none listed	none listed	none listed

OSHA Vacated PELs:
1,2-Benzanthracene, 99%:
No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:
Wear safety glasses and chemical goggles if splashing is possible.

Skin:
Wear appropriate protective gloves and clothing to prevent skin exposure.

Clothing:
Wear appropriate protective clothing to minimize

contact with skin.

Respirators:

Wear a NIOSH/MSHA or European Standard EN 149 approved full-facepiece airline respirator in the positive pressure mode with emergency escape provisions.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Not available.
Appearance:	slightly beige
Odor:	None reported.
pH:	Not available.
Vapor Pressure:	Not available.
Vapor Density:	Not available.
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	437.6 deg C @ 760.00mmHg
Freezing/Melting Point:	157.00 - 159.00 deg C
Decomposition Temperature:	Not available.
Solubility:	insoluble
Specific Gravity/Density:	Not available.
Molecular Formula:	C18H12
Molecular Weight:	228.29

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Not available.
Incompatibilities with Other Materials:
Strong oxidizing agents.
Hazardous Decomposition Products:
Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 56-55-3: CV9275000
LD50/LC50:
Not available.
Carcinogenicity:
1,2-Benzanthracene, 99% -
ACGIH: A2-suspected human carcinogen
California: carcinogen - initial date 7/1/87
NTP: Suspect carcinogen
OSHA: Possible Select carcinogen
IARC: Group 2A carcinogen

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
Not available.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants:
None listed.
RCRA D-Series Chronic Toxicity Reference Levels: None listed.

RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 56-55-3: waste number U018.
CAS# 56-55-3 is banned from land disposal according to RCRA.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
Shipping Name: TOXIC SOLID, ORGANIC, N.O.S.*
Hazard Class: 6.1
UN Number: 2811
Packing Group: I

IMO
Shipping Name: TOXIC SOLID, ORGANIC, N.O.S.
Hazard Class: 6.1
UN Number: 2811
Packing Group: I

IATA
Shipping Name: TOXIC SOLID, ORGANIC, N.O.S.*
Hazard Class: 6.1
UN Number: 2811
Packing Group: I

RID/ADR
Shipping Name: TOXIC SOLID, ORGANIC, N.O.S.
Dangerous Goods Code: 6.1(25A)
UN Number: 2811

Canadian TDG
No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA
CAS# 56-55-3 is listed on the TSCA inventory.

Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.

Section 12b
None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.

SARA

Section 302 (RQ)
CAS# 56-55-3: final RQ = 10 pounds (4.54 kg)

Section 302 (TPQ)
None of the chemicals in this product have a TPQ.

Section 313
This chemical is not at a high enough concentration to be reportable under Section 313.
No chemicals are reportable under Section 313.

Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 56-55-3 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.

STATE
1,2-Benzanthracene, 99% can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.
The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:
WARNING: This product contains 1,2-Benzanthracene, 99%, a chemical known to the state of California to cause cancer.
California No Significant Risk Level:
None of the chemicals in this product are listed.

European/International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols: T
Risk Phrases:
R 45 May cause cancer.
Safety Phrases:
S 45 In case of accident of if you feel unwell, seek medical advice immediately (show the label where possible).
S 53 Avoid exposure - obtain special instructions before use.

WGK (Water Danger/Protection)
CAS# 56-55-3: No information available.

Canada
None of the chemicals in this product are listed on the DSL/NDSL list.
This product has a WHMIS classification of D2A.
CAS# 56-55-3 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits
CAS# 56-55-3:. OEL-FRANCE;Carcinogen

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 3/01/1994 Revision #2 Date: 9/02/1997

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Back to product information.

Please reduce your browser font size for better viewing and printing.

MSDS *Material Safety Data Sheet*

From: Mallinckrodt Baker, Inc.
222 Rod School Lane
Phillipsburg, NJ 08865

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

1,2,4-Trichlorobenzene

MSDS Number: T4875 --- *Effective Date: 12/08/96*

1. Product Identification

Synonyms: unsym-Trichlorobenzene
CAS No.: 120-82-1
Molecular Weight: 181.45
Chemical Formula: C6H3Cl3
Product Codes: 9444

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
1,2,4-Trichlorobenzene	120-82-1	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

CAUTION! MAY CAUSE IRRITATION.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 1 - Slight
Reactivity Rating: 1 - Slight
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT
Storage Color Code: Orange (General Storage)

Potential Health Effects

Inhalation:
None identified.

Ingestion:
None identified.

Skin Contact:
Irritation, prolonged contact may cause skin sensitization.

Eye Contact:
Irritation.

Chronic Exposure:
No information found.

Aggravation of Pre-existing Conditions:
No information found.

4. First Aid Measures

Inhalation:
If a person breathes in large amounts, move the exposed person to fresh air.

Ingestion:
If large amounts were swallowed, give water to drink and get medical advice.

Skin Contact:
In case of contact, immediately wash skin with plenty of soap and water for at least 15 minutes.

Eye Contact:
In case of eye contact, immediately flush with plenty of water for at least 15 minutes.

5. Fire Fighting Measures

Fire:
Flash point: 110C (230F) CC Flammable limits in air % by volume: lel: 2.5; uel: 6.6

Explosion:
No information found.

Fire Extinguishing Media:
Use extinguishing media appropriate for surrounding fire.

Special Information:
Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode.

---

6. Accidental Release Measures

Wear suitable protective clothing. Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush spill area with water.

---

7. Handling and Storage

Keep container tightly closed. Suitable for any general chemical storage area. Product may solidify at room temperature. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL): 5 ppm (TWA) -ACGIH Threshold Limit Value (TLV): 5 ppm (TWA) TLV listed denotes ceiling limit.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
For conditions of use where exposure to the substance is apparent, consult an industrial

hygienist. For emergencies, or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear protective gloves and clean body-covering clothing.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Clear, nearly colorless liquid.

Odor:
Aromatic odor.

Solubility:
Negligible (<0.1%)

Specific Gravity:
1.45

pH:
No information found.

% Volatiles by volume @ 21C (70F):
100

Boiling Point:
213C (415F)

Melting Point:
17C (63F)

Vapor Density (Air=1):
6.2

Vapor Pressure (mm Hg):
Not applicable.

Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:
Hydrogen chloride, carbon monoxide, carbon dioxide.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Strong oxidizing agents.

Conditions to Avoid:
Heat, flame, other sources of ignition.

11. Toxicological Information

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
1,2,4-Trichlorobenzene (120-82-1)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.

Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TRICHLOROBENZENES, LIQUID
Hazard Class: 6.1
UN/NA: UN2321
Packing Group: III
Information reported for product/size: 4L

International (Water, I.M.O.)

Proper Shipping Name: TRICHLOROBENZENES, LIQUID
Hazard Class: 6.1
UN/NA: UN2321
Packing Group: III
Information reported for product/size: 4L

International (Air, I.C.A.O.)

Proper Shipping Name: TRICHLOROBENZENES, LIQUID
Hazard Class: 6.1
UN/NA: UN2321
Packing Group: III
Information reported for product/size: 4L

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\--------

Ingredient	TSCA	EC	Japan	Australia
1,2,4-Trichlorobenzene (120-82-1)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\--------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
1,2,4-Trichlorobenzene (120-82-1)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\--------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
1,2,4-Trichlorobenzene (120-82-1)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\--------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
1,2,4-Trichlorobenzene (120-82-1)	100	No	No

Chemical Weapons Convention: No TSCA 12(b): Yes CDTA: No

```
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: No  Pressure: No
Reactivity: No          (Pure / Liquid)
```

Australian Hazchem Code: 2Z
Poison Schedule: No information found.

WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: 2 **Flammability:** 1 **Reactivity:** 0

Label Hazard Warning:
CAUTION! MAY CAUSE IRRITATION.

Label Precautions:
During use avoid contact with eyes, skin, clothing.. Wash thoroughly after handling. When not in use keep in tightly closed container.

Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes.

Product Use:
Laboratory Reagent.

Revision Information:
Pure. New 16 section MSDS format, all sections have been revised.

Disclaimer:
****
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INFORMATION.

****

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 9/9/97

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

6610 6650 PX0509 PX0510 PX0510MB PX0514 PX0515

Product Name:
Phenol
Synonyms:
Carbolic Acid
Chemical Family:
Aromatic Acid
Formula:
C_6H_5OH
Molecular Weight.:
94.11

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Phenol	108-95-2	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
Hazardous Liquid Or Solid.
CAUSES SEVERE BURNS.
HARMFUL IF INHALED, SWALLOWED OR ABSORBED THROUGH SKIN.
COMBUSTIBLE LIQUID AND VAPOR.
May Cause Damage To Central Nervous System, Kidneys, Liver, Pancreas, Heart, Spleen and Lungs.

Appearance:
Colorless or white to reddish crystals; medicinal odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Highly toxic by inhalation, ingestion or skin contact. Causes burns on contact. The skin may turn white, and later yellowish-brown and may be deeply eroded and scarred. Can cause headache, dizziness, muscle weakness, convulsions and death (ingestion of 1.5 grams has killed). Absorption of phenolic solutions through the skin may be very rapid, and can cause death within 30 minutes to several hours by exposure of as little as 64 square inches of skin. May cause damage to Central Nervous System (CNS), kidneys, liver, pancreas, heart, spleen and lungs.

Medical Cond. Aggravated by Exposure:
Liver, kidney, CNS, respiratory,
pancreatic, and circulatory conditions.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Immediately flush thoroughly with large amounts of water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: Do not induce vomiting; get immediate medical attention.
Remove contaminated clothing and wash before reuse.

5. FIRE FIGHTING MEASURES

Flash Point (F): 175F (cc)
Flammable Limits LEL (%): 1.80
Flammable Limits UEL (%): 8.60
Extinguishing Media:
Use water spray, foam, dry chemical, or CO_2.

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:
Dangerous fire and explosive hazard. Potentially explosive reaction with aluminum chloride + nitromethane (at 110C/100

bar); formaldehyde; peroxydisulfuric acid; peroxymonosulfuric acid; sodium nitrite + heat. Violent reaction with aluminum chloride + nitrobenzene (at 120C); sodium nitrate + trifluoroacetic acid; butadiene.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container tightly closed and protected against physical damage. Store in a cool, dry, well-ventilated area away from ignition sources and oxidizers. Do not breathe dust or vapor. Do not get in eyes, on skin, or on clothing. Retained residue may make empty containers hazardous; use caution!

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves must be worn to prevent skin contact (Neoprene or equivalent) Safety glasses with side shields must be worn at all times. Impervious protective clothing should be worn to prevent skin contact.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Phenol	5	19					X

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Phenol	5	19					X

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 181C
Melting Point (C) : 40.6C
Specific Gravity (H_20 = 1) : 1.07
Vapor Pressure (mm Hg) : 1.0 40C
Percent Volatile by vol (%): 100%
Vapor Density (Air = 1) : 3.2
Evaporation Rate (BuAc = 1): 0.01
Solubility in Water (%) : Miscible
Appearance :
Colorless or white to reddish crystals; medicinal odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
CO_x

Conditions to Avoid:
Heat above 100F (material discolors)

Materials To Avoid:

```
( ) Water
(X) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Al, Mg, Pb and Zn are quickly attacked by
hot phenol  Calcium hypochlorite, alkalies,
acetaldehyde
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-rat LD50: 317 mg/kg     ivn-mus LD50: 112 mg/kg
ihl-mus LC50: 177 mg/cu.m.
```

Toxicological Findings:
Tests on laboratory animals indicate material may cause tumors
and produce adverse mutagenic and reproductive effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: U188

Treatment:
Specified Technology - Incineration to a level below TCA (Total Constituent Analyses) levels. Contact your local permitted waste disposal company (TSD) for permissible treatment site.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Phenol, Solid

DOT ID Number :
UN1671

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Phenol	Y	500/10000	1000

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Phenol	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

```
Health          : 3
Flammability    : 2
Reactivity      : 0
Special Hazards :
```

Revision History: 11/1/81 5/1/84 10/27/87 3/21/88 3/1/91 5/1/93 1/25/94 5/26/94 1/12/96

| = Revised Section

N/A = Not Available

N/E = None Establised

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ACROS ORGANICS

HELP · CATALOGS · SEARCH · ORDER LIST CONTENTS

MATERIAL SAFETY DATA SHEET

Chrysene, 98%
95251

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Chrysene, 98%

```
     1,2 Benzophenanthrene; Benzo(a)phenanthrene.
Company Identification:  Acros Organics N.V.
                         One Reagent Lane
                         Fairlawn, NJ  07410
For information in North America, call:   800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300
```

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
218-01-9	Chrysene, 98%	98%	205-923-4

Hazard Symbols: T
Risk Phrases: 45

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: very light beige.
Caution! Carcinogen. Mutagen. May cause eye and skin irritation. May cause respiratory and digestive tract irritation. May cause cancer in humans.
Target Organs: Liver, skin.

Potential Health Effects

Eye:
May cause eye irritation.

Skin:
May cause skin irritation.

Ingestion:
May cause gastrointestinal irritation with nausea, vomiting and diarrhea.

Inhalation:
May cause respiratory tract irritation.

Chronic:
May cause cancer in humans. May cause cancer according to animal studies.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid.

Skin:
Get medical aid. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion:
Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation:
Get medical aid immediately. Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Notes to Physician:
Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media:
In case of fire use water spray, dry chemical, carbon dioxide, or chemical foam.

Autoignition Temperature: Not available.
Flash Point: Not available.
NFPA Rating: Not published.
Explosion Limits, Lower: Not available.
Upper: Not available.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:
Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Wear a self contained breathing apparatus and appropriate Personal protection. (See Exposure Controls, Personal Protection section).

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Wash thoroughly after handling. Wash hands before eating. Use only in a well ventilated area. Do not breathe dust, vapor, mist, or gas. Do not get on skin or in eyes. Do not ingest or inhale.

Storage:
Store in a cool, dry place. Store in a tightly closed container.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Chrysene, 98%	as benzene solubles: 0.2 mg/m3 (listed under COAL TAR PITCHES).	none listed	benzene soluble fraction: 0.2 mg/m3 TWA (includes anthracene, BaP, phenanthrene, acridine, chrysene, and pyrene) (listed under COAL TAR PITCHES).

OSHA Vacated PELs:
Chrysene, 98%:
benzene soluble fraction: 0.2 mg/m3 TWA (anthracene, BaP, phenathrene, acridine, (listed under COAL TAR PITCHES)

Personal Protective Equipment

Eyes:
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:
Wear appropriate protective gloves to prevent skin exposure.

Clothing:
Wear appropriate protective clothing to prevent skin exposure.

Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Solid
Appearance:	very light beige
Odor:	Not available.
pH:	Not available.
Vapor Pressure:	Not available.
Vapor Density:	Not available.
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	448 deg C @ 760.00mm Hg
Freezing/Melting Point:	254 - 255 deg C
Decomposition Temperature:	Not available.
Solubility:	insoluble
Specific Gravity/Density:	Not available.
Molecular Formula:	C18H12
Molecular Weight:	228.29

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:

Stable under normal temperatures and pressures.
Conditions to Avoid:
Incompatible materials, dust generation.
Incompatibilities with Other Materials:
Strong oxidizing agents.
Hazardous Decomposition Products:
Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 218-01-9: GC0700000
LD50/LC50:
Not available.
Carcinogenicity:
Chrysene, 98% -
ACGIH: A3 - Animal Carcinogen
California: carcinogen - initial date 1/1/90
NIOSH: occupational carcinogen (listed as COAL TAR PITCHES)
NTP: Known carcinogen (listed as COAL TAR PITCHES).
OSHA: Select carcinogen (listed as COAL TAR PITCHES).
IARC: Group 3 carcinogen
Mutagenicity:
Chrysene was mutagenic to S. Typhimurium in the presence of an exogenous metabolic system.
Other Studies:
Genotoxicity : Salmonella typhimurium TA97,TA98,TA100 with m etabolic activation positive (Sakai.M.et al Mutat.Res. 198 5); Saccharomyces cerrevisae (Miotic recombination) D3 str ain 330mg/kg negative.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
Fish toxicity : LC50 (96hr) Neauthes arenacedentata >1ppm.(Rossi,S.S. et al Marine Pollut. Bull. 1978) Invertebrate toxicity : lethal treshold concentration (24hr) Daphnia Magna 0,7|g/l.(* Newsted,J.L. et al Environ. Toxicol. Chem. 1987) Bioaccumulation : 24hr Daphnia Magna log bioconcentration factor 3.7845 (*)
Environmental Fate:
Degradation studies : biodegradated by white rot fungus (Proc.Annu.Meet.Am.Wood-Preserv.Assoc. 1989) May be utilised by axenic cultures of microorganisms e.g. Pseudomonas pancimobilis EPA505, which may have novel degradative systems (Mueller,J.G. et al Appl.Environ.Microbiol.1990; Mueller, J.G. et al Environ.Sci.Technol.1991)

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants:
None listed.
RCRA D-Series Chronic Toxicity Reference Levels: None listed.
RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 218-01-9: waste number U050.
CAS# 218-01-9 is banned from land disposal according to RCRA.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
No information available
IMO
Not regulated as a hazardous material.
IATA
Not regulated as a hazardous material.
RID/ADR
Not regulated as a hazardous material.
Canadian TDG
No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL
TSCA
CAS# 218-01-9 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA
Section 302 (RQ)
CAS# 218-01-9: final RQ = 100 pounds (45.4 kg)
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
Section 313
This material contains Chrysene, 98% (CAS# 218-01-9, 98%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 218-01-9 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
Chrysene, 98% can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.
The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:
WARNING: This product contains Chrysene, 98%, a chemical known to the state of California to cause cancer.
California No Significant Risk Level:
None of the chemicals in this product are listed.
European/International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols: T
Risk Phrases:
R 45 May cause cancer.
Safety Phrases:

S 45 In case of accident of if you feel unwell, seek medical advice immediately (show the label where possible).
S 53 Avoid exposure - obtain special instructions before use.

WGK (Water Danger/Protection)
CAS# 218-01-9: No information available.

Canada
CAS# 218-01-9 is listed on Canada's DSL/NDSL List.
WHMIS: Not available.
CAS# 218-01-9 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits
CAS# 218-01-9:. OEL-AUSTRALIA;Carcinogen. OEL-BELGIUM;Carcinogen -GERMANY;Carcinogen. OEL-SWITZERLAND;Carcinogen. OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV. OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 6/19/1995 Revision #2 Date: 9/02/1997

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Back to product information.

ACROS ORGANICS

HELP CATALOGS SEARCH ORDER LIST CONTENTS

MATERIAL SAFETY DATA SHEET

Di-n-octyl phthalate, 95% (gc)
59857

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Di-n-octyl phthalate, 95% (gc)

Company Identification: Acros Organics N.V.
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
117-84-0	Di-n-octyl phthalate		204-214-7

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Not available.
Appearance: Not available.
Not available.
Target Organs: None.

Potential Health Effects
The toxicological properties of this material have not been investigated. Use appropriate procedures to prevent opportunities for direct contact with the skin or eyes and to prevent inhalation.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid immediately.

Skin:
Get medical aid. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and shoes.

Ingestion:
If victim is conscious and alert, give 2-4 cupfuls of milk or water.

Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store in a cool area away from ignition sources and oxidizers. Generation of dust from application to granular, stick, sheet or strip form causes fire and explosion hazard. Do not breathe dust. Do not get in eyes, on skin, or on clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves should be worn to prevent skin contact (Neoprene or equivalent) Safety glasses with side shields should be worn at all times. Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Zinc							

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Zinc							

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 907C
Melting Point (C) : 419C
Specific Gravity (H_2O = 1) : 7.14
Vapor Pressure (mm Hg) : 1 487C
Percent Volatile by vol (%): N/A
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :
Gray, odorless, granular, sticks, strips, sheets

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
Explosive hydrogen gas, zinc oxide

Conditions to Avoid:
Heat, open flame, moisture. Generation of dust from any application done to granular, stick, strip or sheet form.

Materials To Avoid:

```
(X) Water
(X) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Halogenated hydrocarbons, Strong alkalies,
Alkali hydroxides
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
ihl-hmn TCLo: 124/mg/cu.m./50M
(toxic effect on respiratory and pulmonary systems)
```

Toxicological Findings:
None
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

```
EPA Waste Numbers:
```

Get medical aid immediately.

Inhalation:

Get medical aid immediately. Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Notes to Physician:

Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media:

Use agent most appropriate to extinguish fire.

Autoignition Temperature: Not available.

Flash Point: 199 deg C (390.20 deg F)

NFPA Rating: health-0; flammability-1; reactivity-0

Explosion Limits, Lower: Not available.
Upper: Not available.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Clean up spills immediately, observing precautions in the Protective Equipment section.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:

Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Avoid contact with eyes, skin, and clothing. Avoid ingestion and inhalation.

Storage:

Store in a cool, dry place. Keep container closed when not in use.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:

Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Di-n-octyl phthalate	none listed	none listed	none listed

OSHA Vacated PELs:

Di-n-octyl phthalate:

No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:

Wear chemical goggles.

Skin:

Wear appropriate protective gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to minimize contact with skin.

Respirators:

A respiratory protection program that meets OSHA's 29 CFR |1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Not available.
Appearance:	Not available.
Odor:	Not available.
pH:	Not available.
Vapor Pressure:	Not available.
Vapor Density:	Not available.
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	228 deg C @ 1.00mm Hg
Freezing/Melting Point:	0 deg C
Decomposition Temperature:	Not available.
Solubility:	Not available.
Specific Gravity/Density:	.9820g/cm3
Molecular Formula:	C24H38O4
Molecular Weight:	390.55

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Incompatible materials, strong oxidants.
Incompatibilities with Other Materials:
Not available.
Hazardous Decomposition Products:
Irritating and toxic fumes and gases.
Hazardous Polymerization: Not available.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 117-84-0: TI1925000
LD50/LC50:
CAS# 117-84-0: Oral, mouse: LD50 = 6513 mg/kg; Oral, rat: LD50 = 47 gm/kg.
Carcinogenicity:
Di-n-octyl phthalate -
Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants:
None listed.
RCRA D-Series Chronic Toxicity Reference Levels: None listed.
RCRA F-Series: None listed.

RCRA P-Series: None listed.
RCRA U-Series: CAS# 117-84-0: waste number U107.
CAS# 117-84-0 is banned from land disposal according to RCRA.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
No information available
IMO
Not regulated as a hazardous material.
IATA
Not regulated as a hazardous material.
RID/ADR
Not regulated as a hazardous material.
Canadian TDG
No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL
TSCA
CAS# 117-84-0 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA
Section 302 (RQ)
CAS# 117-84-0: final RQ = 5000 pounds (2270 kg)
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
Section 313
No chemicals are reportable under Section 313.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 117-84-0 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
Di-n-octyl phthalate can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.
California No Significant Risk Level:
None of the chemicals in this product are listed.
European/International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols: Not available.
Risk Phrases:
Safety Phrases:
S 24/25 Avoid contact with skin and eyes.

WGK (Water Danger/Protection)
CAS# 117-84-0: 3
Canada
CAS# 117-84-0 is listed on Canada's DSL/NDSL List.
WHMIS: Not available.
CAS# 117-84-0 is not listed on Canada's Ingredient Disclosure List.
Exposure Limits

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 2/28/1995 Revision #1 Date: 3/04/1996

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Back to product information.

MONSANTO -- AROCLOR 1232
MATERIAL SAFETY DATA SHEET
NSN: 681000F008537
Manufacturer's CAGE: 76541
Part No. Indicator: A
Part Number/Trade Name: AROCLOR 1232

General Information

Company's Name: MONSANTO COMPANY
Company's Street: 800 N. LINDBERGH BLVD.
Company's City: ST. LOUIS
Company's State: MO
Company's Zip Code: 63167
Company's Emerg Ph #: (314) 694-1000
Company's Info Ph #: (314) 694-1000
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Date MSDS Prepared: 01OCT88
Safety Data Review Date: 07JUL89
MSDS Preparer's Name: JOHN H. CRADDOCK
Preparer's Company: MONSANTO COMPANY
Preparer's St Or P. O. Box: 800 N. LINDBERGH BLVD.
Preparer's City: ST. LOUIS
Preparer's State: MO
Preparer's Zip Code: 63167
MSDS Serial Number: BGYFN

Ingredients/Identity Information

Proprietary: NO
Ingredient: AROCLOR 1232 (SARA III)
Ingredient Sequence Number: 01
Percent: 42%
NIOSH (RTECS) Number: TQ1354000
CAS Number: 11141-16-5
OSHA PEL: NOT ESTABLISHED
ACGIH TLV: NOT ESTABLISHED
Other Recommended Limit: 0.001 MG/CUM NIOSH

Physical/Chemical Characteristics

Appearance And Odor: (APHA) 100, MOBIL OIL
Boiling Point: 290-325C
Melting Point: 238C
Vapor Pressure (MM Hg/70 F): 0.005
Specific Gravity: 1.27-1.28
Solubility In Water: INERT

Fire and Explosion Hazard Data

Flash Point: 152-154C
Extinguishing Media: PCBS ARE FIRE-RESISTANT COMPOUNDS. AT TEMPERATURESRANGE 600-650C IN PRESENCE OR OXYGEN PCBS MAY FORM (PCDFS).
Special Fire Fighting Proc: PCBS IN ELECTRICAL EQUIPMENT HAVE BEEN REPORTED TO PRODUCE BOTH CHLORINATED DIOXINS (PCDDS) & FURANS (PCDFS) DURING FIRE SITUATIONS.
Unusual Fire And Expl Hazrds: FIRE FIGHTING EQUIPMENT SHOULD BE THOROUGHLY CLEANED & DECONTAMINATED AFTER USE. WEAR SCBA.

Reactivity Data

Stability: YES

Materials To Avoid: FIRE-RESISTANT COMPOUNDS
Hazardous Decomp Products: CO, CO2, HCI, PHENOLICS, ALDEHYDES, HYDROCHLORIC ACID, RESPIRATORY IRRITANT.
Hazardous Poly Occur: NO

Health Hazard Data

LD50-LC50 Mixture: ACUTE ORAL LD50 (RATS) 8.65 GM/KG
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: SKIN: PCBS CAN BE ABSORBED. SUBSEQUENT DRYING & CRACKING. POTENTIAL FOR CONTRACTING CHLORACNE. EYE: IRRITATING TO TISSUES. INGESTION: SLIGHTLY TOXIC. INHALATION: 54% CHLORINATED MATERIAL PRODUCES MORE LIVE INJURY THAT THE 42% CHLORINATED MATERIAL.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NONE
Signs/Symptoms Of Overexp: SKIN: PCBS CAN BE ABSORBED. DRYING & CRACKING. IRRITATION TO TISSUES. INGESTION: SLIGHT TOXIC. INHALATION: LIVER INJURY, DERMATOLOGICAL SYMPTOMS.
Emergency/First Aid Proc: INGESTION: CONSULT PHYSICIAN. DON'T INDUCE VOMITING/GIVE OILY LAXATIVES. SKIN: CONTAMINATED CLOTHING SHOULD BE REMOVED/WASHED THOROUGHLY W/SOAP & WATER. EYES: IRRIGATED W/COPIOUS QUANTITIES OF RUNNING WATER FOR AT LEAST 15 MINS. PETROLATUM-BASED OPTHALMIC OINTMENT MAY BE APPLIED TO THE EYE TO RELIEVE THE IRRITATING EFFECTS OF PCBS. INHALATION: REMOVE TO FRESH AIR. CONSULT PHYSICIAN.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: ALL NON-ESSENTIAL PERSONNEL SHOULD LEAVE THE AREA. THE AREA SHOULD BE VENTILATED TO PREVENT THE ACCUMULATION OF VAPORS. PERSONNEL SHOULD BE FURNISH W/PROTECTIVE EQUIPMENT & CLOTHING. TRAINED PERSONNEL SHOULD SHUT OFF SOURCES OF PCBS.
Waste Disposal Method: REMOVE BY ABSORPTIVE MATERIAL, SAWDUST, VERMICULITE, DRY SAND, CLAY, DIRT RESIDUES SHOULD BE COLLECTED, PLACED IN PROPER CONTAINERS, MARKED & DISPOSE BY EPA REGULATIONS, STATE & LOCAL REGULATIONS.
Precautions-Handling/Storing: AVOID: PROLONGED BREATHING OF VAPORS/MISTS. CONTACT W/EYES & SKIN. USE PROTECTIVE CLOTHING & EQUIPMENT. WASH THOROUGHLY AFTER HANDLING.
Other Precautions: CONTAMINATED CLOTHING SHOULD BE REMOVED & LAUNDERED BEFORE REUSE.

Control Measures

Respiratory Protection: AVOID BREATHING VAPOR/MIST. USE NIOSH/MSHA APPROVED EQUIPMENT WHEN AIRBORNE EXPOSURE LIMITS ARE EXCEEDED.
Ventilation: PROVIDE NATURAL/MECHANICAL VENTILATION TO KEEP <TLV.
Protective Gloves: RESISTANT
Eye Protection: GOGGLES, FACE SHIELD
Other Protective Equipment: RUBBER APRON, SAFETY SHOWER, EYE BATH.
Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING. REMOVE CONTAMINATED CLOTHING PROMPTLY/LAUNDER BEFORE REUSE.

Transportation Data

Disposal Data

Label Data

Label Required: YES
Label Status: G
Common Name: AROCLOR 1232
Special Hazard Precautions: SKIN: PCBS CAN BE ABSORBED. SUBSEQUENT DRYING & CRACKING. POTENTIAL FOR CONTRACTING CHLORACNE. EYE: IRRITATING TO TISSUES. INGESTION: SLIGHTLY TOXIC. INHALATION: 54% CHLORINATED MATERIAL PRODUCES MORE LIVE INJURY THAT THE 42% CHLORINATED MATERIAL. SKIN: PCBS CAN BE ABSORBED. DRYING & CRACKING. POTENTIAL FOR CONTRACTING CHLORACNE. HOT PCBS MAY CAUSE TERMAL BURNS. EYE: IRRITATION TO TISSUES. INGESTION: SLIGHT TOXIC. INHALATION: LIVER INJURY, DERMATOLOGICAL SYMPTOMS.
Label Name: MONSANTO COMPANY
Label Street: 800 N. LINDBERGH BLVD.
Label City: ST. LOUIS
Label State: MO
Label Zip Code: 63167
Label Emergency Number: (314) 694-1000

SUPELCO -- AROCLOR 1242, 48585
MATERIAL SAFETY DATA SHEET
NSN: 681000N059174
Manufacturer's CAGE: 54968
Part No. Indicator: A
Part Number/Trade Name: AROCLOR 1242, 48585

General Information

Company's Name: SUPELCO INC
Company's Street: SUPELCO PARK
Company's City: BELLEFONTE
Company's State: PA
Company's Country: US
Company's Zip Code: 16823-0048
Company's Emerg Ph #: 814-359-3441
Company's Info Ph #: 814-359-3441
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 04JAN90
Safety Data Review Date: 26APR95
MSDS Serial Number: BXGMZ

Ingredients/Identity Information

Proprietary: NO
Ingredient: POLYCHLORINATED BIPHENYL (AROCLOR 1242); (AROCHLOR 1242) (SARA 313) (CERCLA)
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: TQ1356000
CAS Number: 53469-21-9
OSHA PEL: S, 1 MG/M3
ACGIH TLV: S, 1 MG/M3

Physical/Chemical Characteristics

Appearance And Odor: CLEAR VISCOUS LIQUID TO STICKY SOLID.
Boiling Point: 554F,290C
Melting Point: N/A
Vapor Density (Air=1): N/A
Specific Gravity: 1.3 (WATER=1)
Evaporation Rate And Ref: NOT APPLICABLE
Solubility In Water: NOT APPLICABLE
Percent Volatiles By Volume: N/A

Fire and Explosion Hazard Data

Flash Point: NOT APPLICABLE
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: THIS MATERIAL IS NOT FLAMMABLE. DETERMINED BY SUPPORTING FIRE.
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: THE FOLLOWING TOXIC VAPORS ARE FORMED WHEN THIS MATERIAL IS HEATED TO DECOMPOSITION. HCL.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): NOT APPLICABLE
Materials To Avoid: NOT APPLICABLE

Hazardous Decomp Products: HCL
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

Health Hazard Data

LD50-LC50 Mixture: LD50(ORAL,RAT):4250 MG/KG
Route Of Entry - Inhalation: NO
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: MAY IRRITATE EYES AND/OR SKIN. IRRITATES SKIN, DERMATITIS, LIVER DAMAGE.
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: NO
IARC GROUP 2A, SUPP 7, P 322, 1984; ANTICIPATED CARCINOGEN, NTP 7TH ANN RPT.
Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: EYES:FLUSH W/WATER FOR AT LST 15 MINS. CONT MD. PETROLATUM-BASED OPHTHALMIC OINTMENT MAY BE APPLIED TO EYES TO RELIEVE IRRIT. SKIN:FLUSH W/LG VOLS OF WATER. INHAL:IMMED MOVE TO FRESH AIR. INGEST:NEVER GIVE ANYTHING BY MOUTH TO AN UNCON PERSON. NEVER TRY TO MAKE AN UNCON PERSON VOMIT. DO NOT INDUCE VOMITING. CONTACT A PHYSICIAN.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: CLEAN AREA WITH SOAP AND WATER. TAKE UP WITH ABSORBENT MATERIAL. VENTILATE AREA.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: COMPLY WITH ALL APPLICABLE FEDERAL, STATE & LOCAL REGULATIONS.
Precautions-Handling/Storing: STORE IN SEALED CONTAINER IN COOL, DRY LOCATION. THIS MATERIAL IS INTENDED FOR R&D USE ONLY AND MAY NOT BE USED FOR DRUG, HOUSEHOLD OR OTHER PURPOSES.
Other Precautions: POSSIBLE CANCER HAZARD. AVOID EYE OR SKIN CONTACT. AVOID BREATHING VAPORS.

Control Measures

Respiratory Protection: WEAR NIOSH/MSHA APPROVED RESPIRATORY PROTECTION.
Ventilation: USE ONLY IN WELL VENTILATED AREA.
Protective Gloves: IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS (FP N).
Other Protective Equipment: NONE SPECIFIED BY MANUFACTURER.
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

Transportation Data

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 26APR95
Label Status: G
Common Name: AROCLOR 1242, 48585
Chronic Hazard: YES
Signal Word: CAUTION!
Acute Health Hazard-Slight: X
Contact Hazard-Slight: X

Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: ACUTE:MAY IRRITATE EYES AND/OR SKIN. IRRITATES SKIN, DERMATITIS, LIVER DAMAGE. CHRONIC: CANCER HAZARD. AROCLOR 1242, A POLYCHLORINATED BIPHENYL (PCB), IS LISTED AS A LIVER CARCINOGEN (FP N).
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: SUPELCO INC
Label Street: SUPELCO PARK
Label City: BELLEFONTE
Label State: PA
Label Zip Code: 16823-0048
Label Country: US
Label Emergency Number: 814-359-3441

SUPELCO -- AROCLOR 1254, 48586
MATERIAL SAFETY DATA SHEET
NSN: 681000N059175
Manufacturer's CAGE: 54968
Part No. Indicator: A
Part Number/Trade Name: AROCLOR 1254, 48586

General Information

Company's Name: SUPELCO INC
Company's Street: SUPELCO PARK
Company's City: BELLEFONTE
Company's State: PA
Company's Country: US
Company's Zip Code: 16823-0048
Company's Emerg Ph #: 814-359-3441
Company's Info Ph #: 814-359-3441
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 28DEC89
Safety Data Review Date: 27APR95
MSDS Serial Number: BXGNB

Ingredients/Identity Information

Proprietary: NO
Ingredient: POLYCHLORINATED BIPHENYL (AROCLOR 1254); (AROCLOR 1254) (SARA 313) (CERCLA)
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: TQ1360000
CAS Number: 11097-69-1
OSHA PEL: 0.5 MG/M3, S
ACGIH TLV: 0.5 MG/M3, S

Physical/Chemical Characteristics

Appearance And Odor: CLEAR VISCOUS LIQUID TO STICKY SOLID.
Boiling Point: 689F,365C
Melting Point: N/A
Vapor Pressure (MM Hg/70 F): N/A
Vapor Density (Air=1): N/A
Specific Gravity: 1.5 (H*2O=1)
Evaporation Rate And Ref: NOT APPLICABLE
Solubility In Water: NOT APPLICABLE
Percent Volatiles By Volume: N/A

Fire and Explosion Hazard Data

Flash Point: NOT APPLICABLE
Lower Explosive Limit: N/A
Upper Explosive Limit: N/A
Extinguishing Media: THIS MATERIAL IS NOT FLAMMABLE. EXTINGUISHING MEDIA DETERMINED BY SUPPORTING FIRE.
Special Fire Fighting Proc: USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: THE FOLLOWING TOXIC VAPORS ARE FORMED WHEN THIS MATERIAL IS HEATED TO DECOMPOSITION: HCL.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): NOT APPLICABLE

Materials To Avoid: NOT APPLICABLE
Hazardous Decomp Products: HCL.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

Health Hazard Data

LD50-LC50 Mixture: LD50:(ORAL,RAT) 1295 MG/KG.
Route Of Entry - Inhalation: NO
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: MAY IRRITATE EYES &/OR SKIN. HARMFUL IF ABSORBED THROUGH SKIN. IRRITATES SKIN. DERMATITIS. LIVER DAMAGE.
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: AROCLOR 1254:IARC MONOGRAPHS, SUPP, VOL 7, PG 322, 1987:GRP 2A. NTP 7TH ANNUAL RPT ON CARCINS, 1994:ANTIC TO BE (SUPDAT)
Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: EYES:FLUSH W/WATER FOR AT LEAST 15 MINUTES. IMMED MOVE TO FRESH AIR. INGEST:NEVER GIVE ANYTHING BY MOUTH TO UNCONSCIOUS PERSON. NEVER TRY TO MAKE UNCONSCIOUS PERSON VOMIT. DO NOT INDUCE VOMITING. CONTACT MD.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: CLEAN AREA W/SOAP & WATER. TAKE UP W/ ABSORBENT MATERIAL. VENTILATE AREA.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: COMPLY W/ALL APPLICABLE FEDERAL, STATE OR LOCAL REGULATIONS.
Precautions-Handling/Storing: STORE IN SEALED CONTAINER IN COOL, DRY LOCATION. REPORTED CANCER HAZARD. AVOID EYE OR SKIN CONTACT. AVOID BREATHING VAPORS.
Other Precautions: THIS MATL IS INTENDED FOR R&D USE ONLY & MAY NOT BE USED FOR DRUG, HOUSEHOLD OR OTHER PURPOSES. MATL SHOULD BE HANDLED ONLY BY QUALIFIED PERSONS TRAINED IN LAB PROCEDURES & GOOD SAFETY PRACTICES.

Control Measures

Respiratory Protection: WEAR NIOSH/MSHA APPROVED RESPIRATORY PROTECTION.
Ventilation: USE ONLY IN WELL VENTILATED AREA.
Protective Gloves: IMPERVIOUS GLOVES (FP N).
Eye Protection: ANSI APPROVED CHEM WORKERS GOGGS (FP N).
Other Protective Equipment: EYE WASH FOUNTAIN & DELUGE SHOWER WHICH MEET ANSI DESIGN CRITERIA (FP N).
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: EXPLAN OF CARCIN:CARCINOGEN. ANIMAL:LIVER.

Transportation Data

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 27APR95
Label Date: 26APR95
Label Status: G
Common Name: AROCLOR 1254, 48586
Chronic Hazard: YES

Signal Word: WARNING!
Acute Health Hazard-Moderate: X
Contact Hazard-Slight: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: ACUTE:MAY IRRITATE EYES &/OR SKIN. HARMFUL IF
CANCER HAZARD. CONTAINS AROCLOR 1254, WHICH IS LISTED AS A LIVER CARCINOGEN
(FP N).
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: SUPELCO INC
Label Street: SUPELCO PARK
Label City: BELLEFONTE
Label State: PA
Label Zip Code: 16823-0048
Label Country: US
Label Emergency Number: 814-359-3441

SUPELCO -- AROCLOR 1248, 44807
MATERIAL SAFETY DATA SHEET
NSN: 685000N043080
Manufacturer's CAGE: 54968
Part No. Indicator: A
Part Number/Trade Name: AROCLOR 1248, 44807

General Information

Company's Name: SUPELCO INC
Company's Street: SUPELCO PARK
Company's City: BELLEFONTE
Company's State: PA
Company's Country: US
Company's Zip Code: 16823-0048
Company's Emerg Ph #: 814-359-3441
Company's Info Ph #: 814-359-3441
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 28NOV89
Safety Data Review Date: 20SEP95
MSDS Serial Number: BRRDF
Hazard Characteristic Code: F3

Ingredients/Identity Information

Proprietary: NO
(ORAL,RAT) 11000 MG/KG.
Ingredient Sequence Number: 01
Percent: 0.1
NIOSH (RTECS) Number: TQ1358000
CAS Number: 12672-29-6
OSHA PEL: 1 MG/M3 (MFR)
ACGIH TLV: 1 MG/M3 (MFR)

Proprietary: NO
Ingredient: PENTANE, 2,2,4-TRIMETHYL-; (ISO-OCTANE)
Ingredient Sequence Number: 02
Percent: 100
NIOSH (RTECS) Number: SA3320000
CAS Number: 540-81-1
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Physical/Chemical Characteristics

Appearance And Odor: COLORLESS LIQUID.
Boiling Point: 210F,99C
Melting Point: -177F,-116C
Vapor Pressure (MM Hg/70 F): 41
Vapor Density (Air=1): 3.9
Specific Gravity: 0.69 (H2O=1)
Evaporation Rate And Ref: >1 (ETHER=1)
Solubility In Water: NOT APPLICABLE
Percent Volatiles By Volume: 100

Fire and Explosion Hazard Data

Flash Point: 10F,-12C
Flash Point Method: CC
Lower Explosive Limit: 1.1%
Upper Explosive Limit: 6%

Extinguishing Media: CO2, FOAM, DRY CHEMICAL.
Special Fire Fighting Proc: USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: CAN REACT VIGOROUSLY W/REDUCING MATERIALS.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): NOT APPLICABLE
Materials To Avoid: REDUCING AGENTS.
Hazardous Decomp Products: NOT APPLICABLE
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

Health Hazard Data

LD50-LC50 Mixture: SEE INGREDIENT 1.
Route Of Entry - Inhalation: NO
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Haz Acute And Chronic: CLASSIFIED BY IARC AS A CARCINOGEN. CONTAINS MATERIAL KNOWN TO CAUSE CANCER.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT RELEVANT
Signs/Symptoms Of Overexp: NONE SPECIFIED BY MANUFACTURER.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: EYES:FLUSH W/WATER FOR AT LEAST 15 MINUTES. SKIN:FLUSH W/LARGE VOLUMES OF WATER. INHAL:IMMEDIATELY MOVE TO FRESH AIR. GIVE OXYGEN IF BREATHING IS LABORED. IF BREATHING STOPS, GIVE ARTIFICIAL RESPIRATION. INGEST:NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. NEVER TRY TO MAKE AN UNCONSCIOUS PERSON VOMIT. DO NOT INDUCE VOMITING.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: TAKE UP W/ABSORBENT MATERIAL. VENTILATE AREA.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: COMPLY WITH ALL APPLICABLE FEDERAL, STATE OR LOCAL REGULATIONS.
Precautions-Handling/Storing: STORE IN SEALED CONTAINER IN COOL, DRY LOCATION. KEEP AWAY FROM HEAT. STORE IN DRY, WELL VENTILATED AREA. KEEP AWAY FROM IGNITION SOURCES.
Other Precautions: AVOID EYE/SKIN CONT. AVOID BRTHG VAPS. THIS MATL IS INTENDED FOR R&D USE ONLY & MAY NOT BE USED FOR DRUG, HOUSEHOLD/OTHER PURPOSES. MATL SHOULD BE HNDLD ONLY BY QUALIFIED PERSONS TRAINED IN LAB PROCS & GOOD SAFETY PRACTICES.

Control Measures

Respiratory Protection: WEAR NIOSH/MSHA APPROVED FACE MASK WITH ORGANIC VAPOR CANISTER.
Ventilation: USE ONLY IN WELL VENTILATED AREA.
Protective Gloves: IMPERVIOUS GLOVES (FP N).
Eye Protection: CHEMICAL SAFETY GOGGLES (FP N).
Other Protective Equipment: NOT APPLICABLE
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

Transportation Data

Disposal Data

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Label Data

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Label Required: YES
Technical Review Date: 20SEP93
Label Date: 02SEP93
Label Status: G
Common Name: AROCLOR 1248, 44807
Chronic Hazard: YES
Signal Word: DANGER!
Acute Health Hazard-Slight: X
Contact Hazard-None: X
Fire Hazard-Severe: X
Reactivity Hazard-None: X
Special Hazard Precautions: STORE IN SEALED CONTAINER IN COOL, DRY LOCATION. KEEP AWAY FROM HEAT & IGNITION SOURCES. ACUTE:NONE LISTED BY MANUFACTURER. CHRONIC:CANCER HAZARD. AROCLOR 1248 IS LISTED AS A CARCINOGEN (FP N).
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: SUPELCO INC
Label Street: SUPELCO PARK
Label City: BELLEFONTE
Label State: PA
Label Zip Code: 16823-0048
Label Country: US
Label Emergency Number: 814-359-3441

SUPELCO -- AROCLOR 1260 1UG-UL 1 ML, 44809
MATERIAL SAFETY DATA SHEET
NSN: 681000N021825
Manufacturer's CAGE: 54968
Part No. Indicator: A
Part Number/Trade Name: AROCLOR 1260 1UG/UL 1 ML, 44809

General Information

Company's Name: SUPELCO INC
Company's Street: SUPELCO PARK
Company's City: BELLEFONTE
Company's State: PA
Company's Country: US
Company's Zip Code: 16823-0048
Company's Emerg Ph #: 814-359-3441
Company's Info Ph #: 814-359-3441
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 25OCT91
Safety Data Review Date: 13APR95
MSDS Serial Number: BLXYH
Hazard Characteristic Code: F3

Ingredients/Identity Information

Proprietary: NO
Ingredient: POLYCHLORINATED BIPHENYL (AROCLOR 1260). LD50 (ORAL, RAT):1315 MG/KG.
Ingredient Sequence Number: 01
Percent: 0.1
NIOSH (RTECS) Number: TQ1362000
CAS Number: 11096-82-5
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Proprietary: NO
Ingredient: PENTANE 2,2,4-TRIMETHYL-; (ISOOCTANE)
Ingredient Sequence Number: 02
Percent: 100
NIOSH (RTECS) Number: SA3320000
CAS Number: 540-81-1
OSHA PEL: NOT APPLICABLE
ACGIH TLV: NOT APPLICABLE

Physical/Chemical Characteristics

Appearance And Odor: CLEAR COLORLESS LIQUID.
Boiling Point: 210F,99C
Melting Point: -177F,-116C
Vapor Pressure (MM Hg/70 F): 41
Vapor Density (Air=1): 3.90
Specific Gravity: .690
Evaporation Rate And Ref: >1 (ETHER = 1)
Solubility In Water: NOT APPLICABLE
Percent Volatiles By Volume: 100

Fire and Explosion Hazard Data

Flash Point: 10F,-12C
Flash Point Method: CC
Lower Explosive Limit: 1.1

Upper Explosive Limit: 6.0
Extinguishing Media: CARBON DIOXIDE, FOAM AND DRY CHEMICAL.
Special Fire Fighting Proc: WEAR NIOSH/MSHA APPROVED PRESSURE DEMAND SCBA AND FULL PROTECTIVE EQUIPMENT (FP N) WHEN FIGHTING A CHEMICAL FIRE.
Unusual Fire And Expl Hazrds: CAN REACT VIGOROUSLY WITH REDUCING MATERIALS.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): NOT APPLICABLE
Materials To Avoid: REDUCING AGENTS.
Hazardous Decomp Products: NOT APPLICABLE
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT

Health Hazard Data

LD50-LC50 Mixture: SEE ING 1
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: CONTAINS MATERIAL(S) KNOWN TO THE STATE OF CALIFIRNIA TO BE CANCER CAUSING.
Carcinogenicity - NTP: YES
Carcinogenicity - IARC: YES
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: AROCLOR:IARC CLASS 2B, NTP GROUP B CARCINOGEN.
Signs/Symptoms Of Overexp: SEE HEALTH HAZARDS.
Med Cond Aggravated By Exp: NONE SPECIFIED BY MANUFACTURER.
Emergency/First Aid Proc: EYES:FLUSH WITH WATER FOR AT LEAST 15 MINUTES. SKIN:FLUSH WITH LARGE AMOUNTS OF WATER. INHAL:IMMEDIATELY REMOVE TO FRESH AIR. GIVE OXYGEN IF BREATHING IS LABORED. IF BREATHING STOPS, GIVE ARTIFICIAL RESPIRATION. INGEST:NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON. NEVER TRY TO MAKE AN UNCONSCIOUS PERSON VOMIT. DO NOT INDUCE VOMITING. SEEK MD ATTENTION.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: TAKE UP WITH ABSORBENT MATERIAL. VENTILATE AREA.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: COMPLY WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS.
Precautions-Handling/Storing: STORE IN SEALED CONTR IN COOL, DRY LOCATION. KEEP AWAY FROM HEAT. STORE IN DRY WELL VENT AREA. KEEP AWAY FROM IGNITION SOURCES.
Other Precautions: AVOID EYE AND SKIN CONTACT. AVOID BREATHING VAPORS.

Control Measures

Respiratory Protection: WEAR NIOSH/MSHA APPROVED FACE MASK WITH ORGANIC VAPOR CANISTER.
Ventilation: USE ONLY IN WELL VENTILATED AREAS.
Protective Gloves: IMPERVIOUS GLOVES (FP N).
Eye Protection: CHEMICAL WORKERS GOGGLES (FP N).
Other Protective Equipment: NONE SPECIFIED BY MANUFACTURER.
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Suppl. Safety & Health Data: NONE SPECIFIED BY MANUFACTURER.

Transportation Data

Trans Data Review Date: 92066

DOT PSN Code: LHZ
DOT Proper Shipping Name: PENTANES
DOT Class: 3
DOT ID Number: UN1265
DOT Pack Group: I
DOT Label: FLAMMABLE LIQUID
IMO PSN Code: LGJ
IMO Proper Shipping Name: PENTANES
IMO Regulations Page Number: 3140
IMO UN Number: 1265
IMO UN Class: 3.1
IMO Subsidiary Risk Label: -
IATA PSN Code: TAU
IATA UN ID Number: 1265
IATA Proper Shipping Name: PENTANES,
IATA UN Class: 3
IATA Label: FLAMMABLE LIQUID
AFI PSN Code: TAU
AFI Prop. Shipping Name: PENTANES
AFI Class: 3
AFI ID Number: UN1265
AFI Pack Group: I
AFI Basic Pac Ref: 7-6

Disposal Data

Label Data

Label Required: YES
Label Status: G
Common Name: AROCLOR 1260 1UG/UL 1 ML, 44809
Special Hazard Precautions: CONTAINS MATERIAL(S) KNOWN TO THE STATE OF CALIFIRNIA TO BE CANCER CAUSING. SEE HEALTH HAZARDS.
Label Name: SUPELCO INC
Label Street: SUPELCO PARK
Label City: BELLEFONTE
Label State: PA
Label Zip Code: 16823-0048
Label Country: US
Label Emergency Number: 14-359-3441

ACCUSTANDARD -- 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN SOLUTION, M-613
MATERIAL SAFETY DATA SHEET
NSN: 685000N072525
Manufacturer's CAGE: 0U4A8
Part No. Indicator: A
Part Number/Trade Name: 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN SOLUTION, M-613

General Information

Company's Name: ACCUSTANDARD INC
Company's Street: 25 SCIENCE PARK SUITE 687
Company's City: NEW HAVEN
Company's State: CT
Company's Country: US
Company's Zip Code: 06511
Company's Emerg Ph #: 203-786-5290
Company's Info Ph #: 203-786-5290
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SMJ
Date MSDS Prepared: 24FEB95
Safety Data Review Date: 29AUG96
MSDS Serial Number: CBYLC

Ingredients/Identity Information

Proprietary: NO
Ingredient: DIBENZO-P-DIOXIN, 2,3,7,8-TETRACHLORO-; (2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN) (TCDD) (CERCLA)
Ingredient Sequence Number: 01
Percent: 0.001
NIOSH (RTECS) Number: HP3500000
CAS Number: 1746-01-6
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Proprietary: NO
Ingredient: TOLUENE (SARA 313) (CERCLA)
Ingredient Sequence Number: 02
Percent: 99.999
NIOSH (RTECS) Number: XS5250000
CAS Number: 108-88-3
OSHA PEL: 200 PPM
ACGIH TLV: 50 PPM, S

Physical/Chemical Characteristics

Appearance And Odor: CLEAR LIQUID, WITH AROMATIC ODOR
Boiling Point: 232F,111C
Melting Point: -139F,-95C
Vapor Pressure (MM Hg/70 F): 21.9 @ 20C
Vapor Density (Air=1): 3.2
Specific Gravity: 0.87 (H*2O=1)
Evaporation Rate And Ref: 2.2 (BUTYL ACETATE=1)
Solubility In Water: INSOLUBLE
Percent Volatiles By Volume: >99

Fire and Explosion Hazard Data

Flash Point: 40.0F,4.4C
Flash Point Method: TCC
Lower Explosive Limit: 1.30%
Upper Explosive Limit: 7.10%

Extinguishing Media: USE DRY CHEMICAL, FOAM, CARBON DIOXIDE. WATER SPRAY TO COOL EXPOSED CONTAINERS.
Special Fire Fighting Proc: WEAR NIOSH APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: DANGEROUS FIRE AND EXPLOSION HAZARD. VAPOR CAN TRAVEL DISTANCES TO IGNITION SOURCES AND FLASH BACK.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): HEAT; CONTACT WITH IGNITION SOURCES.
Materials To Avoid: OXIDIZERS, STRONG MINERAL ACIDS.
Hazardous Decomp Products: CO*X, HYDROCARBONS.
Hazardous Poly Occur: NO
Conditions To Avoid (Poly): NOT RELEVANT.

Health Hazard Data

LD50-LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: ACUTE: HARMFUL/FATAL IF SWALLOWED. VAP HARMFUL IF INHALED. SYMPS: HDCH, DIZZ, HALLUCINATIONS, DISTORTED PERCEPTIONS, CHANGES IN MOTOR ACTIVITY, NAUS, RESP IRRIT, CNS DEPRESS, UNCON, LIVER, KIDNEY & LUNG DMG. CONT MAY CAUSE SEV EYE IRRIT. MAY CAUSE SKIN IRRIT. CHRONIC: TOLUENE APPEARS ON THE NAVY (EFTS OF OVEREXPOSURE)
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NOT RELEVANT.
Signs/Symptoms Of Overexp: HLTH HAZ: OCCUPATIONAL CHEMICAL REPRODUCTIVE HAZARDS LIST. SEEK CONSULTATION FROM APPROPRIATE HEALTH PROFESSIONALS CONCERNING LATEST HAZARD LIST INFORMATION AND SAFE HANDLING AND EXPOSURE INFORMATION (FP N).
Med Cond Aggravated By Exp: RESPIRATORY, LIVER AND KIDNEY CONDITIONS.
Emergency/First Aid Proc: GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE. EYES: IMMEDIATELY FLUSH THOROUGHLY W/WATER FOR AT LEAST 15 MINUTES. SKIN: IMMEDIATELY FLUSH THOROUGHLY W/LARGE AMOUNTS OF WATER. INHAL: REMOVE TO FRESH AIR; GIVE ARTIFICIAL RESPIRATION IF BREATHING HAS STOPPED. INGEST: CALL MD IMMEDIATELY. ONLY INDUCE VOMITING AT THE INSTRUCTIONS OF MD. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: WEAR SUITABLE PROTECTIVE EQUIPMENT. ELIMINATE ANY IGNITION SORUCES UNTIL THE AREA IS DETERMINED TO BE FREE FROM EXPLOSION OR FIRE HAZARDS. CONTAIN THE RELEASE AND ELIMINATE ITS SOURCE, IF THIS CAN BE DONE WITHOUT RISK.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method: DISPOSE AS HAZARDOUS WASTE. COMPLY WITH FEDERAL, STATE AND LOCAL REGULATIONS.
Precautions-Handling/Storing: KEEP CONTAINER TIGHTLY CLOSED. STORE IN A COOL AREA AWAY FROM IGNITION SOURCES AND OXIDIZERS. DO NOT BREATHE VAPOR OR MIST.
Other Precautions: DO NOT GET IN EYES, ON SKIN, OR ON CLOTHING. ELECTRICALLY GROUND ALL EQUIPMENT WHEN HANDLING THIS PRODUCT.

Control Measures

Respiratory Protection: IF WORKPLACE EXPOS LIM OF PROD/ANY COMPONENT IS EXCEEDED (SEE TLV/PEL), A NIOSH APPRVD AIR SUPPLIED RESP IS ADVISED IN ABSENCE OF PROPER ENVIRON CTL. OSHA REGS ALSO PERMIT OTHER NIOSH APPRVD RESPS (NEG PRESS TYPE) UNDER SPECIFIED (SUP DAT)

Ventilation: MATERIAL SHOULD BE HANDLED OR TRANSFERRED IN AN APPROVED FUME HOOD OR WITH ADEQUATE VENTILATION.
Protective Gloves: VITON OR EQUIVALENT.
Eye Protection: ANSI APPRVD CHEM WORKERS GOGGS (FP N).
Other Protective Equipment: EMERGENCY EYEWASH & DELUGE SHOWER MEETING ANSI DESIGN CRITERIA (FP N).
Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING. DO NOT TAKE INTERNALLY.
Suppl. Safety & Health Data: RESP PROT: CNDTNS (SEE YOUR SFTY EQUIP SUPPLIER). ENGINEERING AND/OR ADMINISTRATIVE CONTROLS SHOULD BE IMPLEMENTED TO REDUCE EXPOS.

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Transportation Data

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Disposal Data

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Label Data

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Label Required: YES
Technical Review Date: 29AUG96
Label Date: 29AUG96
Label Status: G
Common Name: 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN SOLUTION, M-613
Chronic Hazard: YES
Signal Word: DANGER!
Acute Health Hazard-Moderate: X
Contact Hazard-Moderate: X
Fire Hazard-Severe: X
Reactivity Hazard-None: X
Special Hazard Precautions: FLAMMABLE. ACUTE: HARMFUL OR FATAL IF SWALLOWED. VAPOR HARMFUL IF INHALED. SYMPTOMS: HEADACHE, DIZZINESS, HALLUCINATIONS, DISTORTED PERCEPTIONS, CHANGES IN MOTOR ACTIVITY, NAUSEA, RESPIRATORY IRRITATION, CENTRAL NERVOUS SYSTEM DEPRESSION, UNCONSCIOUSNESS, LIVER, KIDNEY AND LUNG DAMAGE. CONTACT MAY CAUSE SEVERE EYE IRRITATION. MAY CAUSE SKIN IRRITATION. CHRONIC: TOLUENE APPEARS ON THE NAVY OCCUPATIONAL CHEMICAL REPRODUCTIVE HAZARDS LIST (FP N).
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: ACCUSTANDARD INC
Label Street: 25 SCIENCE PARK SUITE 687
Label City: NEW HAVEN
Label State: CT
Label Zip Code: 06511
Label Country: US
Label Emergency Number: 203-786-5290

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 10/23/96

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

16411 2001 CX0012 CX0013 CX0015

Product Name:
Cadmium
Synonyms:
N/A
Chemical Family:
Metal
Formula:
Cd
Molecular Weight.:
112.40

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Cadmium	7440-43-9	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
HAZARDOUS DUST.
HARMFUL IF INHALED OR SWALLOWED.
Can Cause Lung, Liver and Kidney Disease.
CONTAINS CADMIUM. CANCER HAZARD.
AVOID CREATING DUST.
WARNING: This product contains a chemical(s) known to the State of

California to cause cancer.

Appearance:
Gray powder, granules, metallic rods or pieces

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Inhalation of dust or fume can cause severe lung irritation and pulmonary edema, which may be fatal. Chronic exposure can also cause kidney damage. Ingestion causes severe gastrointestinal irritation. Contact with skin or eyes may cause irritation. Medical surveillance of personnel continually exposed to cadmium dust or fumes is recommended.

Medical Cond. Aggravated by Exposure:
Kidney conditions

Routes of Entry:
Inhalation, ingestion

Carcinogenicity:
Suspected human carcinogenic substance. Suspect Cancer Hazard.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flash Point (F): None
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Use carbon dioxide, dry chemical.

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:
Moderate fire and explosion hazard.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store in a cool area away from ignition sources and oxidizers. Do not breathe dust or vapor. Do not get in eyes. Avoid prolonged, or repeated, skin contact.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves should be worn to prevent skin contact (Neoprene, Natural rubber, PVC or equivalent) Safety glasses with side shields should be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Cadmium		0.005					

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Cadmium		0.01					

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 767C
Melting Point (C) : 321C
Specific Gravity (H_20 = 1) : 8.642
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%): N/A
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :
Gray powder, granules, metallic rods or pieces

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
None; forms CdO as combustion product

Conditions to Avoid:
Dusting; contact of dust with ignition source.

Materials To Avoid:

```
( ) Water
( ) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Hydrazoic acid, Te, Se, S, Zn
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
ihl-hmn LCLo: 39 mg/cu.m./20M
orl-rat LD50: 225 mg/kg
```

Toxicological Findings:
Tests on laboratory animals indicate material may cause tumors
and adverse reproductive effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: D006

Treatment:
Specified Technology - Contact your local permitted waste disposal site (TSD) for permissible treatment sites.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Environmentally Hazardous Substance, Solid, n.o.s. (Cadmium) for CX0012
(non-regulated) for CX0013, CX0015, 16411, 2001
DOT ID Number :
UN3077 for CX0012

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Cadmium			10

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Cadmium	Y	Y	0.1

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 3
Flammability : 1
Reactivity : 0
Special Hazards :

Revision History: 2/1/82 10/1/83 1/21/87 10/27/87
6/15/88 11/21/89 3/1/91 2/5/93 11/22/93 9/11/95

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 6/21/99

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

2701 CX1920 CX1922 CX1930 CX1935 CX1939 CX1940
CX1941

Product Name:
Copper
Synonyms:
N/A
Chemical Family:
Metal
Formula:
Cu
Molecular Weight.:
63.55

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Copper	7440-50-8	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
MAY BE HARMFUL IF SWALLOWED.

Appearance:
Reddish lusterous metal

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
May be harmful if swallowed.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
Ingestion: Get immediate medical attention.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flash Point (F): Noncombustible
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Use any suitable for adjacent material.

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
None

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for

reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store at controlled room temperature. Do not breathe fumes.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves should be worn to prevent skin contact (Neoprene or equivalent) Safety glasses with side shields should be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Copper		0.1					

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Copper		0.2					

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 2595C
Melting Point (C) : 1083C
Specific Gravity (H_20 = 1) : 8.94
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%): None
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :

Reddish lusterous metal

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
Cu fumes

Conditions to Avoid:
None

Materials To Avoid:

```
( ) Water
( ) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Acetylene, 1-Bromo-2-propyne
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11. TOXICOLOGICAL INFORMATION

Toxicity Data

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orl-hmn TDLo: 120 ug/kg
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Toxicological Findings:
Tests on laboratory animals indicate material may cause tumors
and adverse reproductive effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

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EPA Waste Numbers:
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Treatment:
Material does not have an EPA Waste number and is not a listed waste, however consultation with a permitted waste disposal site (TSD) should be accomplished.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
non-regulated

DOT ID Number :
none

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Copper			

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Copper	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 2
Flammability : 0
Reactivity : 0
Special Hazards :

Revision History: 12/1/81 6/2/86 6/16/87 10/27/87 1/6/89 3/1/91 3/19/92

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N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 11/9/98

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

4404 MX0398 MX0400 MX0405

Product Name:
Mercury
Synonyms:
Quick Silver
Chemical Family:
Metallic Element
Formula:
Hg
Molecular Weight.:
200.59

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Mercury	7439-97-6	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
VAPOR HAZARDOUS.
MAY BE FATAL IF INHALED OR SWALLOWED.
ABSORPTION THROUGH SKIN HARMFUL.
CAN CAUSE KIDNEY, HEART, LUNG AND BRAIN DAMAGE.
IRRITATING TO SKIN, EYES AND MUCOUS MEMBRANES.
WARNING: This product contains a chemical(s) known to the State of

California to cause birth defects or other reproductive harm.

Appearance:
Silvery-gray; heavy liquid

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Highly toxic by vapor inhalation; symptoms: metallic taste, nausea, abdominal pain, diarrhea, headache, albuminurea. Prolonged or repeated exposure may cause muscle tremors, central nervous system disturbances, kidney, heart, lung and brain damage. May cause burning of the mouth and pharynx, abdominal pain, vomiting, corrosive ulceration, bloody diarrhea. May be followed by a rapid and weak pulse, shallow breathing, paleness, exhaustion, tremors and collapse. Delayed death may occur from kidney failure. Can be absorbed through skin with symptoms similar to ingestion.

Medical Cond. Aggravated by Exposure:
Persons with nervous disorders or impaired kidney or respiratory function may be more susceptible.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.
WARNING: This product contains a chemical(s) known to the State of California to cause birth defects or other reproductive harm.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flash Point (F): Noncombustible
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Use any suitable for adjacent material.

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Emits extremely toxic mercury vapor at high temperatures.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unecessary personel. Wear suitable protective equipment listed under Exposure / Personal Protection. Wear an air supplied respiratory for mercury spills. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.
EM SCIENCE recommends Spill-X absorbent agents for various types of spills. Additional information on the Spill-X products can be provided through the EM SCIENCE Technical Service Department (609) 423-6300. The following EM SCIENCE Spill-X absorbent is recommended for this product:

SX0866 Chemizorb^{N}-Hg Mercury Spill Clean Up Kit

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed and away from heat. Do not breathe vapor. Do not get in eyes, on skin, or on clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves (Neoprene, PVC or equivalent) should be worn to prevent skin contact. Safety glasses with side shields should be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Mercury		0.05					X

ACGIH - TLV:

	TWA		STEL		CL		

Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Mercury		0.025					X

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 357C
Melting Point (C) : -39C
Specific Gravity (H_20 = 1) : 13.55
Vapor Pressure (mm Hg) : 0.001 20C
Percent Volatile by vol (%): 99+% Sublimes
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :
Silvery-gray; heavy liquid

|10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
Hg vapors

Conditions to Avoid:
Heat

Materials To Avoid:

```
( ) Water
( ) Acids
( ) Bases
( ) Corrosives
( ) Oxidizers
(X) Other: Acetylenic compounds, Ammonia, Ethylene
oxide, chlorine dioxide,  azides, metal oxides, methyl
silane, lithium, rubidium, oxygen,  strong oxidants,
metal carbonyls
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

ihl-man TCLo: 44.3 mg/m3/8H ihl-rbt LCLo: 29 mg/m3/30H

Toxicological Findings:
Tests on laboratory animals indicate material may cause tumors and produce adverse mutagenic and reproductive effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: U151 D009

Treatment:
Specified Technology - Contact your local permitted waste disposal site (TSD) for permissible treatment sites.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Mercury

DOT ID Number :
UN2809

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Mercury			1

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Mercury	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

```
Health          : 3
Flammability    : 0
Reactivity      : 0
Special Hazards :
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Revision History: 12/1/81 9/12/86 10/27/87 3/1/91 8/29/91 5/14/92 7/6/93 12/21/94 4/11/95 10/24/96 4/8/97

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MATERIAL SAFETY DATA SHEET (MSDS)

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EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 12/10/98

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

NX0295 NX0305

Product Name:
Nickel
Synonyms:
Nickel Sponge
Chemical Family:
Metals
Formula:
Ni
Molecular Weight.:
58.69

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Nickel	7440-02-0	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA.
HARMFUL IF SWALLOWED.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

Appearance:
Silvery-grey sheet or granules

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Harmful if swallowed. Ingestion may cause gastrointestional irritation with nausea, vomiting and diarrhea. Inhalation of nickel is harmful but in this form is unlikely. Do not use in a manner so as to create dust or fumes which will be inhaled.

Medical Cond. Aggravated by Exposure:
None indicated

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.
Remove contaminated clothing and wash before reuse.

5. FIRE FIGHTING MEASURES

Flash Point (F): None
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Water spray, Foam, Dry powder

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:
Thermal decomposition produces highly toxic fumes. Dangerous fire and explosion hazard (as powder).

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal

Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store in a cool, dry area away from ignition sources and oxidizers. Do not breathe dust or vapor. Do not get in eyes, on skin, or on clothing. Retained residue may make empty containers hazardous; use caution!

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves should be worn to prevent skin contact (Neoprene or equivalent) Safety glasses with side shields should be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Nickel		0.1					

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Nickel		0.1					

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 2900C
Melting Point (C) : 1455C

Specific Gravity (H_20 = 1) : 8.9
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%): N/A
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :
Silvery-grey sheet or granules

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
Nickel Carbonyl

Conditions to Avoid:
Dusting, heat, contact with ignition source

Materials To Avoid:

```
( ) Water
(X) Acids
(X) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Fluorine, Ammonium Nitrate, Hydrazine,
Ammonia, Aluminum,  Aluminium Trichloride, ethylene,
p-dioxan, hydrogen, methanol,  non-metals, sulfur
compounds
```

|11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-rat LDLo: 5000 mg/kg
```

Toxicological Findings:
Tests on laboratory animals indicate material may cause tumors
and produce adverse mutagenic and reproductive effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

```
EPA Waste Numbers:
```

Treatment:
Material does not have an EPA Waste number and is not a listed waste, however consultation with a permitted waste disposal site (TSD) should be accomplished.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

|13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
non-regulated

DOT ID Number :
none

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Nickel			100

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Nickel	Y	Y	0.1

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

|15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 2
Flammability : 0
Reactivity : 0
Special Hazards :

Revision History: 9/1/81 8/5/87 10/27/87 3/1/91
8/9/93 11/1/96

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 3/1/91

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

ZX0010 ZX0011 ZX0017 ZX0020 ZX0033 ZX0035 ZX0040
ZX0045

Product Name:
Zinc
Synonyms:
Granular Zinc
Chemical Family:
Metal
Formula:
Zn
Molecular Weight.:
65.39

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Zinc	7440-66-6	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
Avoid Generation Of Zinc Dust.
MAY BE HARMFUL IF INHALED OR SWALLOWED.

Appearance:
Gray, odorless, granular, sticks, strips, sheets

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
May be harmful if inhaled (dust) or swallowed. Irritating to skin on contact; dust may irritate respiratory tract. Inhalation may cause sweet taste, dry throat, cough, weakness, aching, chills, fever, nausea and vomiting. Fumes may cause metal fume fever. Ingestion may cause severe gastroenteritis.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flash Point (F): Flammable (dust)
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Smother with sand or otherwise cut off oxygen supply
Use special dry chemical; do not use CO_2

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Dust forms explosive and flammable mixtures with air; especially when damp.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:

Treatment:
Material does not have an EPA Waste number and is not a listed waste, however consultation with a permitted waste disposal site (TSD) should be accomplished.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
non-regulated

DOT ID Number :
none

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Zinc			1000

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Zinc		Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 0
Flammability : 1
Reactivity : 0
Special Hazards :

Revision History: 12/1/81 5/1/84 10/27/87 3/30/88

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 10/23/96

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

7365 LX0085 LX0090 LX0095 LX0103 LX0105 LX0110

Product Name:
Lead
Synonyms:
None
Chemical Family:
Metal
Formula:
Pb
Molecular Weight.:
207.20

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Lead	7439-92-1	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
CUMULATIVE POISON.
HARMFUL IF INHALED OR SWALLOWED.
POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA.
MAY CAUSE DAMAGE TO BLOOD, KIDNEYS, NERVOUS AND
REPRODUCTIVE SYSTEMS.
WARNING: This product contains chemicals known to the State of

California to cause cancer and birth defects or other reproductive harm.

Appearance:
Bluish-white metal

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Cumulative poison. Harmful if swallowed. Harmful by inhalation of dust or fumes. Symptoms: lassitude, insomnia, pallor, anorexia, weight loss, malnutrition, headache, constipation, abdominal pain, colic, anemia. May cause damage to blood, kidneys, nervous and reproductive systems.

Medical Cond. Aggravated by Exposure:
Pregnancy

Routes of Entry:
Inhalation, ingestion

Carcinogenicity:
Inorganic lead compounds are listed by IARC as 2B carcinogens.
WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flash Point (F): None
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Use any suitable for adjacent material.

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:

Flammable in the form of dust when exposed to heat or flame. Moderately explosive in the form of dust when exposed to heat or flame. Mixtures of hydrogen peroxide + trioxane explode on contact with lead. Rubber gloves containing lead may ignite in nitric acid.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed when not in use. Store in a dry, well-ventilated area. Do not breathe dust or fumes.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves should be worn to prevent skin contact (Neoprene or equivalent) Safety glasses with side shields should be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Lead		.05					

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Lead		0.15					

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 1740C
Melting Point (C) : 327.4C
Specific Gravity (H_20 = 1) : 11.34
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%): N/A
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :
Bluish-white metal

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
Lead oxide fumes

Conditions to Avoid:
Extreme heat; conditions causing generation of lead dust.

Materials To Avoid:

```
( ) Water
( ) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Sodium, Potassium, NaN3, Zr, disodium
acetylide
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-pgn LDLo: 160 mg/kg
```

Toxicological Findings:
Tests on laboratory animals indicate material may produce adverse mutagenic effects and cause tumors.

Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: D008

Treatment:
Specified Technology - Contact your local permitted waste disposal site (TSD) for permissible treatment sites.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
For LX0103: Environmentally Hazardous Substance, Solid, n.o.s (Lead Powder) For all other catalog #'s (non-regulated)
DOT ID Number :
UN3077 (for LX0103)

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Lead			10

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Lead	Y	Y	0.1

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

|15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 1
Flammability : 0
Reactivity : 0
Special Hazards :

Revision History: 6/1/84 10/27/87 4/16/90 3/1/91 8/24/93 1/19/94 4/6/95 3/8/96

| = Revised Section

N/A = Not Available

N/E = None Establised

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HIGH-PURITY STANDARDS -- CYANIDE
MATERIAL SAFETY DATA SHEET
NSN: 681000N063132
Manufacturer's CAGE: 0YZE4
Part No. Indicator: A
Part Number/Trade Name: CYANIDE

General Information

Company's Name: HIGH-PURITY STANDARDS
Company's P. O. Box: 30188
Company's City: CHARLESTON
Company's State: SC
Company's Country: US
Company's Zip Code: 29417
Company's Emerg Ph #: 803-556-3411
Company's Info Ph #: 803-556-3411
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 002
Status: SMJ
Date MSDS Prepared: 16SEP92
Safety Data Review Date: 08SEP95
MSDS Serial Number: BYWMT

Ingredients/Identity Information

Proprietary: NO
Ingredient: CYANIDE
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: GS7175000
CAS Number: 57-12-5
OSHA PEL: 5 MG/M3 (MFR)
ACGIH TLV: 5 MG/M3 (MFR)

Proprietary: NO
Ingredient: POTASSIUM CYANIDE; (KCN)
Ingredient Sequence Number: 02
Percent: 0.1
NIOSH (RTECS) Number: TS8750000
CAS Number: 151-50-8
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Proprietary: NO
Ingredient: POTASSIUM HYDROXIDE; (KOH)
Ingredient Sequence Number: 03
Percent: 0.5
NIOSH (RTECS) Number: TT2100000
CAS Number: 1310-58-3
OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Physical/Chemical Characteristics

Appearance And Odor: CLEAR, COLORLESS, ODORLESS SOLUTION.
Boiling Point: 212F,100C
Melting Point: N/A
Vapor Pressure (MM Hg/70 F): N/A
Vapor Density (Air=1): N/A
Specific Gravity: 1 (H*2O=1)
Decomposition Temperature: N/A
Solubility In Water: COMPLETE

Fire and Explosion Hazard Data

Flash Point: NOT APPLICABLE
Lower Explosive Limit: N/A
Extinguishing Media: USE APPROPRIATE: DO NOT USE CARBON DIOXIDE EXTINGUISHER.
Special Fire Fighting Proc: USE NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire And Expl Hazrds: NOT APPLICABLE

Reactivity Data

Stability: YES
Cond To Avoid (Stability): THERMAL DECOMPOSITION INCOMPATIBLE.
Materials To Avoid: ACIDS, OXIDIZING AGENTS, ALKALOIDS, IODINE, AMMONIA, CO*2, CHLORAL HYDRATE.

Health Hazard Data

Precautions for Safe Handling and Use

Control Measures

Transportation Data

Disposal Data

Label Data

Label Required: YES
Technical Review Date: 08SEP95
Label Date: 31AUG95
Label Status: G
Common Name: CYANIDE
Chronic Hazard: YES
Signal Word: DANGER!
Acute Health Hazard-Severe: X
Contact Hazard-Severe: X
Fire Hazard-None: X
Reactivity Hazard-None: X
Special Hazard Precautions: CORROSIVE POISON. ACUTE:INGESTION:CORROSIVE TO GASTROINTESTINAL TRACT. IN ADDITION TO PAINFUL SWALLOWING, SYMPTOMS ARE SIMILAR TO THOSE OF ACUTE INHALATION. SKIN CONTACT:CORROSIVE. READILY ABSORBED THROUGH SKIN. ABSORPTION MAY CAUSE SYMPTOMS SIMILAR TO THOSE OF ACUTE INHALATION. EYE CONTACT:CORROSIVE. REDNESS, PAIN AND BLURRED VISON MAY OCCUR. INHALATION:CORROSIVE TO RESPIRATORY TRACT. INHIBITS CELLULAR RESPIRATION. OVEREXPOSURE MAY CAUSE HEADACHE, WEAKNESS, DIZZINESS, LABORED BREATHING AND NAUSEA FOLLOWED BY WEAK AND IRREGULAR HEARTBEAT, UNCONSCIOUSNESS, CONVULSIONS, COMA & DEATH. CHRONIC:REPEATED MINOR SKIN CONTACT CAUSES A "CYANIDE" RASH.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y
Label Name: HIGH-PURITY STANDARDS
Label P.O. Box: 30188
Label City: CHARLESTON
Label State: SC
Label Zip Code: 29417
Label Country: US

Label Emergency Number: 803-556-3411

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 9/9/97

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

AX1665

Product Name:
Antimony
Synonyms:
Stibium
Chemical Family:
Metal
Formula:
Sb
Molecular Weight.:
121.75

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Antimony	7440-36-0	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
HARMFUL IF INHALED OR SWALLOWED.
IRRITATING TO SKIN, EYES AND MUCOUS MEMBRANES.

Appearance:
Blue-white to dark grey crystalline powder/lumps

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Toxic on inhalation or ingestion. Irritating to eyes, skin, and mucous membranes. Acute ingestion can cause vomiting, diarrhea, GI distress, low blood pressure, inflammation of mucous membranes, shallow breathing, and possibly death.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flash Point (F): Combustible
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Use any suitable for adjacent material.

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:
Dust may explode when exposed to flame. May emit toxic fumes of Sb_2H_3.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described

under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store in a cool, well-ventilated, fire-resistant location. Do not breathe dust. Do not get in eyes, on skin, or on clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves (Neoprene, PVC or equivalent) should be worn to prevent skin contact. Safety glasses with side shields should be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Antimony		0.5					

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Antimony		0.5					

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 1635C
Melting Point (C) : 630.5C
Specific Gravity (H_2O = 1) : 6.68
Vapor Pressure (mm Hg) : 1 886C
Percent Volatile by vol (%): N/A
Vapor Density (Air = 1) : N/A

Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :
Blue-white to dark grey crystalline powder/lumps

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
None

Conditions to Avoid:
Heat, open flame; reacts with nascent hydrogen or certain concentrated acids to evolve highly toxic stibine gas.

Materials To Avoid:

( ) Water
(X) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: NH_4NO_3, BrF_3, Halogens, Potassium and Sodium compounds

11. TOXICOLOGICAL INFORMATION

Toxicity Data

ipr-rat LD50: 100 mg/kg

Toxicological Findings:
Tests on laboratory animals indicate material may cause tumors.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers:

Treatment:
Material does not have an EPA Waste number and is not a listed waste, however consultation with a permitted waste disposal site (TSD) should be accomplished.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Antimony Powder

DOT ID Number :
UN2871

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Antimony			5000

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Antimony	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
AX1665 and 7831 were previously on the same MSDS as AX1660.
AX1660 is now on a separate MSDS.

NFPA Hazard Ratings:

Health : 1
Flammability : 2
Reactivity : 0
Special Hazards :

Revision History: 4/9/96

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION

Trade Name: Arsenic
Molecular Weight: 74.91
Formula: As
CAS #: 7440-38-2

II HAZARDOUS INGREDIENTS

PEL (mg/m^3): OSHA: 0.01
ACGIH: 0.2
SARA Title III Sect. 313 Chem: Yes
Weight %: 99.99+

III PHYSICAL DATA

Boiling Point (°C):	Not applicable	**Melting Point (°C):**	Sublimes at 613
Vapor Density (Air=1):	Not applicable	**Evaporation Rate:**	N/A
Solubility in H_2O:	Insoluble	**pH:**	N/A
Appearance and Odor:	Gray-black metal, odorless.	**Specific gravity (H_2O=1):**	5.72

IV FIRE AND EXPLOSION HAZARDS DATA

Flash Point (Method used): N/A
Autoignition Temp (°C): N/A
Flammability: LEL: No data **UEL:** No data

Special Fire Fighting Procedures: Use NIOSH/MSHA approved self-contained breathing apparatus and full protective clothing if involved in fire.

Fire Extinguishing agents Recommended: No specific agents recommended.
Extinguishing Media: N/A
Unusual Fire and Explosion Hazards: N/A

V HEALTH HAZARD INFORMATION

Primary Routes of Entry: Inhalation

Carcinogenicity: IARC classifies arsenic and certain arsenic compounds as Group 1 carcinogens (carcinogenic to humans). NTP classifies these materials as "..substances, and technological or manufacturing processes that are known to be carcinogenic." OSHA classifies inorganic arsenic and its compounds as carcinogens.

Acute Overexposure (symptoms and effects): Chronic overexposure to arsenic compounds may cause skin and eye irritation, peripheral neuritis of the hands and feet, and a increased risk of lung and skin cancer. Symptoms of chronic toxicity include weight loss, nausea, diarrhea, weakness, loss of appetite and skin lesions.

Medical Conditions Possibly Aggravated: Diseases of the lung, liver, kidneys, and nervous systems.

EMERGENCY AND FIRST AID PROCEDURES:

SKIN AND EYES: Flush with plenty of water. If symptoms develop, consult a physician.
INHALATION: Remove from exposure; place individual under care of a physician.
INGESTION: Induce vomiting in conscious individual and call a physician.

VI REACTIVITY DATA

Stability: Stable
Incompatibility (Material to Avoid): Halogen gases, halides, halogenates, potassium nitrate or permanganate or peroxides may cause a violent reaction or explode.

Hazardous Decomposition Products: At temperatures above the melting point, metal oxide fumes may be evolved. Under reducing conditions (i.e. any strong acid or base plus an active metal) or in the presence of nascent hydrogen, highly toxic arsine gas may be evolved.

Hazardous Polymerization: Will not occur
Conditions to Avoid: Not applicable

VII SPILL OR LEAK PROCEDURES

Steps to Be Taken in Case Material Is Released or Spilled: Any method which keeps dust to a minimum is acceptable. Vacuuming is preferred for dust. Use approved respiratory protection if possibility of dust/fume exposure exists. Do not use compressed air for cleaning.

Waste Disposal Method: If hazardous under 40 CFR 261, Subparts B and C, material must be treated or disposed in a faciiity meeting the requirements of 40 CFR 264 or 265. If non-hazardous, material should be disposed in a facility meeting the requirements of 40 CFR 257.

RCRA Status of Unused Material: If discarded in unaltered form, material should be tested to determine if it must be classified as a hazardous waste for disposal purposes. Under specified circumstances, application can be made to the EPA Administrator to have a particular waste designated non-hazardous.

Regulated by DOT?: Arsenic is regulated as a Poison B Hazardous Material.

VIII SPECIAL PROTECTION INFORMATION

Respiratory Protection: Where airborne exposures may exceed OSHA/ACGIH permissible air concentrations, the minimum respiratory protection recommended is a negative pressure air purifying respirator with cartridges that are NIOSH/MSHA approved against dust, fumes and mists having a TWA less than 0.05 mg/m^3

Eye and Face: Safety glasses recommended where the possibility of getting dust particles in eyes exists.

Other Clothing and Equipment: Full protective clothing is recommended for exposures that exceed permissible air concentrations. All contaminated clothing should be removed before leaving plant premises.

IX SPECIAL PRECAUTIONS

Normal Handling: Use of approved respirators is required for applications where adequate ventilation cannot be provided. Activities which generate dust or fume should be avoided. When melted, the temperature should be kept as low as possible.

Personal Hygiene: Avoid inhalation or ingestion. Practice good housekeeping and personal hygiene procedures. No tobacco or food in the work area. Wash thoroughly before eating or smoking. Shower and change clothes at end of work shift. Do not wear contaminated clothing home. Do not blow dust off clothing with compressed air.

Engineering Controls: Local exhaust ventilation is recommended for dust and/or fume generating operations where airborne exposures may exceed permissible air concentrations.

Special Precautions/Procedures/Label Instructions: Where airborne arsenic exposures may exceed the OSHA action level and PEL, refer to the OSHA Arsenic Standard 29 CFR1910.1018.

Label signal word: DANGER

Prepared by: S. Dierks
Revised Date: June 1993

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 10/29/96

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

CX1579 CX1580

Product Name:
Chromium
Synonyms:
Chrome
Chemical Family:
Metal
Formula:
Cr
Molecular Weight.:
52.00

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Chromium	7440-47-3	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
DUST IRRITATING.
LABORATORY TESTS INDICATE MATERIAL MAY BE CARCINOGENIC.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

Appearance:

Silver-gray powder or granules

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Exposure to chromium by inhalation, skin or eye contact causes irritation.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
Proven human carcinogenic substance. Cancer Hazard.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Skin: Wash thoroughly with soap and water.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flash Point (F): N/A
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Dry powder, sand, water fog

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Fine powder may ignite or explode in atmospheres of carbon dioxide.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal

Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store in a cool area away from ignition sources. Do not breathe dust. Do not get in eyes, on skin, or on clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves (Natural rubber, Neoprene or equivalent) should be worn to prevent skin contact. Safety glasses with side shields must be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Chromium		1.0					

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Chromium		0.5					

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 2642C
Melting Point (C) : 1900C
Specific Gravity (H_20 = 1) : 7.14
Vapor Pressure (mm Hg) : N/A

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

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Manufacturer.....:
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A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 10/1/98

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

SX0110 SX0111

Product Name:
Selenium
Synonyms:
Elemental Selenium
Chemical Family:
Metal
Formula:
Se
Molecular Weight.:
78.96

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Selenium	7782-49-2	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
HARMFUL IF INHALED OR SWALLOWED.
IRRITATING TO SKIN, EYES AND MUCOUS MEMBRANES.

Appearance:
Dark gray to black shot or powder

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Toxic by ingestion and inhalation. Occupational exposure has caused pallor (paleness), nervousness, depression, garlic odor of breath and sweat, gastrointestinal disturbances and dermatitis. Chronic effects are damaging to lungs, Central Nervous System, and liver. Selenium is also irritating to skin, eyes, and respiratory system.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flash Point (F): None
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Use any suitable for adjacent material.

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:
Thermal decomposition produces toxic fumes.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the

release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store in a cool, well-ventilated area away from incompatible materials. Do not breathe dust or vapor. Do not get in eyes, on skin, or on clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves (Neoprene, PVC or equivalent) should be worn to prevent skin contact. Safety glasses with side shields should be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Selenium		0.2					

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Selenium		0.2					

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 685C
Melting Point (C) : 217C
Specific Gravity (H_2O = 1) : 4.81
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%): None

Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :
Dark gray to black shot or powder

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
Produces SeO_2 on combustion

Conditions to Avoid:
Extreme heat

Materials To Avoid:

```
( ) Water
(X) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Metal amides, carbides, alkali metals,
halogen compounds
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-rat LD50: 6700 mg/kg    ihl-rat LCLo: 33 mg/kg/8H
```

Toxicological Findings:
Tests on laboratory animals indicate material may cause tumors
and adverse reproductive effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

```
EPA Waste Numbers:  D010
```

Treatment:
Specified Technology - Contact your local permitted waste disposal site (TSD) for permissible treatment sites.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL

CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

|13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
non-regulated

DOT ID Number :
none

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Selenium			100

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Selenium	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 1
Flammability : 1
Reactivity : 0
Special Hazards :

Revision History: 3/1/82 12/1/85 1/13/87 10/27/87 3/1/91 3/4/94

| = Revised Section

N/A = Not Available

N/E = None Establised

The statements contained herein are offered for informational purposes only and are based upon technical data that EM Science believes to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make NO WARRANTY, EXPRESS OR IMPLIED, OR MERCHANTABILITY, FITNESS OR OTHERWISE.

MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION

Trade Name:	Thallium	**Synonym:**	Thallium metal
Chemical Nature:	Metallic Element	**Formula:**	Tl
CAS #:	7440-28-0	**EINECS #:**	231-138-1
RTECS #:	XG 3425000	**EEC #:**	081-001-00-3

NTP, NIOSH, EPA Status: EPA TSCA Chemical Inventory, 1989. EPA TSCA Section 8(e) & Status Report 8 EHQ-0680-0345. EPA TSCA test submission (TSCATS) Data Base, April 1990.

II HAZARDOUS INGREDIENTS

Hazardous Ingredients: Pure metal 99.9% minimum MSHA STANDARD-air, TWA 0.1 mg/m^3 (skin) (DTLVS 3,256,71).

HMIS Rating: Health: 3 **Flammability:** 0 **Reactivity:** 0

III PHYSICAL DATA

Boiling Point:	1457 °C	**Melting Point:**	303 °C
Vapor Pressure:	N/A	**%Volatile by Volume:**	N/A
Density:	11.85 gm/cm^3		
Solubility in H_2O:	Insoluble, may be protected from air oxidation by immersion in water.		
Appearance and Odor:	Solid, odorless. Highly toxic by inhalation.		

IV FIRE AND EXPLOSION HAZARDS DATA

Flash Point (Method used): N/A
Special Fire Fighting Procedures: Release of (highly) toxic gases/vapors on exposure to temperature rise.

Personal Protection in Emergencies: Gloves, face-shield, protective clothing, compressed air/oxygen apparatus, gas-tight suit. Take account of toxic firefighting water: limit and if possible collect/contain the water.

Flammable Limits: N/A **Extinguishing Media:** No available data.
Unusual Fire and Explosion Hazards: Reacts violently with (some) halogens: (increased) risk of fire. Material begins to emit highly toxic fumes and vapors at temperatures over 147 °C.

V HEALTH HAZARD INFORMATION

Threshold Limit Value:

Health Hazard Rating: TWA 0.1 mg/m^3; OSHA PEL 8H TWA 0.1 mg Tl/m^3 (skin) FEREAC 54,2923,89); OSHA PEL Final 8H TWA 0.1 mg Tl/m^3 (skin) (FEREAC 54, 2923,89); NIOSH Criteria Documents Notes 1983: HZD X3172; NIS 3; TNF 158; NOS 5; TNE 1662; TFE 1308.

Effects of Overexposure: Highly toxic by ingestion and inhalation. Substance is absorbed through the skin; no toxicity data on skin absorption. Irritant to the skin, the respiratory organs, the eyes. The substance may have an effect on the nervous system. Cumulative effect. No available data on the carcinogenicity, mutagenicity, teratogenicity.

EMERGENCY AND FIRST AID PROCEDURES: In case of accident or if you feel unwell, seek medical advice immediately.

INHALATION: Remove victim to fresh air. Seek immediate medical attention.
INGESTION: Rinse mouth with water, induce vomiting. Seek immediate medical attention.
SKIN CONTACT: Wash immediately with water, soap may be used.
EYES: Flush with copious amounts of water for at least 15 minutes.

VI REACTIVITY DATA

Stability: Stable
Incompatibility: Reacts with (some) acids. Reacts violently with (some) halogens.

Hazardous Decomposition Products: None
Hazardous Polymerization: Will not occur
Conditions to Avoid: Reacts slowly with damp air.

VII SPILL OR LEAK PROCEDURES

Steps to Be Taken in Case Material Is Released or Spilled: Wearing suitable respiratory protection, protection clothing and gloves; sweep up and place in a properly marked container. Sweep spill area with moist sweeping compound and put this material into same container with dry sweepings. Seal container and submit for disposal. Wash clothing and equipment after handling.

Waste Disposal Method: Dispose of in accordance with Local, State and Federal Waste Disposal Regulations.

VIII SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type): Dust production: Dust mask with filter type P3. High dust Production: Compressed air/ oxygen apparatus. On heating: Gas Mask.

Ventilation: Carry operations in the open/under local exhaust/ventilation.
Protective Gloves: Yes
Eye Protection: Face shield/ tight-fitting goggles.
Other Protective Equipment: Protective/dust proof clothing.

IX SPECIAL PRECAUTIONS

Other Handling and Storage Conditions:

- Protect container from physical damage.
- Store in a cool dry well ventilated area, away from acids and oxidizers.
- Comply with legal requirements
- Measure the concentration in the air regularly
- Avoid exposure/contact
- Avoid raising dust
- Do not discharge the waste in the drain
- Store in a dry area
- Keep substance away from: Heat sources, Oxidizing agents, (strong) acids, and Halogens.

Precautionary Labeling: DANGER! HIGHLY TOXIC! May be fatal if swallowed or inhaled. Avoid contact with skin and eyes. Wash very thoroughly after handling. Keep container tightly closed when not in use.

Prepared by: S. Dierks
Dated: December 1994

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 4/6/93

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

1057 AX0620 AX0625 AX0627 AX0630 AX0635 AX0640
AX0645

Product Name:
Aluminum
Synonyms:
Aluminum
Chemical Family:
Metal
Formula:
Al
Molecular Weight.:
26.98

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Aluminum	7429-90-5	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
INHALATION OF ALUMINUM (POWDER OR DUST) MAY CAUSE RESPIRATORY IRRITATION.
INHALATION OF FINELY DIVIDED POWDER HAS BEEN REPORTED AS A CAUSE OF PULMONARY FIBROSIS.
ALUMINUM POWDER IS A FLAMMABLE SOLID WHICH FORMS

FLAMMABLE AND EXPLOSIVE MIXTURES WITH AIR.

Appearance:
White-gray malleable, ductile metal or powder

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Aluminum dust may cause eye and respiratory irritation. Aluminum dust may cause pulmonary fibrosis.

Medical Cond. Aggravated by Exposure:
Respiratory conditions

Routes of Entry:
Inhalation, ingestion

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: Get immediate medical attention; if conscious, give water freely.

5. FIRE FIGHTING MEASURES

Flash Point (F): N/A
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
CO_2, Dry chemical (DO NOT USE WATER)

Fire Fighting Procedures:
Dust is easily ignited; hazard greater as fineness increases.

Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Dust, powder forms explosive mixture with air. Dust, when damp, may heat spontaneously.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed and protected against physical damage. Keep dry and isolate from acids, caustics and chlorinated hydrocarbons. Store separate from oxidizing materials and combustible materials. Do not breathe dust. Do not get in eyes. Avoid prolonged, or repeated, skin contact.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves (Neoprene or equivalent) should be worn to prevent skin contact Safety glasses with side shields should be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Aluminum		5					

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Aluminum		5					

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 2450C

Melting Point (C) : 660C
Specific Gravity (H_20 = 1) : 2.7
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%): N/A
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :
White-gray malleable, ductile metal or powder

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
None indicated

Conditions to Avoid:
Avoid dusting; reacts with some acids and caustic solutions to produce hydrogen, which is highly flammable.

Materials To Avoid:

```
( ) Water
(X) Acids
( ) Bases
(X) Corrosives
(X) Oxidizers
(X) Other: Mineral acids, harsh alkalis, halogenated
compounds, heavy  metals.
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

None established

Toxicological Findings:
None
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers:

Treatment:
Material does not have an EPA Waste number and is not a listed waste, however consultation with a permitted waste disposal site (TSD) should be accomplished.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
non-regulated (for all except AX0630)
See Other Info.(Section 15) for DOT Shipping Name & Number on AX0630
DOT ID Number :
none (see Other Info.)

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Aluminum			

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Aluminum	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
Tranport Information for AX0630:

DOT Shipping Name: Aluminum Powder, Uncoated
DOT Number : UN1396

NFPA Hazard Ratings:

Health : 0
Flammability : 1
Reactivity : 1
Special Hazards :

Revision History: 1/1/82 5/1/84 6/2/87 10/27/87
3/1/91 7/20/92 8/31/92

| = Revised Section

N/A = Not Available

N/E = None Establised

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Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

3819 IX0240 IX0245 IX0250 IX0252

Product Name:
Iron
Synonyms:
N/A
Chemical Family:
Metal - Element
Formula:
Fe
Molecular Weight.:
55.85

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Iron	7439-89-6	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
MAY BE HARMFUL IF INHALED.

Appearance:
Silvery-white to grey- black powder or filings

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Dust inhalation may be harmful. Repeated inhalation can cause chronic bronchitis. Iron dust may cause conjunctivitis, choroditis, retinitis and siderosis of tissue. Chronic exposure to excess levels of iron (more than 50-100 mg of iron per day) can result in pathological deposition of iron in the body tissues, the symptoms of which are fibrosis of the pancreas, diabetes mellitus, and liver cirrhosis.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flash Point (F): None
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Dry chemical only

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Moderate hazard when dust is exposed to heat, flame. Explosive or violent reaction with ammonium nitrate + heat; ammonium peroxodisulfate; chloric acid; chlorine trifluoride; chloroformamidinium nitrate; bromine pentafluoride + heat (with iron powder); air + oil (with iron dust); sodium acetylide. Ignites on contact with chlorine; dinitrogen tetraoxide; liquid fluorine; hydrogen peroxide (with iron powder); nitryl fluoride + heat; peroxyformic acid; potassium perchlorate; potassium dichromate; sodium peroxide (at 240C); polystyrene + friction or spark (iron powder). Mixtures of iron dust with air + water may ignite on drying. Reduced iron reacts with water to produce explosive hydrogen gas.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store at controlled room temperature. Do not breathe dust. Do not get in eyes. Avoid prolonged, or repeated, skin contact.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves (Neoprene, PVC or equivalent) should be worn to prevent skin contact. Safety glasses with side shields should be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Iron							

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Iron							

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 3000C

Melting Point (C) : 1535C
Specific Gravity (H_20 = 1) : 7.86
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%): None
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :
Silvery-white to grey- black powder or filings

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
None

Conditions to Avoid:
Heat, flame; material will oxidize in moist air; reacts with steam when hot to produce flammable hydrogen gas

Materials To Avoid:

```
(X) Water
(X) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Halogens and halogen compounds
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
ipr-rbt LDLo: 20 mg/kg
```

Toxicological Findings:
Tests on laboratory animals indicate inhalation
of material may cause lung tumors.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

```
EPA Waste Numbers:
```

Treatment:
Material does not have an EPA Waste number and is not a listed waste, however consultation with a permitted waste disposal site (TSD) should be accomplished.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
For IX0240: Ferrous Metal Shavings
non-regulated (for all other catalog #'s)
DOT ID Number :
UN2793 (for IX0240)

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Iron			

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Iron			

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 1
Flammability : 1
Reactivity : 0
Special Hazards :

Revision History: 3/1/82 8/1/83 6/2/86 6/22/87

10/27/87 3/1/91 1/19/94

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 4/28/93

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

MX0005 MX0006

Product Name:
Magnesium
Synonyms:
Magnesium Powder
Chemical Family:
Metal
Formula:
Mg
Molecular Weight.:
24.31

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Magnesium	7439-95-4	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
FLAMMABLE SOLID.
Reacts With Water And Acid Liberating And Igniting Hydrogen.
MAY BE HARMFUL IF INHALED OR SWALLOWED.
MAY CAUSE BURNS.

Appearance:

Silvery gray powder

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
May be harmful if inhaled or swallowed. Contact with skin can cause irritation; may cause burns. Inhalation of dust and fumes can cause metal fume fever.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin or eye contact: Brush off all solid particles; flush thoroughly with large amounts of water.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: Get immediate medical attention.

5. FIRE FIGHTING MEASURES

Flash Point (F): N/A
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
G-1 Powder, Powdered Talc, Dry Sand, "Purple K".
DO NOT USE WATER.

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.
Burns with a very bright flame; "fire glasses" must be worn.

Fire & Explosion Hazards:
Dust suspended in air is a dangerous explosion hazard in the presence of moisture.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the

release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container tightly closed. Store in a dry, well-ventilated area away from sparks, flame and oxidizing materials. Do not breathe dust or vapor. Do not get in eyes, on skin, or on clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves must be worn to prevent skin contact (Neoprene or equivalent) Safety glasses with side shields must be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Magnesium							

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Magnesium							

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 1100C
Melting Point (C) : 651C
Specific Gravity (H_20 = 1) : 1.74 5C
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%): N/A
Vapor Density (Air = 1) : N/A

Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Reacts
Appearance :
Silvery gray powder

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
None

Conditions to Avoid:
Reacts with water and acids to evolve flammable hydrogen. Avoid dusting (dispersion of fine particles into air).

Materials To Avoid:

```
(X) Water
(X) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Cyanides, Halogens, Halogen compounds
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-dog LDLo: 230 mg/kg
```

Toxicological Findings:
None
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

```
EPA Waste Numbers:  D001
```

Treatment:
Specified Technology - Contact your local permitted waste disposal site (TSD) for permissible treatment sites.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Magnesium Powder

DOT ID Number :
UN1418

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Magnesium			

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Magnesium			

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 0
Flammability : 1
Reactivity : 2
Special Hazards : W

Revision History: 4/1/84 10/27/87 3/1/91 9/24/91 11/4/91

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION

Trade Name: Silver
Chemical Nature: Pure Element
Synonym: Silver Metal Products
Formula: Ag

II HAZARDOUS INGREDIENTS

TLV (Units): Silver Metal 0.01 mg/m³ as dust

III PHYSICAL DATA

Boiling Point: 2210 °C
Melting Point: 960.8 °C
Specific Gravity: 10.53%
Volatiles by Weight: N/A
Solubility in H_2O: Insoluble
Appearance and Odor: Silver Grey, lustrous, malleable and ductile metal, no odor.

IV FIRE AND EXPLOSION HAZARDS DATA

Flash Point: Not Flammable
Extinguishing Media: N/A
Flammable Limits: Upper: N/A **Lower:** N/A
Special Fire Fighting Procedures: At high temperatures this metal could melt and continuous heating could produce metal vapor out of fire area.

V HEALTH HAZARD INFORMATION

Threshold Limit Value: 0.01 mg/m³
Effects of Over Exposure: As solid no known effects

EMERGENCY AND FIRST AID PROCEDURES:

EYES/SKIN: Flush with water
INHALATION/INGESTION: Seek immediate medical attention.

VI REACTIVITY DATA

Stability: Stable
Incompatibility (Material to Avoid): N/A
Hazardous Decomposition Products: N/A
Hazardous Polymerization: Will not Occur

VII SPILL OR LEAK PROCEDURES

Steps to be taken if spilled or released: hazard from spills, avoid inhalation of dust if as powder. Transfer to a glass or metal container and submit or retain for disposal or salvage.

Waste Disposal Method: In accordance with governmental regulations. Has reclaim value.

VIII SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type): None
Ventilation: Local during working and melting.

Protective Gloves: None recommended
Eye Protection: Safety Glasses
Other Protective Equipment: Lab coat and apron

IX SPECIAL PRECAUTIONS

Other Handling and Storage Conditions: Wash thoroughly after handling. Keep container tightly closed. Protect silver from tarnishing (sulphur containing atmosphere) Inhalation of dust should be avoided.

Prepared by: Steve Dierks
Date Prepared: January 1996

Please reduce your browser font size for better viewing and printing.

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

METHYLENE CHLORIDE

MSDS Number: M4420 --- ***Effective Date: 03/01/97***

1. Product Identification

Synonyms: MC; Dichloromethane (DCM); Methylene dichloride; Methylene bichloride; Methane dichloride
CAS No.: 75-09-2
Molecular Weight: 84.93
Chemical Formula: CH2Cl2
Product Codes: 9264, 9266, 9315, 9324, 9329, 9330, 9341, 9348, Q480

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Methylene Chloride	75-09-2	100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, CARDIOVASCULAR SYSTEM, AND BLOOD. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)
Flammability Rating: 1 - Slight
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes formation of carbon monoxide in blood which affects cardiovascular system and central nervous system. Continued exposure may cause increased light-headedness, staggering, unconsciousness, and even death. Exposure may make the symptoms of angina (chest pains) worse.

Ingestion:
May cause irritation of the gastrointestinal tract with vomiting. If vomiting results in aspiration, chemical pneumonia could follow. Absorption through gastrointestinal tract may produce symptoms of central nervous system depression ranging from light headedness to unconsciousness.

Skin Contact:
Causes irritation, redness and pain. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.

Eye Contact:
Vapors can cause eye irritation. Contact can produce pain, inflammation and temporal eye damage.

Chronic Exposure:
Can cause headache, mental confusion, depression, liver effects, kidney effects, bronchitis, loss of appetite, nausea, lack of balance, and visual disturbances. Can cause dermatitis upon prolonged skin contact. Methylene chloride may cause cancer in humans.

Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, eye problems, impaired liver, kidney, respiratory or cardiovascular function may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Autoignition temperature: 556C (1033F) Flammable limits in air % by volume: lel: 12; uel: 23 Forms flammable vapor-air mixtures above 100C (212F).

Explosion:
Concentrated can be ignited by a high intensity ignition source. Vapor may form flammable mixture in atmosphere that contains a high percentage of oxygen. Sealed containers may rupture when heated.

Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limited protection to the combustion products of this material.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Outside or detached storage is recommended. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. To minimize decomposition, all storage containers should be galvanized or lined with a phenolic coating. This material may corrode plastic and rubber. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Odor Threshold: 205 - 307 ppm. The odor threshold only serves as a warning of exposure; not smelling it does not mean you are not being exposed.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Methylene Chloride (Dichloromethane): - OSHA Permissible Exposure Limit (PEL) - 25 ppm (TWA), 125 ppm (STEL), 12.5 ppm (8-hour TWA - Action Level) - ACGIH Threshold Limit Value (TLV) - 50 ppm (TWA), A2 - suspected human carcinogen.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. The cartridges recommended for this material have a predicted service of less than 30 minutes at concentrations of ten times (10x) the exposure limits. Actual service life will vary considerbly, depending on

concentration levels, temperature, humidity, and work rate. This substance has poor warning properties.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene is a recommended material for personal protective equipment. Natural rubber and polyvinyl chloride ARE NOT recommended materials for personal protective equipment.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:
Do not use closed circuit rebreathing system employing soda lime or other carbon dioxide absorber because of formation of toxic compounds capable of producing cranial nerve paralysis. See OSHA Standard for medical surveillance, record keeping, and reporting requirements for methylene chloride (29 CFR 1910.1052).

---

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.

Odor:
Chloroform-like odor.

Solubility:
1.32 gm/100 gm water @ 20C.

Specific Gravity:
1.33 @ 15C/4C

pH:
No information found.

% Volatiles by volume @ 21C (70F):
100

Boiling Point:
39.8C (104F)

Melting Point:
-97C (-143F)

Vapor Density (Air=1):
2.9

Vapor Pressure (mm Hg):
350 @ 20C (68F)

Evaporation Rate (BuAc=1):
27.5

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:
Emits highly toxic fumes of phosgene when heated to decomposition. Decomposes in a flame or hot surface to form toxic gas phosgene and corrosive mists of hydrochloric acid. Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Strong oxidizers, strong caustics, plastics, rubber, nitric acid, water + heat, and chemically active metals, such as aluminum and magnesium powder, sodium, potassium, and lithium. Avoid contact with open flames and electrical arcs. Liquid methylene chloride will attack some forms of plastics, rubber, and coatings.

Conditions to Avoid:
Moisture, heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:
Dichloromethane: Oral rat LD50: 1600 mg/kg; inhalation rat LC50: 52 gm/m3; investigated as a tumorigen, mutagen, reproductive effector.

Reproductive Toxicity:
Dichloromethane has been linked to spontaneous abortions in humans.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Methylene Chloride (75-09-2)	No	Yes	2B

12. Ecological Information

Environmental Fate:
When released into the soil, this material may leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of greater than 30 days. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.

Environmental Toxicity:
The LC50/96-hour values for fish are over 100 mg/l. This material is not expected to be toxic to aquatic life.

---

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

---

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1
UN/NA: UN1593
Packing Group: III
Information reported for product/size: 56L

International (Water, I.M.O.)

Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1
UN/NA: UN1593
Packing Group: III
Information reported for product/size: 56L

International (Air, I.C.A.O.)

Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1
UN/NA: UN1593
Packing Group: III
Information reported for product/size: 56L

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\--------

Ingredient	TSCA	EC	Japan	Australia
Methylene Chloride (75-09-2)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\--------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Methylene Chloride (75-09-2)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\--------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Methylene Chloride (75-09-2)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\--------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Methylene Chloride (75-09-2)	1000	U080	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

Prop 65:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2Z
Poison Schedule: S5

WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 2 **Flammability:** 1 **Reactivity:** 0

Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, CARDIOVASCULAR SYSTEM, AND BLOOD. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

Label Precautions:
Do not breathe vapor. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Keep away from heat and flame. Do not get in eyes, on skin, or on clothing.

Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:
Laboratory Reagent.

Revision Information:
Pure. New 16 section MSDS format, all sections have been revised.

Disclaimer:
****
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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

CHEM SERVICE -- F30 TRANS-1,2-DICHLOROETHENE
MATERIAL SAFETY DATA SHEET
NSN: 655000F037529
Manufacturer's CAGE: 8Y898
Part No. Indicator: A
Part Number/Trade Name: F30 TRANS-1,2-DICHLOROETHENE

General Information

Company's Name: CHEM SERVICE INC
Company's Street: 660 TOWER LN
Company's P. O. Box: 3108
Company's City: WEST CHESTER
Company's State: PA
Company's Country: US
Company's Zip Code: 19381-3108
Company's Emerg Ph #: 215-692-3026/800-452-9994
Company's Info Ph #: 215-692-3026/800-452-9994
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 28APR92
Safety Data Review Date: 15DEC94
Preparer's Company: CHEM SERVICE INC
Preparer's St Or P. O. Box: 660 TOWER LN
Preparer's City: WEST CHESTER
Preparer's State: PA
Preparer's Zip Code: 19381-3108
MSDS Serial Number: BWJGZ

Ingredients/Identity Information

Proprietary: NO
Ingredient: TRANS-1,2-DICHLOROETHYLENE, TRANS-1,2-DICHLOROETHENE
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: KV9400000
CAS Number: 156-60-5
OSHA PEL: 200 PPM
ACGIH TLV: 200 PPM

Physical/Chemical Characteristics

Appearance And Odor: COLORLESS LIQUID W/FRUITY/PLEASANT ODOR.
Boiling Point: 118.4F
Melting Point: -58F
Solubility In Water: SLIGHT

Fire and Explosion Hazard Data

Flash Point: 39.2F
Lower Explosive Limit: 9.7
Upper Explosive Limit: 12.8
Extinguishing Media: CO2, DRY CHEMICAL POWDER/SPRAY.
Unusual Fire And Expl Hazrds: FLAMMABLE CHEMICAL.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): AIR, HEAT, MOISTURE, LIGHT.
Materials To Avoid: STRONG OXIDIZING AGENTS.
Hazardous Decomp Products: TOXIC FUMES/CO/CO2/HYDROGEN CHLORIDE GAS. DECOMPOSITION PRODUCTS ARE CORROSIVE.
Hazardous Poly Occur: NO

Health Hazard Data

LD50-LC50 Mixture: ORAL LD50 (RAT/MOUSE): 7536 MG/KG
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: INHALATION: HARMFUL/RESPIRATORY TRACT IRRITATION. SKIN: HARMFUL IF ABSORBED/IRRITATION. EXPOSURE CAN CAUSE CNS DEPRESSION.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NONE
Signs/Symptoms Of Overexp: IRRITATION.
Emergency/First Aid Proc: EYES: FLUSH CONTINUOUSLY W/WATER FOR 15-20 MINS. SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NOT BURNED, WASH W/SOAP & WATER TO CLEANSE. INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED. KEEP WARM & QUIET. INGESTION: DON'T GIVE LIQUIDS/INDUCE VOMITING IF UNCONSCIOUS/CONVULSIVE. IF VOMITING OCCURS, WATCH CLOSELY TO AVOID AIRWAY OBSTRUCTION. OBTAIN MEDICAL ATTENTION IN ALL CASES.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE AREA. WEAR APPRORPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR DISPOSAL. WASH CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.
Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.
Precautions-Handling/Storing: STORE IN A COOL DRY PLACE ONLY W/COMPATIBLE CHEMICALS. KEEP TIGHTLY CLOSED. STORE UNDER REFRIGERATION. FOR LABORATORY USE ONLY.
Other Precautions: AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATH VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL CHEMICALS SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL CONTACT.

Control Measures

Respiratory Protection: WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.
Ventilation: CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.
Eye Protection: EYE SHIELDS
Work Hygienic Practices: REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. READILY ABSORBED & RETAINED ON CLOTHING & SHOES.

Transportation Data

Disposal Data

Label Data

Label Required: YES
Label Status: G
Common Name: F30 TRANS-1,2-DICHLOROETHENE
Special Hazard Precautions: INHALATION: HARMFUL/RESPIRATORY TRACT IRRITATION. SKIN: HARMFUL IF ABSORBED/IRRITATION. EXPOSURE CAN CAUSE CNS DEPRESSION. IRRITATION.
Label Name: CHEM SERVICE INC
Label Street: 660 TOWER LN
Label P.O. Box: 3108
Label City: WEST CHESTER

Label State: PA
Label Zip Code: 19381-3108
Label Country: US
Label Emergency Number: 215-692-3026/800-452-9994

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 6/6/97

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

0138658D BX1670 BX1673 MX1034

Product Name:
2-Butanone
Synonyms:
Methyl Ethyl Ketone
Chemical Family:
Ketone
Formula:
$CH_3COCH_2CH_3$
Molecular Weight.:
72.11

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
2-Butanone	78-93-3	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
FLAMMABLE LIQUID AND VAPOR.
Vapor Irritating To Eyes And Respiratory Passages.
Liquid Irritating To Eyes.
MAY CAUSE EYE INJURY.
MAY CAUSE SKIN IRRITATION.
May Cause Damage To Lungs And Central Nervous System.

Appearance:
Colorless liquid, sharp, mint-like odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Vapor irritating to eyes and respiratory passages. Liquid irritating to eyes; may cause eye injury. Prolonged or repeated skin contact may cause irritation. Inhalation of high concentrations may cause headache, dizziness, nausea, narcosis, lung damage. Prolonged exposure may produce central nervous system depression and narcosis.

Medical Cond. Aggravated by Exposure:
Respiratory conditions

Routes of Entry:
Inhalation, ingestion

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: Do not induce vomiting; get immediate medical attention.

5. FIRE FIGHTING MEASURES

Flash Point (F): 21F (tcc)
Flammable Limits LEL (%): 1.80
Flammable Limits UEL (%): 11.50
Extinguishing Media:
Water spray, "alcohol" foam, dry chemical, CO_2

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Vapor can travel distances to ignition source and flash back.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.
EM SCIENCE recommends Spill-X absorbent agents for various types of spills. Additional information on the Spill-X products can be provided through the EM SCIENCE Technical Service Department (609) 423-6300. The following EM SCIENCE Spill-X absorbent is recommended for this product:

SX0863 Solvent Spill Treatment Kit

7. HANDLING AND STORAGE

Handling & Storage:
Keep container tightly closed. Store in a cool area away from ignition sources and oxidizers. Electrically ground all equipment when handling this product. Do not breathe vapor. Do not get in eyes, on skin, or on clothing. Retained residue may make empty containers hazardous; use caution!

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves (Butyl rubber, Polyurethane or equivalent) should be worn to prevent skin contact. Safety glasses with side shields must be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
2-Butanone	200	590	300	885			

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
2-Butanone	200	590	300	885			

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 80C
Melting Point (C) : -86C
Specific Gravity (H_20 = 1) : 0.805
Vapor Pressure (mm Hg) : 75 20C
Percent Volatile by vol (%): 99+%
Vapor Density (Air = 1) : 2.5
Evaporation Rate (BuAc = 1): 3.8
Solubility in Water (%) : 27%
Appearance :
Colorless liquid, sharp, mint-like odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
CO_x, peroxides

Conditions to Avoid:
Heat; contact with ignition source

Materials To Avoid:

```
( ) Water
(X) Acids
(X) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Potassium t-butoxide, alkaline materials,
halogens, hydrogen  peroxide and nitric acid, haloforms
and strong bases,  2-Propanol
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-rat LD50: 2737 mg/kg   skn-rbt LD50: 6480 mg/kg
ihl-mus LC50: 40 g/cu.m./2H
```

Toxicological Findings:
Laboratory rats exposed by inhalation to over 1000 ppm for most of their pregnancy period exhibited minor embryotoxic/fetotoxic

effects.
Tests on laboratory animals indicate material may produce adverse mutagenic effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: U159 D001 D035

Treatment:
Specified Technology - Incineration or fuels blending to less than the TCLP standard. Contact your local permitted waste disposal site (TSD) for permissible treatment sites.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Methyl Ethyl Ketone (for BX1670, BX1673, MX1034)
Ethyl Methyl Ketone (for 0138658D)
DOT ID Number :
UN1193

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
2-Butanone			5000

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
2-Butanone	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:

None

NFPA Hazard Ratings:

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Health          : 1
Flammability    : 3
Reactivity      : 0
Special Hazards :
```

Revision History: 11/1/81 10/1/83 5/6/86 6/30/87 10/27/87 1/8/88 5/8/89 3/1/91 1/4/96

| = Revised Section

N/A = Not Available

N/E = None Establised

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MSDS Material Safety Data Sheet

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

TRICHLOROETHYLENE

MSDS Number: T4940 --- *Effective Date: 09/14/00*

1. Product Identification

Synonyms: Trichloroethene; TCE; acetylene trichloride; Ethinyl trichloride
CAS No.: 79-01-6
Molecular Weight: 131.39
Chemical Formula: C2HCl3
Product Codes:
J.T. Baker: 5376, 9454, 9458, 9464, 9473, 9474
Mallinckrodt: 8598, 8600, 8633

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Trichloroethylene	79-01-6	100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS HEART, CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. CAUSES SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)
Flammability Rating: 1 - Slight
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Vapors can irritate the respiratory tract. Causes depression of the central nervous system with symptoms of visual disturbances and mental confusion, incoordination, headache, nausea, euphoria, and dizziness. Inhalation of high concentrations could cause unconsciousness, heart effects, liver effects, kidney effects, and death.
Ingestion:
Cases irritation to gastrointestinal tract. May also cause effects similar to inhalation. May cause coughing, abdominal pain, diarrhea, dizziness, pulmonary edema, unconsciousness. Kidney failure can result in severe cases. Estimated fatal dose is 3-5 ml/kg.
Skin Contact:
Cause irritation, redness and pain. Can cause blistering. Continued skin contact has a defatting action and can produce rough, dry, red skin resulting in secondary infection.
Eye Contact:
Vapors may cause severe irritation with redness and pain. Splashes may cause eye damage.
Chronic Exposure:
Chronic exposures may cause liver, kidney, central nervous system, and peripheral nervous system effects. Workers chronically exposed may exhibit central nervous system depression, intolerance to alcohol, and increased cardiac output. This material is linked to mutagenic effects in humans. This material is also a suspect carcinogen.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, cardiovascular disorders, impaired liver or kidney or respiratory function, or central or peripheral nervous system disorders may be more susceptible to the effects of the substance.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Call a physician.
Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

5. Fire Fighting Measures

Fire:
Autoignition temperature: 420C (788F)
Flammable limits in air % by volume:
lel: 8; uel: 12.5
Explosion:
A strong ignition source, e. g., a welding torch, can produce ignition. Sealed containers may rupture when heated.
Fire Extinguishing Media:
Use water spray to keep fire exposed containers cool. If substance does ignite, use CO_2, dry chemical or foam.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limited protection to the combustion products of this material.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Isolate from incompatible substances. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Trichloroethylene:
-OSHA Permissible Exposure Limit (PEL):

100 ppm (TWA), 200 ppm (Ceiling),
300 ppm/5min/2hr (Max)

-ACGIH Threshold Limit Value (TLV):
50 ppm (TWA) 100 ppm (STEL);
listed as A5, not suspected as a human carcinogen.
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has poor warning properties. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene is a recommended material for personal protective equipment.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Chloroform-like odor.
Solubility:
Practically insoluble in water. Readily miscible in organic solvents.
Specific Gravity:
1.47 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
87C (189F)
Melting Point:
-73C (-99F)
Vapor Density (Air=1):
4.5
Vapor Pressure (mm Hg):
57.8 @ 20C (68F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Will slowly decompose to hydrochloric acid when exposed to light and moisture.
Hazardous Decomposition Products:
May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong caustics and alkalis, strong oxidizers, chemically active metals, such as barium, lithium, sodium, magnesium, titanium and beryllium, liquid oxygen.
Conditions to Avoid:
Heat, flame, ignition sources, light, moisture, incompatibles

11. Toxicological Information

Toxicological Data:
Trichloroethylene: Oral rat LD50: 5650 mg/kg; investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
This material has been linked to mutagenic effects in humans.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Trichloroethylene (79-01-6)	No	Yes	2A

12. Ecological Information

Environmental Fate:
When released into the soil, this material may leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released to water, this material is expected to quickly evaporate. This material has an experimentally-determined bioconcentration factor (BCF) of less than 100. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.
Environmental Toxicity:
The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be slightly toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 5GL

International (Water, I.M.O.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 5GL

International (Air, I.C.A.O.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 5GL

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\--------

Ingredient	TSCA	EC	Japan	Australia
Trichloroethylene (79-01-6)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\--------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Trichloroethylene (79-01-6)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\--------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Trichloroethylene (79-01-6)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\--------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Trichloroethylene (79-01-6)	100	U228	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: No information found.
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: 2 Flammability: 1 Reactivity: 0
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS HEART, CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. CAUSES SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep away from heat and flame.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician. Note to physician: Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 8, 11.
Disclaimer:
****

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****

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

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MSDS Material Safety Data Sheet

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

From: Mallinckrodt Baker, Inc.
222 Rod School Lane
Phillipsburg, NJ 08865

MALLINCKRODT J.T.Baker

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

TETRACHLOROETHYLENE

MSDS Number: T0767 — *Effective Date: 08/02/00*

1. Product Identification

Synonyms: ethylene tetrachloride; tetrachloroethene; perchloroethylene; carbon bichloride; carbon dichloride
CAS No.: 127-18-4
Molecular Weight: 165.83
Chemical Formula: Cl2C:CCl2
Product Codes:
J.T. Baker: 9218, 9360, 9453, 9465, 9469
Mallinckrodt: 1933, 8058

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Tetrachloroethylene	127-18-4	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Irritating to the upper respiratory tract. Giddiness, headache, intoxication, nausea and vomiting may follow the inhalation of large amounts while massive amounts can cause breathing arrest, liver and kidney damage, and death. Concentrations of 600 ppm and more can affect the central nervous system after a few minutes.
Ingestion:
Not highly toxic by this route because of low water solubility. Used as an oral dosage for hookworm (1 to 4 ml). Causes abdominal pain, nausea, diarrhea, headache, and dizziness.
Skin Contact:
Causes irritation to skin. Symptoms include redness, itching, and pain. May be absorbed through the skin with possible systemic effects.
Eye Contact:
Causes irritation, redness, and pain.
Chronic Exposure:
May cause liver, kidney or central nervous system damage after repeated or prolonged exposures. Suspected cancer risk from animal studies.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance. The use of alcoholic beverages enhances the toxic effects.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Wash skin with soap or mild detergent and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

Health Rating: 3 - Severe (Cancer Causing)
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Irritating to the upper respiratory tract. Giddiness, headache, intoxication, nausea and vomiting may follow the inhalation of large amounts while massive amounts can cause breathing arrest, liver and kidney damage, and death. Concentrations of 600 ppm and more can affect the central nervous system after a few minutes.
Ingestion:
Not highly toxic by this route because of low water solubility. Used as an oral dosage for hookworm (1 to 4 ml). Causes abdominal pain, nausea, diarrhea, headache, and dizziness.
Skin Contact:
Causes irritation to skin. Symptoms include redness, itching, and pain. May be absorbed through the skin with possible systemic effects.
Eye Contact:
Causes irritation, redness, and pain.
Chronic Exposure:
May cause liver, kidney or central nervous system damage after repeated or prolonged exposures. Suspected cancer risk from animal studies.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance. The use of alcoholic beverages enhances the toxic effects.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Wash skin with soap or mild detergent and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard but becomes hazardous in a fire situation because of vapor generation and possible degradation to phosgene (highly toxic) and hydrogen chloride (corrosive). Vapors are heavier than air and collect in low-lying areas.
Explosion:
Not considered to be an explosion hazard. Containers may explode when involved in a fire.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Water spray may be used to keep fire exposed containers cool.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

---

7. Handling and Storage

Store in a cool, dry, ventilated area away from sources of heat or ignition. Isolate from flammable materials. Protect from direct sunlight. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
100 ppm (TWA), 200 ppm (ceiling),
300 ppm/5min/3-hour (max)

-ACGIH Threshold Limit Value (TLV):

25 ppm (TWA), 100 ppm (STEL); listed as A3, animal carcinogen
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Ethereal odor.
Solubility:
0.015 g in 100 g of water.
Specific Gravity:
1.62 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
121C (250F)
Melting Point:
-19C (-2F)
Vapor Density (Air=1):
5.7
Vapor Pressure (mm Hg):
18 @ 25C (77F)
Evaporation Rate (BuAc=1):
0.33 (trichloroethylene = 1)

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Slowly decomposed by light. Deteriorates rapidly in warm, moist climates.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition. Hydrogen chloride gas and phosgene gas may be formed upon heating. Decomposes with

moisture to yield trichloroacetic acid and hydrochloric acid.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong acids, strong oxidizers, strong alkalis, especially NaOH, KOH; finely divided metals, especially zinc, barium, lithium. Slowly corrodes aluminum, iron and zinc.
Conditions to Avoid:
Moisture, light, heat and incompatibles.

11. Toxicological Information

Oral rat LD50: 2629 mg/kg; inhalation rat LC50: 34.2 g/m3/8H; investigated as a tumorigen, mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Tetrachloroethylene (127-18-4)	No	Yes	2A

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to quickly evaporate. When released into the soil, this material may leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into water, this material is not expected to biodegrade. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals.
Environmental Toxicity:
The LC50/96-hour values for fish are between 1 and 10 mg/l. The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TETRACHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1897
Packing Group: III
Information reported for product/size: 20L

International (Water, I.M.O.)

Proper Shipping Name: TETRACHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1897
Packing Group: III
Information reported for product/size: 20L

International (Air, I.C.A.O.)

Proper Shipping Name: TETRACHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1897
Packing Group: III
Information reported for product/size: 20L

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\--------

Ingredient	TSCA	EC	Japan	Australia
Tetrachloroethylene (127-18-4)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\--------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Tetrachloroethylene (127-18-4)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\--------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Tetrachloroethylene (127-18-4)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\--------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Tetrachloroethylene (127-18-4)	100	U210	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2[Z]

Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: **2** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor or mist.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.
Product Use:
Laboratory Reagent.
Revision Information:
No changes.
Disclaimer:
****

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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 10/28/96

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

TX0160 TX0165

Product Name:
1,1,2,2-Tetrachloroethane
Synonyms:
Acetylene Tetrachloride
Chemical Family:
Chlorinated Hydrocarbon
Formula:
$Cl_2CHCHCl_2$
Molecular Weight.:
167.85

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
1,1,2,2-Tetrachloroethane	79-34-5	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
MAY BE FATAL IF INHALED, SWALLOWED OR ABSORBED THROUGH SKIN.
POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA.
Vapor Irritating And Narcotic.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

Appearance:
Colorless to pale yellow liquid, chloroform-like odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Toxic by ingestion, inhalation and skin absorption. Causes nausea, headache, CNS disturbances, irritation of eyes and respiratory passages, liver damage, kidney damage, coma and death.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
Proven animal carcinogenic substance. Possible Cancer Hazard.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.
Remove contaminated clothing and wash before reuse.

5. FIRE FIGHTING MEASURES

Flash Point (F): Noncombustible
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Use any suitable for adjacent material.

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:
Thermal decomposition produces highly toxic fumes.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store in a dry, well-ventilated area. Do not breathe vapor. Do not get in eyes, on skin, or on clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves (PVA or equivalent) must be worn to prevent skin contact. Safety glasses with side shields must be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
1,1,2,2-Tetrachloroethane							
	1	7					X

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
1,1,2,2-Tetrachloroethane							
	1	6.9					X

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 146.5C
Melting Point (C) : -44C
Specific Gravity (H_20 = 1) : 1.595
Vapor Pressure (mm Hg) : 8 20C
Percent Volatile by vol (%): 99+%
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : 0.29%
Appearance :
Colorless to pale yellow liquid, chloroform-like odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
Phosgene, HCl, CO_x, Chlorine

Conditions to Avoid:
Hydrolyzes on contact with water resulting in highly toxic fumes.

Materials To Avoid:

```
(X) Water
( ) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: N2O4, Sodium, Potassium, Strong
alkali
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-hmn TDLo: 30 mg/kg   ihl-hmn TCLo: 1000 mg/cu.m./30M
```

Toxicological Findings:
Tests on laboratory animals indicate material may produce adverse mutagenic effects and cause tumors.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

```
EPA Waste Numbers:  U209
```

Treatment:
Specified Technology - Incineration to a level below TCA (Total Constituent Analyses) levels. Contact your local permitted waste disposal company (TSD) for permissible treatment site.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Tetrachloroethane

DOT ID Number :
UN1702

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
1,1,2,2-Tetrachloroethane			100

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
1,1,2,2-Tetrachloroethane	Y	Y	0.1

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 3
Flammability : 0
Reactivity : 0
Special Hazards :

Revision History: 3/1/82 4/9/86 6/5/87 10/27/87
6/15/88 3/1/91 4/28/93

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 2/12/97

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

DX0794 DX0796 DX0797 DX0800 DX0805

Product Name:
1,2-Dichloroethane
Synonyms:
Ethylene Dichloride; Ethylene Chloride
Chemical Family:
Chlorinated Hydrocarbon
Formula:
$ClCH_2CH_2Cl$
Molecular Weight.:
98.96

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
1,2-Dichloroethane	107-06-2	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
FLAMMABLE LIQUID AND VAPOR.
HARMFUL IF INHALED OR SWALLOWED.
CAUSES EYE IRRITATION.
MAY CAUSE EYE INJURY.
MAY CAUSE SKIN IRRITATION.
SUSPECT CANCER HAZARD. MAY CAUSE CANCER.

May Cause Damage To Liver, Kidneys, Lungs and Blood.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

Appearance:
Colorless liquid; chloroform-like odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Toxic by ingestion and inhalation. May be toxic by skin absorption. Symptoms: dizziness, headache, nausea, CNS depression, coma. Repeated or prolonged exposure may cause damage to liver, kidneys, lungs and blood. Causes severe eye irritation, possible eye burns on contact. Contact may cause skin irritation. Respoductive toxicity tests have been conducted to evaluate the potential adverse effects ethylene dichloride may have in reproduction and offspring of laboratory animals. Results indicate ethylene dichloride did not cause teratogenic effects in mice, rats or rabbits. Results also indicate ethylene dichloride is not embryo or fetal toxic in laboratory animals except at concentrations which are toxic to the mother.

Medical Cond. Aggravated by Exposure:
Alcoholism, acute and chronic kidney and liver disease, asthma, bronchitis, rhythm disorders of the heart, diabetes, and circulatory or blood clotting disorders.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
Suspected human carcinogenic substance. Suspect Cancer Hazard.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Immediately flush thoroughly with large amounts of water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: Do not induce vomiting; get immediate medical attention.
Remove contaminated clothing and wash before reuse.
NOTE TO PHYSICIAN: Adrenalin should never be given to a person overexposed to ethylene dichloride.

5. FIRE FIGHTING MEASURES

Flash Point (F): 56F (tcc)
Flammable Limits LEL (%): 6.20
Flammable Limits UEL (%): 15.90

Extinguishing Media:
Dry chemical, Carbon dioxide, Foam; water spray to cool fire-exposed containers and disperse vapors.

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:
Dangerous fire hazard. Vapor can travel distances to ignition source and flash back. Thermal decomposition produces highly toxic fumes.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.
EM SCIENCE recommends Spill-X absorbent agents for various types of spills. Additional information on the Spill-X products can be provided through the EM SCIENCE Technical Service Department (609) 423-6300. The following EM SCIENCE Spill-X absorbent is recommended for this product:

```
SX0863  Solvent Spill Treatment Kit
```

7. HANDLING AND STORAGE

Handling & Storage:
Keep container tightly closed. Store in a cool area away from ignition sources and oxidizers. Do not breathe vapor. Do not get in eyes, on skin, or on clothing. Electrically ground all equipment when handling this product. Retained residue may make empty containers hazardous; use caution!

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves (Viton, PVA, or equivalent) should be worn to prevent skin contact. Safety glasses with side shields must be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

Component	TWA PPM	TWA MG/M3	STEL PPM	STEL MG/M3	CL PPM	CL MG/M3	Skin
1,2-Dichloroethane	1	4	2	8			

ACGIH - TLV:

Component	TWA PPM	TWA MG/M3	STEL PPM	STEL MG/M3	CL PPM	CL MG/M3	Skin
1,2-Dichloroethane	10	40					

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 83.5C
Melting Point (C) : -35.7C
Specific Gravity (H_20 = 1) : 1.256
Vapor Pressure (mm Hg) : 67 20C
Percent Volatile by vol (%): 99+%
Vapor Density (Air = 1) : 3.42
Evaporation Rate (BuAc = 1): 6.46
Solubility in Water (%) : 0.81%
Appearance :
Colorless liquid; chloroform-like odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
CO_x, hydrogen chloride, phosgene, various hydrocarbons

Conditions to Avoid:
Heat, contact with ignition source.

Materials To Avoid:

( ) Water
( ) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers

(X) Other: Alkalies, Aluminum, Ammonia, Nitrogen tetroxide, Amines

11. TOXICOLOGICAL INFORMATION

Toxicity Data

orl-hmn LDLo: 286 mg/kg orl-mus LD50: 489 mg/kg
ihl-rat LC50: 1000 ppm/7H skn-rbt LD50: 2800 mg/kg

Toxicological Findings:

Tests on laboratory animals indicate material may produce adverse mutagenic effects and cause tumors.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: U077 D001 D028

Treatment:

Specified Technology - Incineration or fuels blending to less than the TCLP standard. Contact your local permitted waste disposal site (TSD) for permissible treatment sites.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:

Ethylene Dichloride

DOT ID Number :

UN1184

14. REGULATORY INFORMATION

TSCA Statement:

The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
1,2-Dichloroethane			100

	OSHA	SARA	DeMinimis

Component	Floor List	313	for SARA 313 (%)
1,2-Dichloroethane	Y	Y	0.1

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 2
Flammability : 3
Reactivity : 0
Special Hazards :

Revision History: 9/1/81 5/1/85 5/6/86 6/4/87 10/27/87 10/4/89 3/1/91 4/29/96 10/29/96

| = Revised Section

N/A = Not Available

N/E = None Establised

The statements contained herein are offered for informational purposes only and are based upon technical data that EM Science believes to be accurate. It is intended for use only by persons having the necessary technical skill and at their own discretion and risk. Since conditions and manner of use are outside our control, we make NO WARRANTY, EXPRESS OR IMPLIED, OR MERCHANTABILITY, FITNESS OR OTHERWISE.

Please reduce your browser font size for better viewing and printing.

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

2-Hexanone

MSDS Number: H2664 — ***Effective Date: 12/08/96***

1. Product Identification

Synonyms: Methyl Butyl Ketone
CAS No.: 591-78-6
Molecular Weight: 100.16
Chemical Formula: CH3CH2CH2CH2COCH3
Product Codes: N230

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Methyl n-butyl Ketone	591-78-6	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! FLAMMABLE! CAUSES IRRITATION. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. TARGET ORGAN(S):Central nervous system, skin, respiratory system.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Irritation of mucous membranes, severe irritation of respiratory system, may cause narcosis.

Ingestion:
Headache, nausea, vomiting, dizziness, gastrointestinal irritation, central nervous system depression.

Skin Contact:
Severe irritation, prolonged contact may cause dermatitis, May be absorbed through the skin with possible systemic effects.

Eye Contact:
Severe irritation.

Chronic Exposure:
No information found.

Aggravation of Pre-existing Conditions:
No information found.

---

4. First Aid Measures

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Prompt action is essential.

Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before re-use.

Eye Contact:
In case of eye contact, immediately flush with plenty of water for at least 15 minutes.

5. Fire Fighting Measures

Fire:
Flash point: 19C (66F) CC Autoignition temperature: 424C (795F) Flammable limits in air % by volume: lel: 1.3; uel: 8.1

Explosion:
Vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire. Sensitive to static discharge.

Fire Extinguishing Media:
Use alcohol foam, dry chemical or carbon dioxide. (Water may be ineffective.)

Special Information:
Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Move exposed containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool.

6. Accidental Release Measures

Wear self-contained breathing apparatus and full protective clothing. Shut off ignition sources; no flares, smoking or flames in area. Stop leak if you can do so without risk. Use water spray to reduce vapors. Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush area with water. J. T. Baker SOLUSORB(tm) solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Keep container tightly closed. Store in a cool, dry, well-ventilated, flammable liquid storage area or cabinet. Do not store near oxidizing materials. Bond and ground containers when transferring liquid. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL): 5 ppm (TWA) -ACGIH Threshold Limit Value (TLV): 5 ppm (TWA) The TLV listed denotes TLV (skin).

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
For conditions of use where exposure to the substance is apparent, consult an industrial hygienist. For emergencies, or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Colorless liquid.

Odor:
Faint ketone odor.

Solubility:
Moderate (1-10%)

Specific Gravity:
0.80

pH:
No information found.

% Volatiles by volume @ 21C (70F):
100

Boiling Point:
127C (261F)

Melting Point:
-57C (-71F)

Vapor Density (Air=1):
3.4

Vapor Pressure (mm Hg):
11 @ 20C (68F)

Evaporation Rate (BuAc=1):
1.2

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:
Carbon monoxide, carbon dioxide.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Strong oxidizing agents.

Conditions to Avoid:
Heat, flame, other sources of ignition.

11. Toxicological Information

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Methyl n-butyl Ketone (591-78-6)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.

Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: KETONES, LIQUID, N.O.S. (2-HEXANONE)
Hazard Class: 3
UN/NA: UN1224
Packing Group: II
Information reported for product/size: 25G

International (Water, I.M.O.)

Proper Shipping Name: KETONES, LIQUID, N.O.S. (2-HEXANONE)
Hazard Class: 3.2
UN/NA: UN1224
Packing Group: II
Information reported for product/size: 25G

International (Air, I.C.A.O.)

Proper Shipping Name: KETONES, LIQUID, N.O.S. (2-HEXANONE)
Hazard Class: 3.2
UN/NA: UN1224
Packing Group: II
Information reported for product/size: 25G

15. Regulatory Information

```
--------\Chemical Inventory Status - Part 1\--------------------------------
Ingredient                                        TSCA  EC   Japan  Australia
----------------------------------------------    ----  ---  -----  ---------
```

Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :
Blue-white to dark grey crystalline powder/lumps

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
None

Conditions to Avoid:
Heat, open flame; reacts with nascent hydrogen or certain concentrated acids to evolve highly toxic stibine gas.

Materials To Avoid:

```
( ) Water
(X) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: NH4NO3, BrF3, Halogens,
Potassium and  Sodium compounds
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

ipr-rat LD50: 100 mg/kg

Toxicological Findings:
Tests on laboratory animals indicate material may cause tumors.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers:

Treatment:
Material does not have an EPA Waste number and is not a listed waste, however consultation with a permitted waste disposal site (TSD) should be accomplished.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Antimony Powder

DOT ID Number :
UN2871

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Antimony			5000

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Antimony	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
AX1665 and 7831 were previously on the same MSDS as AX1660.
AX1660 is now on a separate MSDS.

NFPA Hazard Ratings:

Health : 1
Flammability : 2
Reactivity : 0
Special Hazards :

Revision History: 4/9/96

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION

Trade Name: Arsenic
Molecular Weight: 74.91
Formula: As
CAS #: 7440-38-2

II HAZARDOUS INGREDIENTS

PEL (mg/m^3): OSHA: 0.01
ACGIH: 0.2
SARA Title III Sect. 313 Chem: Yes
Weight %: 99.99+

III PHYSICAL DATA

Boiling Point (°C):	Not applicable	**Melting Point (°C):**	Sublimes at 613
Vapor Density (Air=1):	Not applicable	**Evaporation Rate:**	N/A
Solubility in H_2O:	Insoluble	**pH:**	N/A
Appearance and Odor:	Gray-black metal, odorless.	**Specific gravity (H_2O=1):**	5.72

IV FIRE AND EXPLOSION HAZARDS DATA

Flash Point (Method used): N/A
Autoignition Temp (°C): N/A
Flammability: LEL: No data **UEL:** No data

Special Fire Fighting Procedures: Use NIOSH/MSHA approved self-contained breathing apparatus and full protective clothing if involved in fire.

Fire Extinguishing agents Recommended: No specific agents recommended.
Extinguishing Media: N/A
Unusual Fire and Explosion Hazards: N/A

V HEALTH HAZARD INFORMATION

Primary Routes of Entry: Inhalation

Carcinogenicity: IARC classifies arsenic and certain arsenic compounds as Group I carcinogens (carcinogenic to humans). NTP classifies these materials as "..substances, and technological or manufacturing processes that are known to be carcinogenic." OSHA classifies inorganic arsenic and its compounds as carcinogens.

Acute Overexposure (symptoms and effects): Chronic overexposure to arsenic compounds may cause skin and eye irritation, peripheral neuritis of the hands and feet, and a increased risk of lung and skin cancer. Symptoms of chronic toxicity include weight loss, nausea, diarrhea, weakness, loss of appetite and skin lesions.

Medical Conditions Possibly Aggravated: Diseases of the lung, liver, kidneys, and nervous systems.

EMERGENCY AND FIRST AID PROCEDURES:

SKIN AND EYES: Flush with plenty of water. If symptoms develop, consult a physician.
INHALATION: Remove from exposure; place individual under care of a physician.
INGESTION: Induce vomiting in conscious individual and call a physician.

VI REACTIVITY DATA

Stability: Stable
Incompatibility (Material to Avoid): Halogen gases, halides, halogenates, potassium nitrate or permanganate or peroxides may cause a violent reaction or explode.

Hazardous Decomposition Products: At temperatures above the melting point, metal oxide fumes may be evolved. Under reducing conditions (i.e. any strong acid or base plus an active metal) or in the presence of nascent hydrogen, highly toxic arsine gas may be evolved.

Hazardous Polymerization: Will not occur
Conditions to Avoid: Not applicable

VII SPILL OR LEAK PROCEDURES

Steps to Be Taken in Case Material Is Released or Spilled: Any method which keeps dust to a minimum is acceptable. Vacuuming is preferred for dust. Use approved respiratory protection if possibility of dust/fume exposure exists. Do not use compressed air for cleaning.

Waste Disposal Method: If hazardous under 40 CFR 261, Subparts B and C, material must be treated or disposed in a faciiity meeting the requirements of 40 CFR 264 or 265. If non-hazardous, material should be disposed in a facility meeting the requirements of 40 CFR 257.

RCRA Status of Unused Material: If discarded in unaltered form, material should be tested to determine if it must be classified as a hazardous waste for disposal purposes. Under specified circumstances, application can be made to the EPA Administrator to have a particular waste designated non-hazardous.

Regulated by DOT?: Arsenic is regulated as a Poison B Hazardous Material.

VIII SPECIAL PROTECTION INFORMATION

Respiratory Protection: Where airborne exposures may exceed OSHA/ACGIH permissible air concentrations, the minimum respiratory protection recommended is a negative pressure air purifying respirator with cartridges that are NIOSH/MSHA approved against dust, fumes and mists having a TWA less than 0.05 mg/m^3

Eye and Face: Safety glasses recommended where the possibility of getting dust particles in eyes exists.

Other Clothing and Equipment: Full protective clothing is recommended for exposures that exceed permissible air concentrations. All contaminated clothing should be removed before leaving plant premises.

IX SPECIAL PRECAUTIONS

Normal Handling: Use of approved respirators is required for applications where adequate ventilation cannot be provided. Activities which generate dust or fume should be avoided. When melted, the temperature should be kept as low as possible.

Personal Hygiene: Avoid inhalation or ingestion. Practice good housekeeping and personal hygiene procedures. No tobacco or food in the work area. Wash thoroughly before eating or smoking. Shower and change clothes at end of work shift. Do not wear contaminated clothing home. Do not blow dust off clothing with compressed air.

Engineering Controls: Local exhaust ventilation is recommended for dust and/or fume generating operations where airborne exposures may exceed permissible air concentrations.

Special Precautions/Procedures/Label Instructions: Where airborne arsenic exposures may exceed the OSHA action level and PEL, refer to the OSHA Arsenic Standard 29 CFR1910.1018.

Label signal word: DANGER

Prepared by: S. Dierks
Revised Date: June 1993

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 10/29/96

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

CX1579 CX1580

Product Name:
Chromium
Synonyms:
Chrome
Chemical Family:
Metal
Formula:
Cr
Molecular Weight.:
52.00

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Chromium	7440-47-3	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
DUST IRRITATING.
LABORATORY TESTS INDICATE MATERIAL MAY BE CARCINOGENIC.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

Appearance:

Silver-gray powder or granules

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Exposure to chromium by inhalation, skin or eye contact causes irritation.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
Proven human carcinogenic substance. Cancer Hazard.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Skin: Wash thoroughly with soap and water.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flash Point (F): N/A
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Dry powder, sand, water fog

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Fine powder may ignite or explode in atmospheres of carbon dioxide.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal

Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store in a cool area away from ignition sources. Do not breathe dust. Do not get in eyes, on skin, or on clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves (Natural rubber, Neoprene or equivalent) should be worn to prevent skin contact. Safety glasses with side shields must be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Chromium		1.0					

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Chromium		0.5					

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 2642C
Melting Point (C) : 1900C
Specific Gravity (H_20 = 1) : 7.14
Vapor Pressure (mm Hg) : N/A

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 10/1/98

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

SX0110 SX0111

Product Name:
Selenium
Synonyms:
Elemental Selenium
Chemical Family:
Metal
Formula:
Se
Molecular Weight.:
78.96

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Selenium	7782-49-2	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
HARMFUL IF INHALED OR SWALLOWED.
IRRITATING TO SKIN, EYES AND MUCOUS MEMBRANES.

Appearance:
Dark gray to black shot or powder

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Toxic by ingestion and inhalation. Occupational exposure has caused pallor (paleness), nervousness, depression, garlic odor of breath and sweat, gastrointestinal disturbances and dermatitis. Chronic effects are damaging to lungs, Central Nervous System, and liver. Selenium is also irritating to skin, eyes, and respiratory system.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flash Point (F): None
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Use any suitable for adjacent material.

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:
Thermal decomposition produces toxic fumes.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the

release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store in a cool, well-ventilated area away from incompatible materials. Do not breathe dust or vapor. Do not get in eyes, on skin, or on clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves (Neoprene, PVC or equivalent) should be worn to prevent skin contact. Safety glasses with side shields should be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Selenium		0.2					

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Selenium		0.2					

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. *PHYSICAL AND CHEMCIAL PROPERTIES*

Boiling Point (C 760 mmHg) : 685C
Melting Point (C) : 217C
Specific Gravity (H_2O = 1) : 4.81
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%): None

Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :
Dark gray to black shot or powder

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
Produces SeO_2 on combustion

Conditions to Avoid:
Extreme heat

Materials To Avoid:

```
( ) Water
(X) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Metal amides, carbides, alkali metals,
halogen compounds
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-rat LD50: 6700 mg/kg     ihl-rat LCLo: 33 mg/kg/8H
```

Toxicological Findings:
Tests on laboratory animals indicate material may cause tumors
and adverse reproductive effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

```
EPA Waste Numbers:  D010
```

Treatment:
Specified Technology - Contact your local permitted waste disposal site (TSD) for permissible treatment sites.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL

CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

|13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
non-regulated

DOT ID Number :
none

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Selenium			100

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Selenium	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 1
Flammability : 1
Reactivity : 0
Special Hazards :

Revision History: 3/1/82 12/1/85 1/13/87 10/27/87 3/1/91 3/4/94

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION

Trade Name:	Thallium	**Synonym:**	Thallium metal
Chemical Nature:	Metallic Element	**Formula:**	Tl
CAS #:	7440-28-0	**EINECS #:**	231-138-1
RTECS #:	XG 3425000	**EEC #:**	081-001-00-3

NTP, NIOSH, EPA Status: EPA TSCA Chemical Inventory, 1989. EPA TSCA Section 8(e) & Status Report 8 EHQ-0680-0345. EPA TSCA test submission (TSCATS) Data Base, April 1990.

II HAZARDOUS INGREDIENTS

Hazardous Ingredients: Pure metal 99.9% minimum MSHA STANDARD-air, TWA 0.1 mg/m³ (skin) (DTLVS 3,256,71).

HMIS Rating: Health: 3 **Flammability:** 0 **Reactivity:** 0

III PHYSICAL DATA

Boiling Point:	1457 °C	**Melting Point:**	303 °C
Vapor Pressure:	N/A	**%Volatile by Volume:**	N/A
Density:	11.85 gm/cm³		
Solubility in H_2O:	Insoluble, may be protected from air oxidation by immersion in water.		
Appearance and Odor:	Solid, odorless. Highly toxic by inhalation.		

IV FIRE AND EXPLOSION HAZARDS DATA

Flash Point (Method used): N/A
Special Fire Fighting Procedures: Release of (highly) toxic gases/vapors on exposure to temperature rise.

Personal Protection in Emergencies: Gloves, face-shield, protective clothing, compressed air/oxygen apparatus, gas-tight suit. Take account of toxic firefighting water: limit and if possible collect/contain the water.

Flammable Limits: N/A **Extinguishing Media:** No available data.
Unusual Fire and Explosion Hazards: Reacts violently with (some) halogens: (increased) risk of fire. Material begins to emit highly toxic fumes and vapors at temperatures over 147 °C.

V HEALTH HAZARD INFORMATION

Threshold Limit Value:

Health Hazard Rating: TWA 0.1 mg/m³; OSHA PEL 8H TWA 0.1 mg Tl/m³ (skin) FEREAC 54,2923,89); OSHA PEL Final 8H TWA 0.1 mg Tl/m³ (skin) (FEREAC 54, 2923,89); NIOSH Criteria Documents Notes 1983: HZD X3172; NIS 3; TNF 158; NOS 5; TNE 1662; TFE 1308.

Effects of Overexposure: Highly toxic by ingestion and inhalation. Substance is absorbed through the skin; no toxicity data on skin absorption. Irritant to the skin, the respiratory organs, the eyes. The substance may have an effect on the nervous system. Cumulative effect. No available data on the carcinogenicity, mutagenicity, teratogenicity.

EMERGENCY AND FIRST AID PROCEDURES: In case of accident or if you feel unwell, seek medical advice immediately.

INHALATION: Remove victim to fresh air. Seek immediate medical attention.
INGESTION: Rinse mouth with water, induce vomiting. Seek immediate medical attention.
SKIN CONTACT: Wash immediately with water, soap may be used.
EYES: Flush with copious amounts of water for at least 15 minutes.

VI REACTIVITY DATA

Stability: Stable
Incompatibility: Reacts with (some) acids. Reacts violently with (some) halogens.

Hazardous Decomposition Products: None
Hazardous Polymerization: Will not occur
Conditions to Avoid: Reacts slowly with damp air.

VII SPILL OR LEAK PROCEDURES

Steps to Be Taken in Case Material Is Released or Spilled: Wearing suitable respiratory protection, protection clothing and gloves; sweep up and place in a properly marked container. Sweep spill area with moist sweeping compound and put this material into same container with dry sweepings. Seal container and submit for disposal. Wash clothing and equipment after handling.

Waste Disposal Method: Dispose of in accordance with Local, State and Federal Waste Disposal Regulations.

VIII SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type): Dust production: Dust mask with filter type P3. High dust Production: Compressed air/ oxygen apparatus. On heating: Gas Mask.

Ventilation: Carry operations in the open/under local exhaust/ventilation.
Protective Gloves: Yes
Eye Protection: Face shield/ tight-fitting goggles.
Other Protective Equipment: Protective/dust proof clothing.

IX SPECIAL PRECAUTIONS

Other Handling and Storage Conditions:

- Protect container from physical damage.
- Store in a cool dry well ventilated area, away from acids and oxidizers.
- Comply with legal requirements
- Measure the concentration in the air regularly
- Avoid exposure/contact
- Avoid raising dust
- Do not discharge the waste in the drain
- Store in a dry area
- Keep substance away from: Heat sources, Oxidizing agents, (strong) acids, and Halogens.

Precautionary Labeling: DANGER! HIGHLY TOXIC! May be fatal if swallowed or inhaled. Avoid contact with skin and eyes. Wash very thoroughly after handling. Keep container tightly closed when not in use.

Prepared by: S. Dierks
Dated: December 1994

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 4/6/93

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

1057 AX0620 AX0625 AX0627 AX0630 AX0635 AX0640
AX0645

Product Name:
Aluminum
Synonyms:
Aluminum
Chemical Family:
Metal
Formula:
Al
Molecular Weight.:
26.98

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Aluminum	7429-90-5	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
INHALATION OF ALUMINUM (POWDER OR DUST) MAY CAUSE RESPIRATORY IRRITATION.
INHALATION OF FINELY DIVIDED POWDER HAS BEEN REPORTED AS A CAUSE OF PULMONARY FIBROSIS.
ALUMINUM POWDER IS A FLAMMABLE SOLID WHICH FORMS

FLAMMABLE AND EXPLOSIVE MIXTURES WITH AIR.

Appearance:
White-gray malleable, ductile metal or powder

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Aluminum dust may cause eye and respiratory irritation. Aluminum dust may cause pulmonary fibrosis.

Medical Cond. Aggravated by Exposure:
Respiratory conditions

Routes of Entry:
Inhalation, ingestion

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: Get immediate medical attention; if conscious, give water freely.

5. FIRE FIGHTING MEASURES

Flash Point (F): N/A
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
CO_2, Dry chemical (DO NOT USE WATER)

Fire Fighting Procedures:
Dust is easily ignited; hazard greater as fineness increases.

Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Dust, powder forms explosive mixture with air. Dust, when damp, may heat spontaneously.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed and protected against physical damage. Keep dry and isolate from acids, caustics and chlorinated hydrocarbons. Store separate from oxidizing materials and combustible materials. Do not breathe dust. Do not get in eyes. Avoid prolonged, or repeated, skin contact.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves (Neoprene or equivalent) should be worn to prevent skin contact Safety glasses with side shields should be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Aluminum		5					

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Aluminum		5					

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 2450C

Melting Point (C) : 660C
Specific Gravity (H_20 = 1) : 2.7
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%): N/A
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :
White-gray malleable, ductile metal or powder

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
None indicated

Conditions to Avoid:
Avoid dusting; reacts with some acids and caustic solutions to produce hydrogen, which is highly flammable.

Materials To Avoid:

```
( ) Water
(X) Acids
( ) Bases
(X) Corrosives
(X) Oxidizers
(X) Other: Mineral acids, harsh alkalis, halogenated
compounds, heavy  metals.
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

None established

Toxicological Findings:
None
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers:

Treatment:
Material does not have an EPA Waste number and is not a listed waste, however consultation with a permitted waste disposal site (TSD) should be accomplished.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

|13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
non-regulated (for all except AX0630)
See Other Info.(Section 15) for DOT Shipping Name & Number on AX0630
DOT ID Number :
none (see Other Info.)

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Aluminum			

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Aluminum	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

|15. OTHER INFORMATION

Comments:
Tranport Information for AX0630:

DOT Shipping Name: Aluminum Powder, Uncoated
DOT Number : UN1396

NFPA Hazard Ratings:

Health : 0
Flammability : 1
Reactivity : 1
Special Hazards :

Revision History: 1/1/82 5/1/84 6/2/87 10/27/87
3/1/91 7/20/92 8/31/92

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

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Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 3/10/94

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

3819 IX0240 IX0245 IX0250 IX0252

Product Name:
Iron
Synonyms:
N/A
Chemical Family:
Metal - Element
Formula:
Fe
Molecular Weight.:
55.85

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Iron	7439-89-6	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
MAY BE HARMFUL IF INHALED.

Appearance:
Silvery-white to grey- black powder or filings

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Dust inhalation may be harmful. Repeated inhalation can cause chronic bronchitis. Iron dust may cause conjunctivitis, choroditis, retinitis and siderosis of tissue. Chronic exposure to excess levels of iron (more than 50-100 mg of iron per day) can result in pathological deposition of iron in the body tissues, the symptoms of which are fibrosis of the pancreas, diabetes mellitus, and liver cirrhosis.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

5. FIRE FIGHTING MEASURES

Flash Point (F): None
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Dry chemical only

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Moderate hazard when dust is exposed to heat, flame. Explosive or violent reaction with ammonium nitrate + heat; ammonium peroxodisulfate; chloric acid; chlorine trifluoride; chloroformamidinium nitrate; bromine pentafluoride + heat (with iron powder); air + oil (with iron dust); sodium acetylide. Ignites on contact with chlorine; dinitrogen tetraoxide; liquid fluorine; hydrogen peroxide (with iron powder); nitryl fluoride + heat; peroxyformic acid; potassium perchlorate; potassium dichromate; sodium peroxide (at 240C); polystyrene + friction or spark (iron powder). Mixtures of iron dust with air + water may ignite on drying. Reduced iron reacts with water to produce explosive hydrogen gas.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store at controlled room temperature. Do not breathe dust. Do not get in eyes. Avoid prolonged, or repeated, skin contact.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves (Neoprene, PVC or equivalent) should be worn to prevent skin contact. Safety glasses with side shields should be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Iron							

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Iron							

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 3000C

Melting Point (C) : 1535C
Specific Gravity (H_20 = 1) : 7.86
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%): None
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Insoluble
Appearance :
Silvery-white to grey- black powder or filings

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
None

Conditions to Avoid:
Heat, flame; material will oxidize in moist air; reacts with steam when hot to produce flammable hydrogen gas

Materials To Avoid:

```
(X) Water
(X) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Halogens and halogen compounds
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
ipr-rbt LDLo: 20 mg/kg
```

Toxicological Findings:
Tests on laboratory animals indicate inhalation
of material may cause lung tumors.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

```
EPA Waste Numbers:
```

Treatment:
Material does not have an EPA Waste number and is not a listed waste, however consultation with a permitted waste disposal site (TSD) should be accomplished.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
For IX0240: Ferrous Metal Shavings
non-regulated (for all other catalog #'s)
DOT ID Number :
UN2793 (for IX0240)

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Iron			

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Iron			

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 1
Flammability : 1
Reactivity : 0
Special Hazards :

Revision History: 3/1/82 8/1/83 6/2/86 6/22/87

10/27/87 3/1/91 1/19/94

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

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Manufacturer.....:
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A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 4/28/93

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

MX0005 MX0006

Product Name:
Magnesium
Synonyms:
Magnesium Powder
Chemical Family:
Metal
Formula:
Mg
Molecular Weight.:
24.31

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Magnesium	7439-95-4	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
FLAMMABLE SOLID.
Reacts With Water And Acid Liberating And Igniting Hydrogen.
MAY BE HARMFUL IF INHALED OR SWALLOWED.
MAY CAUSE BURNS.

Appearance:

Silvery gray powder

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
May be harmful if inhaled or swallowed. Contact with skin can cause irritation; may cause burns. Inhalation of dust and fumes can cause metal fume fever.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin or eye contact: Brush off all solid particles; flush thoroughly with large amounts of water.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: Get immediate medical attention.

5. FIRE FIGHTING MEASURES

Flash Point (F): N/A
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
G-1 Powder, Powdered Talc, Dry Sand, "Purple K".
DO NOT USE WATER.

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.
Burns with a very bright flame; "fire glasses" must be worn.

Fire & Explosion Hazards:
Dust suspended in air is a dangerous explosion hazard in the presence of moisture.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the

release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container tightly closed. Store in a dry, well-ventilated area away from sparks, flame and oxidizing materials. Do not breathe dust or vapor. Do not get in eyes, on skin, or on clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves must be worn to prevent skin contact (Neoprene or equivalent) Safety glasses with side shields must be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Magnesium							

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Magnesium							

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 1100C
Melting Point (C) : 651C
Specific Gravity (H_2O = 1) : 1.74 5C
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%): N/A
Vapor Density (Air = 1) : N/A

Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Reacts
Appearance :
Silvery gray powder

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
None

Conditions to Avoid:
Reacts with water and acids to evolve flammable hydrogen. Avoid dusting (dispersion of fine particles into air).

Materials To Avoid:

```
(X) Water
(X) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Cyanides, Halogens, Halogen compounds
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-dog LDLo: 230 mg/kg
```

Toxicological Findings:
None
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

```
EPA Waste Numbers:  D001
```

Treatment:
Specified Technology - Contact your local permitted waste disposal site (TSD) for permissible treatment sites.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

|13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Magnesium Powder

DOT ID Number :
UN1418

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Magnesium			

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Magnesium			

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 0
Flammability : 1
Reactivity : 2
Special Hazards : W

Revision History: 4/1/84 10/27/87 3/1/91 9/24/91 11/4/91

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION

Trade Name: Silver
Chemical Nature: Pure Element
Synonym: Silver Metal Products
Formula: Ag

II HAZARDOUS INGREDIENTS

TLV (Units): Silver Metal 0.01 mg/m³ as dust

III PHYSICAL DATA

Boiling Point: 2210 °C
Specific Gravity: 10.53%
Solubility in H_2O: Insoluble
Melting Point: 960.8 °C
Volatiles by Weight: N/A
Appearance and Odor: Silver Grey, lustrous, malleable and ductile metal, no odor.

IV FIRE AND EXPLOSION HAZARDS DATA

Flash Point: Not Flammable
Extinguishing Media: N/A
Flammable Limits: Upper: N/A **Lower:** N/A
Special Fire Fighting Procedures: At high temperatures this metal could melt and continuous heating could produce metal vapor out of fire area.

V HEALTH HAZARD INFORMATION

Threshold Limit Value: *0.01 mg/m³*
Effects of Over Exposure: As solid no known effects

EMERGENCY AND FIRST AID PROCEDURES:

EYES/SKIN: Flush with water
INHALATION/INGESTION: Seek immediate medical attention.

VI REACTIVITY DATA

Stability: Stable
Incompatibility (Material to Avoid): N/A
Hazardous Decomposition Products: N/A
Hazardous Polymerization: Will not Occur

VII SPILL OR LEAK PROCEDURES

Steps to be taken if spilled or released: hazard from spills, avoid inhalation of dust if as powder. Transfer to a glass or metal container and submit or retain for disposal or salvage.

Waste Disposal Method: In accordance with governmental regulations. Has reclaim value.

VIII SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type): None
Ventilation: Local during working and melting.

Protective Gloves: None recommended
Eye Protection: Safety Glasses
Other Protective Equipment: Lab coat and apron

IX SPECIAL PRECAUTIONS

Other Handling and Storage Conditions: Wash thoroughly after handling. Keep container tightly closed. Protect silver from tarnishing (sulphur containing atmosphere) Inhalation of dust should be avoided.

Prepared by: Steve Dierks
Date Prepared: January 1996

Please reduce your browser font size for better viewing and printing.

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

METHYLENE CHLORIDE

MSDS Number: M4420 — ***Effective Date: 03/01/97***

1. Product Identification

Synonyms: MC; Dichloromethane (DCM); Methylene dichloride; Methylene bichloride; Methane dichloride
CAS No.: 75-09-2
Molecular Weight: 84.93
Chemical Formula: CH2Cl2
Product Codes: 9264, 9266, 9315, 9324, 9329, 9330, 9341, 9348, Q480

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Methylene Chloride	75-09-2	100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, CARDIOVASCULAR SYSTEM, AND BLOOD. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)
Flammability Rating: 1 - Slight
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes formation of carbon monoxide in blood which affects cardiovascular system and central nervous system. Continued exposure may cause increased light-headedness, staggering, unconsciousness, and even death. Exposure may make the symptoms of angina (chest pains) worse.

Ingestion:
May cause irritation of the gastrointestinal tract with vomiting. If vomiting results in aspiration, chemical pneumonia could follow. Absorption through gastrointestinal tract may produce symptoms of central nervous system depression ranging from light headedness to unconsciousness.

Skin Contact:
Causes irritation, redness and pain. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.

Eye Contact:
Vapors can cause eye irritation. Contact can produce pain, inflammation and temporal eye damage.

Chronic Exposure:
Can cause headache, mental confusion, depression, liver effects, kidney effects, bronchitis, loss of appetite, nausea, lack of balance, and visual disturbances. Can cause dermatitis upon prolonged skin contact. Methylene chloride may cause cancer in humans.

Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, eye problems, impaired liver, kidney, respiratory or cardiovascular function may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Autoignition temperature: 556C (1033F) Flammable limits in air % by volume: lel: 12; uel: 23 Forms flammable vapor-air mixtures above 100C (212F).

Explosion:
Concentrated can be ignited by a high intensity ignition source. Vapor may form flammable mixture in atmosphere that contains a high percentage of oxygen. Sealed containers may rupture when heated.

Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limited protection to the combustion products of this material.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Outside or detached storage is recommended. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. To minimize decomposition, all storage containers should be galvanized or lined with a phenolic coating. This material may corrode plastic and rubber. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Odor Threshold: 205 - 307 ppm. The odor threshold only serves as a warning of exposure; not smelling it does not mean you are not being exposed.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Methylene Chloride (Dichloromethane): - OSHA Permissible Exposure Limit (PEL) - 25 ppm (TWA), 125 ppm (STEL), 12.5 ppm (8-hour TWA - Action Level) - ACGIH Threshold Limit Value (TLV) - 50 ppm (TWA), A2 - suspected human carcinogen.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. The cartridges recommended for this material have a predicted service of less than 30 minutes at concentrations of ten times (10x) the exposure limits. Actual service life will vary considerbly, depending on

concentration levels, temperature, humidity, and work rate. This substance has poor warning properties.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene is a recommended material for personal protective equipment. Natural rubber and polyvinyl chloride ARE NOT recommended materials for personal protective equipment.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:
Do not use closed circuit rebreathing system employing soda lime or other carbon dioxide absorber because of formation of toxic compounds capable of producing cranial nerve paralysis. See OSHA Standard for medical surveillance, record keeping, and reporting requirements for methylene chloride (29 CFR 1910.1052).

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9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.

Odor:
Chloroform-like odor.

Solubility:
1.32 gm/100 gm water @ 20C.

Specific Gravity:
1.33 @ 15C/4C

pH:
No information found.

% Volatiles by volume @ 21C (70F):
100

Boiling Point:
39.8C (104F)

Melting Point:
-97C (-143F)

Vapor Density (Air=1):
2.9

Vapor Pressure (mm Hg):
350 @ 20C (68F)

Evaporation Rate (BuAc=1):
27.5

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:
Emits highly toxic fumes of phosgene when heated to decomposition. Decomposes in a flame or hot surface to form toxic gas phosgene and corrosive mists of hydrochloric acid. Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Strong oxidizers, strong caustics, plastics, rubber, nitric acid, water + heat, and chemically active metals, such as aluminum and magnesium powder, sodium, potassium, and lithium. Avoid contact with open flames and electrical arcs. Liquid methylene chloride will attack some forms of plastics, rubber, and coatings.

Conditions to Avoid:
Moisture, heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:
Dichloromethane: Oral rat LD50: 1600 mg/kg; inhalation rat LC50: 52 gm/m3; investigated as a tumorigen, mutagen, reproductive effector.

Reproductive Toxicity:
Dichloromethane has been linked to spontaneous abortions in humans.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Methylene Chloride (75-09-2)	No	Yes	2B

12. Ecological Information

Environmental Fate:
When released into the soil, this material may leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of greater than 30 days. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.

Environmental Toxicity:
The LC50/96-hour values for fish are over 100 mg/l. This material is not expected to be toxic to aquatic life.

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13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

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14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1
UN/NA: UN1593
Packing Group: III
Information reported for product/size: 56L

International (Water, I.M.O.)

Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1
UN/NA: UN1593
Packing Group: III
Information reported for product/size: 56L

International (Air, I.C.A.O.)

Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1
UN/NA: UN1593
Packing Group: III
Information reported for product/size: 56L

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\----------

Ingredient	TSCA	EC	Japan	Australia
Methylene Chloride (75-09-2)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Methylene Chloride (75-09-2)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Methylene Chloride (75-09-2)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Methylene Chloride (75-09-2)	1000	U080	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

Prop 65:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2Z
Poison Schedule: S5

WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 2 **Flammability:** 1 **Reactivity:** 0

Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, CARDIOVASCULAR SYSTEM, AND BLOOD. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

Label Precautions:
Do not breathe vapor. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Keep away from heat and flame. Do not get in eyes, on skin, or on clothing.

Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:
Laboratory Reagent.

Revision Information:
Pure. New 16 section MSDS format, all sections have been revised.

Disclaimer:
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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

CHEM SERVICE -- F30 TRANS-1,2-DICHLOROETHENE
MATERIAL SAFETY DATA SHEET
NSN: 655000F037529
Manufacturer's CAGE: 8Y898
Part No. Indicator: A
Part Number/Trade Name: F30 TRANS-1,2-DICHLOROETHENE

General Information

Company's Name: CHEM SERVICE INC
Company's Street: 660 TOWER LN
Company's P. O. Box: 3108
Company's City: WEST CHESTER
Company's State: PA
Company's Country: US
Company's Zip Code: 19381-3108
Company's Emerg Ph #: 215-692-3026/800-452-9994
Company's Info Ph #: 215-692-3026/800-452-9994
Record No. For Safety Entry: 001
Tot Safety Entries This Stk#: 001
Status: SE
Date MSDS Prepared: 28APR92
Safety Data Review Date: 15DEC94
Preparer's Company: CHEM SERVICE INC
Preparer's St Or P. O. Box: 660 TOWER LN
Preparer's City: WEST CHESTER
Preparer's State: PA
Preparer's Zip Code: 19381-3108
MSDS Serial Number: BWJGZ

Ingredients/Identity Information

Proprietary: NO
Ingredient: TRANS-1,2-DICHLOROETHYLENE, TRANS-1,2-DICHLOROETHENE
Ingredient Sequence Number: 01
NIOSH (RTECS) Number: KV9400000
CAS Number: 156-60-5
OSHA PEL: 200 PPM
ACGIH TLV: 200 PPM

Physical/Chemical Characteristics

Appearance And Odor: COLORLESS LIQUID W/FRUITY/PLEASANT ODOR.
Boiling Point: 118.4F
Melting Point: -58F
Solubility In Water: SLIGHT

Fire and Explosion Hazard Data

Flash Point: 39.2F
Lower Explosive Limit: 9.7
Upper Explosive Limit: 12.8
Extinguishing Media: CO_2, DRY CHEMICAL POWDER/SPRAY.
Unusual Fire And Expl Hazrds: FLAMMABLE CHEMICAL.

Reactivity Data

Stability: YES
Cond To Avoid (Stability): AIR, HEAT, MOISTURE, LIGHT.
Materials To Avoid: STRONG OXIDIZING AGENTS.
Hazardous Decomp Products: TOXIC FUMES/CO/CO_2/HYDROGEN CHLORIDE GAS. DECOMPOSITION PRODUCTS ARE CORROSIVE.
Hazardous Poly Occur: NO

Health Hazard Data

LD50-LC50 Mixture: ORAL LD50 (RAT/MOUSE): 7536 MG/KG
Route Of Entry - Inhalation: YES
Route Of Entry - Skin: YES
Route Of Entry - Ingestion: YES
Health Haz Acute And Chronic: INHALATION: HARMFUL/RESPIRATORY TRACT IRRITATION. SKIN: HARMFUL IF ABSORBED/IRRITATION. EXPOSURE CAN CAUSE CNS DEPRESSION.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NONE
Signs/Symptoms Of Overexp: IRRITATION.
Emergency/First Aid Proc: EYES: FLUSH CONTINUOUSLY W/WATER FOR 15-20 MINS. SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NOT BURNED, WASH W/SOAP & WATER TO CLEANSE. INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED. KEEP WARM & QUIET. INGESTION: DON'T GIVE LIQUIDS/INDUCE VOMITING IF UNCONSCIOUS/CONVULSIVE. IF VOMITING OCCURS, WATCH CLOSELY TO AVOID AIRWAY OBSTRUCTION. OBTAIN MEDICAL ATTENTION IN ALL CASES.

Precautions for Safe Handling and Use

Steps If Matl Released/Spill: EVACUATE AREA. WEAR APPRORPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR DISPOSAL. WASH CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.
Waste Disposal Method: BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.
Precautions-Handling/Storing: STORE IN A COOL DRY PLACE ONLY W/COMPATIBLE CHEMICALS. KEEP TIGHTLY CLOSED. STORE UNDER REFRIGERATION. FOR LABORATORY USE ONLY.
Other Precautions: AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATH VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL CHEMICALS SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL CONTACT.

Control Measures

Respiratory Protection: WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.
Ventilation: CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.
Eye Protection: EYE SHIELDS
Work Hygienic Practices: REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. READILY ABSORBED & RETAINED ON CLOTHING & SHOES.

Transportation Data

Disposal Data

Label Data

Label Required: YES
Label Status: G
Common Name: F30 TRANS-1,2-DICHLOROETHENE
Special Hazard Precautions: INHALATION: HARMFUL/RESPIRATORY TRACT IRRITATION. SKIN: HARMFUL IF ABSORBED/IRRITATION. EXPOSURE CAN CAUSE CNS DEPRESSION. IRRITATION.
Label Name: CHEM SERVICE INC
Label Street: 660 TOWER LN
Label P.O. Box: 3108
Label City: WEST CHESTER

Label State: PA
Label Zip Code: 19381-3108
Label Country: US
Label Emergency Number: 215-692-3026/800-452-9994

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 6/6/97

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

0138658D BX1670 BX1673 MX1034

Product Name:
2-Butanone
Synonyms:
Methyl Ethyl Ketone
Chemical Family:
Ketone
Formula:
$CH_3COCH_2CH_3$
Molecular Weight.:
72.11

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
2-Butanone	78-93-3	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
FLAMMABLE LIQUID AND VAPOR.
Vapor Irritating To Eyes And Respiratory Passages.
Liquid Irritating To Eyes.
MAY CAUSE EYE INJURY.
MAY CAUSE SKIN IRRITATION.
May Cause Damage To Lungs And Central Nervous System.

Appearance:
Colorless liquid, sharp, mint-like odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Vapor irritating to eyes and respiratory passages. Liquid irritating to eyes; may cause eye injury. Prolonged or repeated skin contact may cause irritation. Inhalation of high concentrations may cause headache, dizziness, nausea, narcosis, lung damage. Prolonged exposure may produce central nervous system depression and narcosis.

Medical Cond. Aggravated by Exposure:
Respiratory conditions

Routes of Entry:
Inhalation, ingestion

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: Do not induce vomiting; get immediate medical attention.

5. FIRE FIGHTING MEASURES

Flash Point (F): 21F (tcc)
Flammable Limits LEL (%): 1.80
Flammable Limits UEL (%): 11.50
Extinguishing Media:
Water spray, "alcohol" foam, dry chemical, CO_2

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
Vapor can travel distances to ignition source and flash back.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.
EM SCIENCE recommends Spill-X absorbent agents for various types of spills. Additional information on the Spill-X products can be provided through the EM SCIENCE Technical Service Department (609) 423-6300. The following EM SCIENCE Spill-X absorbent is recommended for this product:

SX0863 Solvent Spill Treatment Kit

7. HANDLING AND STORAGE

Handling & Storage:
Keep container tightly closed. Store in a cool area away from ignition sources and oxidizers. Electrically ground all equipment when handling this product. Do not breathe vapor. Do not get in eyes, on skin, or on clothing. Retained residue may make empty containers hazardous; use caution!

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves (Butyl rubber, Polyurethane or equivalent) should be worn to prevent skin contact. Safety glasses with side shields must be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
2-Butanone	200	590	300	885			

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
2-Butanone	200	590	300	885			

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 80C
Melting Point (C) : -86C
Specific Gravity (H_20 = 1) : 0.805
Vapor Pressure (mm Hg) : 75 20C
Percent Volatile by vol (%): 99+%
Vapor Density (Air = 1) : 2.5
Evaporation Rate (BuAc = 1): 3.8
Solubility in Water (%) : 27%
Appearance :
Colorless liquid, sharp, mint-like odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
CO_x, peroxides

Conditions to Avoid:
Heat; contact with ignition source

Materials To Avoid:

```
( ) Water
(X) Acids
(X) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: Potassium t-butoxide, alkaline materials,
halogens, hydrogen  peroxide and nitric acid, haloforms
and strong bases,  2-Propanol
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-rat LD50: 2737 mg/kg   skn-rbt LD50: 6480 mg/kg
ihl-mus LC50: 40 g/cu.m./2H
```

Toxicological Findings:
Laboratory rats exposed by inhalation to over 1000 ppm for most of their pregnancy period exhibited minor embryotoxic/fetotoxic

effects.
Tests on laboratory animals indicate material may produce
adverse mutagenic effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: U159 D001 D035

Treatment:
Specified Technology - Incineration or fuels blending to less than the TCLP standard. Contact your local permitted waste disposal site (TSD) for permissible treatment sites.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Methyl Ethyl Ketone (for BX1670, BX1673, MX1034)
Ethyl Methyl Ketone (for 0138658D)
DOT ID Number :
UN1193

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
2-Butanone			5000

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
2-Butanone	Y	Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:

None

NFPA Hazard Ratings:

```
Health          : 1
Flammability    : 3
Reactivity      : 0
Special Hazards :
```

Revision History: 11/1/81 10/1/83 5/6/86 6/30/87 10/27/87 1/8/88 5/8/89 3/1/91 1/4/96

| = Revised Section

N/A = Not Available

N/E = None Establised

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Please reduce your browser font size for better viewing and printing.

MSDS *Material Safety Data Sheet*

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT J.T.Baker

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

TRICHLOROETHYLENE

MSDS Number: T4940 — ***Effective Date: 09/14/00***

1. Product Identification

Synonyms: Trichloroethene; TCE; acetylene trichloride; Ethinyl trichloride
CAS No.: 79-01-6
Molecular Weight: 131.39
Chemical Formula: C2HCl3
Product Codes:
J.T. Baker: 5376, 9454, 9458, 9464, 9473, 9474
Mallinckrodt: 8598, 8600, 8633

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Trichloroethylene	79-01-6	100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS HEART, CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. CAUSES SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)
Flammability Rating: 1 - Slight
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Vapors can irritate the respiratory tract. Causes depression of the central nervous system with symptoms of visual disturbances and mental confusion, incoordination, headache, nausea, euphoria, and dizziness. Inhalation of high concentrations could cause unconsciousness, heart effects, liver effects, kidney effects, and death.
Ingestion:
Cases irritation to gastrointestinal tract. May also cause effects similar to inhalation. May cause coughing, abdominal pain, diarrhea, dizziness, pulmonary edema, unconsciousness. Kidney failure can result in severe cases. Estimated fatal dose is 3-5 ml/kg.
Skin Contact:
Cause irritation, redness and pain. Can cause blistering. Continued skin contact has a defatting action and can produce rough, dry, red skin resulting in secondary infection.
Eye Contact:
Vapors may cause severe irritation with redness and pain. Splashes may cause eye damage.
Chronic Exposure:
Chronic exposures may cause liver, kidney, central nervous system, and peripheral nervous system effects. Workers chronically exposed may exhibit central nervous system depression, intolerance to alcohol, and increased cardiac output. This material is linked to mutagenic effects in humans. This material is also a suspect carcinogen.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, cardiovascular disorders, impaired liver or kidney or respiratory function, or central or peripheral nervous system disorders may be more susceptible to the effects of the substance.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Call a physician.
Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

5. Fire Fighting Measures

Fire:
Autoignition temperature: 420C (788F)
Flammable limits in air % by volume:
lel: 8; uel: 12.5
Explosion:
A strong ignition source, e. g., a welding torch, can produce ignition. Sealed containers may rupture when heated.
Fire Extinguishing Media:
Use water spray to keep fire exposed containers cool. If substance does ignite, use CO2, dry chemical or foam.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limited protection to the combustion products of this material.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Isolate from incompatible substances. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Trichloroethylene:
-OSHA Permissible Exposure Limit (PEL):

100 ppm (TWA), 200 ppm (Ceiling),
300 ppm/5min/2hr (Max)

-ACGIH Threshold Limit Value (TLV):
50 ppm (TWA) 100 ppm (STEL);
listed as A5, not suspected as a human carcinogen.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has poor warning properties. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene is a recommended material for personal protective equipment.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.

Odor:
Chloroform-like odor.

Solubility:
Practically insoluble in water. Readily miscible in organic solvents.

Specific Gravity:
1.47 @ 20C/4C

pH:
No information found.

% Volatiles by volume @ 21C (70F):
100

Boiling Point:
87C (189F)

Melting Point:
-73C (-99F)

Vapor Density (Air=1):
4.5

Vapor Pressure (mm Hg):
57.8 @ 20C (68F)

Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Will slowly decompose to hydrochloric acid when exposed to light and moisture.
Hazardous Decomposition Products:
May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong caustics and alkalis, strong oxidizers, chemically active metals, such as barium, lithium, sodium, magnesium, titanium and beryllium, liquid oxygen.
Conditions to Avoid:
Heat, flame, ignition sources, light, moisture, incompatibles

11. Toxicological Information

Toxicological Data:
Trichloroethylene: Oral rat LD50: 5650 mg/kg; investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
This material has been linked to mutagenic effects in humans.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Trichloroethylene (79-01-6)	No	Yes	2A

12. Ecological Information

Environmental Fate:
When released into the soil, this material may leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released to water, this material is expected to quickly evaporate. This material has an experimentally-determined bioconcentration factor (BCF) of less than 100. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.
Environmental Toxicity:
The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be slightly toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 5GL

International (Water, I.M.O.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 5GL

International (Air, I.C.A.O.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 5GL

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\--------

Ingredient	TSCA	EC	Japan	Australia
Trichloroethylene (79-01-6)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\--------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Trichloroethylene (79-01-6)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\--------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Trichloroethylene (79-01-6)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\--------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Trichloroethylene (79-01-6)	100	U228	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: No information found.
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 2 Flammability: 1 Reactivity: 0
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS HEART, CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. CAUSES SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep away from heat and flame.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician. Note to physician: Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 8, 11.
Disclaimer:
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Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 5GL

International (Water, I.M.O.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 5GL

International (Air, I.C.A.O.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 5GL

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\--------

Ingredient	TSCA	EC	Japan	Australia
Trichloroethylene (79-01-6)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\--------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Trichloroethylene (79-01-6)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\--------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Trichloroethylene (79-01-6)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\--------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Trichloroethylene (79-01-6)	100	U228	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: No information found.
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: 2 Flammability: 1 Reactivity: 0
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS HEART, CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. CAUSES SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep away from heat and flame.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician. Note to physician: Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 8, 11.
Disclaimer:
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Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving

the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

Please reduce your browser font size for better viewing and printing.

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

MALLINCKRODT J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

TETRACHLOROETHYLENE

MSDS Number: T0767 — *Effective Date: 08/02/00*

1. Product Identification

Synonyms: ethylene tetrachloride; tetrachloroethene; perchloroethylene; carbon bichloride; carbon dichloride
CAS No.: 127-18-4
Molecular Weight: 165.83
Chemical Formula: Cl2C:CCl2
Product Codes:
J.T. Baker: 9218, 9360, 9453, 9465, 9469
Mallinckrodt: 1933, 8058

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Tetrachloroethylene	127-18-4	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Irritating to the upper respiratory tract. Giddiness, headache, intoxication, nausea and vomiting may follow the inhalation of large amounts while massive amounts can cause breathing arrest, liver and kidney damage, and death. Concentrations of 600 ppm and more can affect the central nervous system after a few minutes.
Ingestion:
Not highly toxic by this route because of low water solubility. Used as an oral dosage for hookworm (1 to 4 ml). Causes abdominal pain, nausea, diarrhea, headache, and dizziness.
Skin Contact:
Causes irritation to skin. Symptoms include redness, itching, and pain. May be absorbed through the skin with possible systemic effects.
Eye Contact:
Causes irritation, redness, and pain.
Chronic Exposure:
May cause liver, kidney or central nervous system damage after repeated or prolonged exposures. Suspected cancer risk from animal studies.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance. The use of alcoholic beverages enhances the toxic effects.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Wash skin with soap or mild detergent and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

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5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard but becomes hazardous in a fire situation because of vapor generation and possible degradation to phosgene (highly toxic) and hydrogen chloride (corrosive). Vapors are heavier than air and collect in low-lying areas.
Explosion:
Not considered to be an explosion hazard. Containers may explode when involved in a fire.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Water spray may be used to keep fire exposed containers cool.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

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7. Handling and Storage

Store in a cool, dry, ventilated area away from sources of heat or ignition. Isolate from flammable materials. Protect from direct sunlight. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

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8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
100 ppm (TWA), 200 ppm (ceiling),
300 ppm/5min/3-hour (max)

-ACGIH Threshold Limit Value (TLV):

25 ppm (TWA), 100 ppm (STEL); listed as A3, animal carcinogen
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Ethereal odor.
Solubility:
0.015 g in 100 g of water.
Specific Gravity:
1.62 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
121C (250F)
Melting Point:
-19C (-2F)
Vapor Density (Air=1):
5.7
Vapor Pressure (mm Hg):
18 @ 25C (77F)
Evaporation Rate (BuAc=1):
0.33 (trichloroethylene = 1)

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Slowly decomposed by light. Deteriorates rapidly in warm, moist climates.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition. Hydrogen chloride gas and phosgene gas may be formed upon heating. Decomposes with

moisture to yield trichloroacetic acid and hydrochloric acid.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong acids, strong oxidizers, strong alkalis, especially NaOH, KOH; finely divided metals, especially zinc, barium, lithium. Slowly corrodes aluminum, iron and zinc.
Conditions to Avoid:
Moisture, light, heat and incompatibles.

11. Toxicological Information

Oral rat LD50: 2629 mg/kg; inhalation rat LC50: 34.2 g/m3/8H; investigated as a tumorigen, mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Tetrachloroethylene (127-18-4)	No	Yes	2A

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to quickly evaporate. When released into the soil, this material may leach into groundwater. When released into the soil, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. When released into water, this material is not expected to biodegrade. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals.
Environmental Toxicity:
The LC50/96-hour values for fish are between 1 and 10 mg/l. The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TETRACHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1897
Packing Group: III
Information reported for product/size: 20L

International (Water, I.M.O.)

Proper Shipping Name: TETRACHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1897
Packing Group: III
Information reported for product/size: 20L

International (Air, I.C.A.O.)

Proper Shipping Name: TETRACHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1897
Packing Group: III
Information reported for product/size: 20L

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15. Regulatory Information

--------\Chemical Inventory Status - Part 1\--------

Ingredient	TSCA	EC	Japan	Australia
Tetrachloroethylene (127-18-4)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\--------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Tetrachloroethylene (127-18-4)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\--------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Tetrachloroethylene (127-18-4)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\--------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Tetrachloroethylene (127-18-4)	100	U210	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2[Z]

Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: **2** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor or mist.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.
Product Use:
Laboratory Reagent.
Revision Information:
No changes.
Disclaimer:
****

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****

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 10/28/96

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

TX0160 TX0165

Product Name:
1,1,2,2-Tetrachloroethane
Synonyms:
Acetylene Tetrachloride
Chemical Family:
Chlorinated Hydrocarbon
Formula:
$Cl_2CHCHCl_2$
Molecular Weight.:
167.85

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
1,1,2,2-Tetrachloroethane	79-34-5	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
MAY BE FATAL IF INHALED, SWALLOWED OR ABSORBED THROUGH SKIN.
POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA.
Vapor Irritating And Narcotic.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

Appearance:
Colorless to pale yellow liquid, chloroform-like odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Toxic by ingestion, inhalation and skin absorption. Causes nausea, headache, CNS disturbances, irritation of eyes and respiratory passages, liver damage, kidney damage, coma and death.

Medical Cond. Aggravated by Exposure:
Data not available.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
Proven animal carcinogenic substance. Possible Cancer Hazard.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.
Remove contaminated clothing and wash before reuse.

5. FIRE FIGHTING MEASURES

Flash Point (F): Noncombustible
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Use any suitable for adjacent material.

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:
Thermal decomposition produces highly toxic fumes.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container closed. Store in a dry, well-ventilated area. Do not breathe vapor. Do not get in eyes, on skin, or on clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material should be handled or transferred in an approved fume hood or with adequate ventilation. Protective gloves (PVA or equivalent) must be worn to prevent skin contact. Safety glasses with side shields must be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
1,1,2,2-Tetrachloroethane							
	1	7					X

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
1,1,2,2-Tetrachloroethane							
	1	6.9					X

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 146.5C
Melting Point (C) : -44C
Specific Gravity (H_20 = 1) : 1.595
Vapor Pressure (mm Hg) : 8 20C
Percent Volatile by vol (%): 99+%
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : 0.29%
Appearance :
Colorless to pale yellow liquid, chloroform-like odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
Phosgene, HCl, CO_x, Chlorine

Conditions to Avoid:
Hydrolyzes on contact with water resulting in highly toxic fumes.

Materials To Avoid:

```
(X) Water
( ) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
(X) Other: N2O4, Sodium, Potassium, Strong
alkali
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-hmn TDLo: 30 mg/kg   ihl-hmn TCLo: 1000 mg/cu.m./30M
```

Toxicological Findings:
Tests on laboratory animals indicate material may produce adverse mutagenic effects and cause tumors.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

```
EPA Waste Numbers:  U209
```

Treatment:
Specified Technology - Incineration to a level below TCA (Total Constituent Analyses) levels. Contact your local permitted waste disposal company (TSD) for permissible treatment site.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Tetrachloroethane

DOT ID Number :
UN1702

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
1,1,2,2-Tetrachloroethane			100

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
1,1,2,2-Tetrachloroethane	Y	Y	0.1

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 3
Flammability : 0
Reactivity : 0
Special Hazards :

Revision History: 3/1/82 4/9/86 6/5/87 10/27/87
6/15/88 3/1/91 4/28/93

| = Revised Section

N/A = Not Available

N/E = None Establised

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MATERIAL SAFETY DATA SHEET (MSDS)

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1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 2/12/97

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

DX0794 DX0796 DX0797 DX0800 DX0805

Product Name:
1,2-Dichloroethane
Synonyms:
Ethylene Dichloride; Ethylene Chloride
Chemical Family:
Chlorinated Hydrocarbon
Formula:
$ClCH_2CH_2Cl$
Molecular Weight.:
98.96

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
1,2-Dichloroethane	107-06-2	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
FLAMMABLE LIQUID AND VAPOR.
HARMFUL IF INHALED OR SWALLOWED.
CAUSES EYE IRRITATION.
MAY CAUSE EYE INJURY.
MAY CAUSE SKIN IRRITATION.
SUSPECT CANCER HAZARD. MAY CAUSE CANCER.

May Cause Damage To Liver, Kidneys, Lungs and Blood.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

Appearance:
Colorless liquid; chloroform-like odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Toxic by ingestion and inhalation. May be toxic by skin absorption. Symptoms: dizziness, headache, nausea, CNS depression, coma. Repeated or prolonged exposure may cause damage to liver, kidneys, lungs and blood. Causes severe eye irritation, possible eye burns on contact. Contact may cause skin irritation. Respoductive toxicity tests have been conducted to evaluate the potential adverse effects ethylene dichloride may have in reproduction and offspring of laboratory animals. Results indicate ethylene dichloride did not cause teratogenic effects in mice, rats or rabbits. Results also indicate ethylene dichloride is not embryo or fetal toxic in laboratory animals except at concentrations which are toxic to the mother.

Medical Cond. Aggravated by Exposure:
Alcoholism, acute and chronic kidney and liver disease, asthma, bronchitis, rhythm disorders of the heart, diabetes, and circulatory or blood clotting disorders.

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
Suspected human carcinogenic substance. Suspect Cancer Hazard.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Immediately flush thoroughly with large amounts of water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: Do not induce vomiting; get immediate medical attention.
Remove contaminated clothing and wash before reuse.
NOTE TO PHYSICIAN: Adrenalin should never be given to a person overexposed to ethylene dichloride.

5. FIRE FIGHTING MEASURES

Flash Point (F): 56F (tcc)
Flammable Limits LEL (%): 6.20
Flammable Limits UEL (%): 15.90

Extinguishing Media:
Dry chemical, Carbon dioxide, Foam; water spray to cool fire-exposed containers and disperse vapors.

Fire Fighting Procedures:
Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:
Dangerous fire hazard. Vapor can travel distances to ignition source and flash back. Thermal decomposition produces highly toxic fumes.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.
EM SCIENCE recommends Spill-X absorbent agents for various types of spills. Additional information on the Spill-X products can be provided through the EM SCIENCE Technical Service Department (609) 423-6300. The following EM SCIENCE Spill-X absorbent is recommended for this product:

```
SX0863  Solvent Spill Treatment Kit
```

7. HANDLING AND STORAGE

Handling & Storage:
Keep container tightly closed. Store in a cool area away from ignition sources and oxidizers. Do not breathe vapor. Do not get in eyes, on skin, or on clothing. Electrically ground all equipment when handling this product. Retained residue may make empty containers hazardous; use caution!

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves (Viton, PVA, or equivalent) should be worn to prevent skin contact. Safety glasses with side shields must be worn at all times.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

Component	TWA PPM	TWA MG/M3	STEL PPM	STEL MG/M3	CL PPM	CL MG/M3	Skin
1,2-Dichloroethane	1	4	2	8			

ACGIH - TLV:

Component	TWA PPM	TWA MG/M3	STEL PPM	STEL MG/M3	CL PPM	CL MG/M3	Skin
1,2-Dichloroethane	10	40					

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 83.5C
Melting Point (C) : -35.7C
Specific Gravity (H_20 = 1) : 1.256
Vapor Pressure (mm Hg) : 67 20C
Percent Volatile by vol (%): 99+%
Vapor Density (Air = 1) : 3.42
Evaporation Rate (BuAc = 1): 6.46
Solubility in Water (%) : 0.81%
Appearance :
Colorless liquid; chloroform-like odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
CO_x, hydrogen chloride, phosgene, various hydrocarbons

Conditions to Avoid:
Heat, contact with ignition source.

Materials To Avoid:

( ) Water
( ) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers

(X) Other: Alkalies, Aluminum, Ammonia, Nitrogen tetroxide, Amines

11. TOXICOLOGICAL INFORMATION

Toxicity Data

orl-hmn LDLo: 286 mg/kg orl-mus LD50: 489 mg/kg
ihl-rat LC50: 1000 ppm/7H skn-rbt LD50: 2800 mg/kg

Toxicological Findings:

Tests on laboratory animals indicate material may produce adverse mutagenic effects and cause tumors.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: U077 D001 D028

Treatment:

Specified Technology - Incineration or fuels blending to less than the TCLP standard. Contact your local permitted waste disposal site (TSD) for permissible treatment sites.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:

Ethylene Dichloride

DOT ID Number :

UN1184

14. REGULATORY INFORMATION

TSCA Statement:

The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
1,2-Dichloroethane			100

	OSHA	SARA	DeMinimis

Component	Floor List	313	for SARA 313 (%)
1,2-Dichloroethane	Y	Y	0.1

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 2
Flammability : 3
Reactivity : 0
Special Hazards :

Revision History: 9/1/81 5/1/85 5/6/86 6/4/87 10/27/87 10/4/89 3/1/91 4/29/96 10/29/96

| = Revised Section

N/A = Not Available

N/E = None Establised

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Please reduce your browser font size for better viewing and printing.

MSDS *Material Safety Data Sheet*

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

2-Hexanone

MSDS Number: H2664 — ***Effective Date: 12/08/96***

1. Product Identification

Synonyms: Methyl Butyl Ketone
CAS No.: 591-78-6
Molecular Weight: 100.16
Chemical Formula: CH3CH2CH2CH2COCH3
Product Codes: N230

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Methyl n-butyl Ketone	591-78-6	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! FLAMMABLE! CAUSES IRRITATION. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. TARGET ORGAN(S):Central nervous system, skin, respiratory system.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Irritation of mucous membranes, severe irritation of respiratory system, may cause narcosis.

Ingestion:
Headache, nausea, vomiting, dizziness, gastrointestinal irritation, central nervous system depression.

Skin Contact:
Severe irritation, prolonged contact may cause dermatitis, May be absorbed through the skin with possible systemic effects.

Eye Contact:
Severe irritation.

Chronic Exposure:
No information found.

Aggravation of Pre-existing Conditions:
No information found.

---

4. First Aid Measures

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Prompt action is essential.

Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before re-use.

Eye Contact:
In case of eye contact, immediately flush with plenty of water for at least 15 minutes.

---

5. Fire Fighting Measures

Fire:
Flash point: 19C (66F) CC Autoignition temperature: 424C (795F) Flammable limits in air % by volume: lel: 1.3; uel: 8.1

Explosion:
Vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire. Sensitive to static discharge.

Fire Extinguishing Media:
Use alcohol foam, dry chemical or carbon dioxide. (Water may be ineffective.)

Special Information:
Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Move exposed containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool.

---

6. Accidental Release Measures

Wear self-contained breathing apparatus and full protective clothing. Shut off ignition sources; no flares, smoking or flames in area. Stop leak if you can do so without risk. Use water spray to reduce vapors. Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush area with water. J. T. Baker SOLUSORB(tm) solvent adsorbent is recommended for spills of this product.

---

7. Handling and Storage

Keep container tightly closed. Store in a cool, dry, well-ventilated, flammable liquid storage area or cabinet. Do not store near oxidizing materials. Bond and ground containers when transferring liquid. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL): 5 ppm (TWA) -ACGIH Threshold Limit Value (TLV): 5 ppm (TWA) The TLV listed denotes TLV (skin).

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
For conditions of use where exposure to the substance is apparent, consult an industrial hygienist. For emergencies, or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Colorless liquid.

Odor:
Faint ketone odor.

Solubility:
Moderate (1-10%)

Specific Gravity:
0.80

pH:
No information found.

% Volatiles by volume @ 21C (70F):
100

Boiling Point:
127C (261F)

Melting Point:
-57C (-71F)

Vapor Density (Air=1):
3.4

Vapor Pressure (mm Hg):
11 @ 20C (68F)

Evaporation Rate (BuAc=1):
1.2

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:
Carbon monoxide, carbon dioxide.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
Strong oxidizing agents.

Conditions to Avoid:
Heat, flame, other sources of ignition.

11. Toxicological Information

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Methyl n-butyl Ketone (591-78-6)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.

Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: KETONES, LIQUID, N.O.S. (2-HEXANONE)
Hazard Class: 3
UN/NA: UN1224
Packing Group: II
Information reported for product/size: 25G

International (Water, I.M.O.)

Proper Shipping Name: KETONES, LIQUID, N.O.S. (2-HEXANONE)
Hazard Class: 3.2
UN/NA: UN1224
Packing Group: II
Information reported for product/size: 25G

International (Air, I.C.A.O.)

Proper Shipping Name: KETONES, LIQUID, N.O.S. (2-HEXANONE)
Hazard Class: 3.2
UN/NA: UN1224
Packing Group: II
Information reported for product/size: 25G

15. Regulatory Information

```
--------\Chemical Inventory Status - Part 1\--------------------------------
Ingredient                                      TSCA  EC   Japan  Australia
------------------------------------------------ ----  ---  -----  ---------
```

```
Methyl n-butyl Ketone (591-78-6)                    Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\--------------------------------
                                                        --Canada--
Ingredient                                          Korea  DSL   NDSL  Phil.
---------------------------------------------      -----  ---   ----  -----
Methyl n-butyl Ketone (591-78-6)                     Yes   Yes   No     Yes

--------\Federal, State & International Regulations - Part 1\---------------
                                              -SARA 302-    ------SARA 313------
Ingredient                                    RQ    TPQ     List  Chemical Catg.
---------------------------------------      ---   -----   ----  --------------
Methyl n-butyl Ketone (591-78-6)              No    No      No         No

--------\Federal, State & International Regulations - Part 2\---------------
                                                      -RCRA-    -TSCA-
Ingredient                                    CERCLA  261.33     8(d)
---------------------------------------      ------  ------    ------
Methyl n-butyl Ketone (591-78-6)              No      No         No

Chemical Weapons Convention:  No     TSCA 12(b):  Yes    CDTA:  No
SARA 311/312:  Acute: Yes     Chronic: Yes  Fire: Yes Pressure: No
Reactivity: No          (Pure / Liquid)
```

Australian Hazchem Code: No information found.
Poison Schedule: No information found.

WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: 2 **Flammability:** 3 **Reactivity:** 0

Label Hazard Warning:
WARNING! FLAMMABLE! CAUSES IRRITATION. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. TARGET ORGAN(S):Central nervous system, skin, respiratory system.

Label Precautions:
Keep away from heat, sparks, flame. Do not get in eyes, on skin, on clothing. Avoid breathing vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling. In case of fire, use alcohol foam, dry chemical, carbon dioxide - water may be ineffective. In case of spill, soak up with sand or earth. Flush spill area with water.

Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give

anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Prompt action is essential. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Product Use:
Laboratory Reagent.

Revision Information:
Pure. New 16 section MSDS format, all sections have been revised.

Disclaimer:
****
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****

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

Please reduce your browser font size for better viewing and printing.

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 202-483-7616

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

p-CRESOL

MSDS Number: C5467 --- *Effective Date: 02/25/99*

1. Product Identification

Synonyms: 4-methylphenol; 4-Cresol; 1-Hydroxy -4-Methylbenzene
CAS No.: 106-44-5
Molecular Weight: 108.14
Chemical Formula: CH3C6H4OH
Product Codes: F847

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
p-Cresol	106-44-5	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! MAY BE FATAL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CORROSIVE. CAUSES SEVERE BURNS TO EVERY AREA OF CONTACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, KIDNEYS, PANCREAS AND CARDIOVASCULAR SYSTEM. VAPOR IS IRRITATING TO EYES AND RESPIRATORY TRACT. COMBUSTIBLE LIQUID AND VAPOR.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)

Flammability Rating: 2 - Moderate
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: White (Corrosive)

Potential Health Effects

Cresol is toxic via ingestion and skin absorption. Cresol is similar to phenol in its action on the body, but is less severe in its effects.

Inhalation:
Breathing vapor, dust or mist results in digestive disturbances (vomiting, difficulty in swallowing, diarrhea, loss of appetite). Will irritate, possibly burn respiratory tract. Other symptoms listed under ingestion may also occur.
Ingestion:
Poison. Symptoms may include burning pain in mouth and throat, abdominal pain, headache, dizziness, muscular weakness, irregular breathing, weak pulse, lung damage, liver damage, pancreas damage, kidney damage, coma, and possibly death from circulatory or cardiac failure.
Skin Contact:
Corrosive. Causes severe pain followed by numbness. May be absorbed through the skin with systemic poisoning effects to follow. Discoloration and severe burns may occur.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Repeated exposure may cause symptoms described for acute poisoning as well as liver damage.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Onset of systemic effects may be delayed as long as 72 hours.

5. Fire Fighting Measures

Fire:
Flash point: 86C (187F) CC
Autoignition temperature: 559C (1038F)
Flammable limits in air % by volume:
lel: 1.1
Combustible Liquid and Vapor! Contact with strong oxidizers may cause fire.
Explosion:
Above flash point, vapor-air mixtures are explosive within flammable limits noted above.
Fire Extinguishing Media:
Water spray, dry chemical, alcohol foam, or carbon dioxide.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Remove all sources of ignition. Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Solid Spills: Clean up spills in a manner that does not disperse dust into the air. Use non-sparking tools and equipment. Reduce airborne dust and prevent scattering by moistening with water. Pick up spill for recovery or disposal and place in a closed container. Liquid Spills: Absorb with vermiculite, dry sand, earth or similar material and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer. Any Spill: US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB(R) solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Keep in a tightly closed container. Store in a cool, dry, ventilated area away from sources of heat or ignition. Protect against physical damage. Store separately from reactive or combustible materials, and out of direct sunlight. Containers of this material may be hazardous when empty since they retain product residues (dust, solids, vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
5 ppm (TWA) (skin), cresol, all isomers

-ACGIH Threshold Limit Value (TLV):
5 ppm (TWA) (skin), cresol, all isomers
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a full-face piece respirator with an organic vapor cartridge and particulate filter (NIOSH type P100 or R100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. Please note that N series filters are not recommended for this material. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

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9. Physical and Chemical Properties

Appearance:
Crystals or liquid becoming dark with age.
Odor:
Phenolic odor.
Solubility:
Slightly soluble in water.
Specific Gravity:
1.0178
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
201C (394F)
Melting Point:
34.8C (95F)
Vapor Density (Air=1):
3.72
Vapor Pressure (mm Hg):
1 @ 53C (127F)
Evaporation Rate (BuAc=1):
No information found.

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
May produce acrid smoke and irritating fumes when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Acids, bases, oxidizing agents.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 207 mg/Kg;Inhalation rat LD50: > 710 mg/m3; skin rabbit LD50: 301 mg/kg; investigated as a tumorigen, mutagen.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
p-Cresol (106-44-5)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is not expected to evaporate significantly. When released into water, this material is expected to readily biodegrade. When released into water, this material is not expected to evaporate significantly. When released into the water, this material is expected to have a half-life between 1 and 10 days. This material has an experimentally-determined bioconcentration factor (BCF) of less than 100. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition. When released into the air, this material is expected to have a half-life of less than 1 day.
Environmental Toxicity:
This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and

unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: CRESOLS
Hazard Class: 6.1, 8
UN/NA: UN2076
Packing Group: II
Information reported for product/size: 500ML

International (Water, I.M.O.)

Proper Shipping Name: PARA-CRESOLS, SOLID
Hazard Class: 6.1, 8
UN/NA: UN2076
Packing Group: II
Information reported for product/size: 500ML

International (Air, I.C.A.O.)

Proper Shipping Name: PARA-CRESOLS, SOLID
Hazard Class: 6.1, 8
UN/NA: UN2076
Packing Group: II
Information reported for product/size: 500ML

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\--------

Ingredient	TSCA	EC	Japan	Australia
p-Cresol (106-44-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\--------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
p-Cresol (106-44-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\--------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
p-Cresol (106-44-5)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\--------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
p-Cresol (106-44-5)	100	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes

SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: 2X
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: 3 Flammability: 1 Reactivity: 0
Label Hazard Warning:
POISON! DANGER! MAY BE FATAL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CORROSIVE. CAUSES SEVERE BURNS TO EVERY AREA OF CONTACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, KIDNEYS, PANCREAS AND CARDIOVASCULAR SYSTEM. VAPOR IS IRRITATING TO EYES AND RESPIRATORY TRACT. COMBUSTIBLE LIQUID AND VAPOR.
Label Precautions:
Do not breathe vapor.
Do not get in eyes, on skin, or on clothing.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep away from heat, sparks and flame.
Label First Aid:
In all cases call a physician immediately. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 3, 8.
Disclaimer:
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****

Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

ACROS ORGANICS
HELP CATALOGS SEARCH ORDER LIST CONTENTS

MATERIAL SAFETY DATA SHEET

4-Chloroaniline, 98%
96878

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: 4-Chloroaniline, 98%

1-Amino-4-chlorobenzene
Company Identification: Acros Organics N.V.
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
106-47-8	4-Chloroaniline	98.0	203-401-0

Hazard Symbols: T N
Risk Phrases: 23/24/25 33 50/53

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: Not available.
Caution! May be harmful if absorbed through the skin. Light sensitive. Air sensitive. May cause methemoglobinemia. Causes eye and skin irritation. Causes digestive and respiratory tract irritation. May cause cancer based on animal studies. May cause skin eruptions and/or acne.
Target Organs: None.

Potential Health Effects

Eye:
Causes eye irritation.

Skin:
Causes skin irritation. May be absorbed through the skin in harmful amounts. Produces acneiform eruptions.

Ingestion:
May cause irritation of the digestive tract. May cause methemoglobinemia, cyanosis, convulsions, and death. Methemoglobinemia is characterized by dizziness, drowsiness, headache, breath shortness, cyanosis with bluish skin, rapid heart

rate and chocolate-brown colored blood. May cause skin eruptions and/or acne.

Inhalation:
May cause respiratory tract irritation. May cause effects similar to those described for ingestion.

Chronic:
May cause cancer according to animal studies.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid immediately.

Skin:
Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if symptoms occur.

Ingestion:
If victim is conscious and alert, give 2-4 cupfuls of milk or water. Get medical aid immediately. Induce vomiting by giving one teaspoon of Syrup of Ipecac. Do NOT induce vomiting. Allow the victim to rinse his mouth and then to drink 2-4 cupfuls of water, and seek medical advice.

Inhalation:
Get medical aid immediately. Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Notes to Physician:
Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.

Extinguishing Media:
In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.

Autoignition Temperature: > 450 deg C (> 842.00 deg F)
Flash Point: > 120 deg C (> 248.00 deg F)
NFPA Rating: Not published.
Explosion Limits, Lower: Not available.
Upper: Not available.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:
Absorb spill with inert material, (e.g., dry sand or earth), then place into a chemical waste container. Sweep up, then place into a suitable container for disposal.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Avoid contact with skin and eyes. Do not ingest or inhale.

Storage:
Poison room locked.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate ventilation to keep airborne concentrations low. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
4-Chloroaniline	2 ppm TWA; 7.6 mg/m3 TWA (listed under ANILINE).skin - potential for cutaneous absorption (listed under ANILINE).	NIOSH Potential Occupational Carcinogen - see Appendix A (listed under	5 ppm TWA; 19 mg/m3 TWA (listed under ANILINE).

OSHA Vacated PELs:
4-Chloroaniline:
2 ppm TWA; 8 mg/m3 TWA (listed under ANILINE)

Personal Protective Equipment

Eyes:
Wear safety glasses and chemical goggles if splashing is possible. Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:
Wear appropriate protective gloves and clothing to prevent skin exposure. Wear appropriate gloves to prevent skin exposure.

Clothing:
Wear appropriate protective clothing to minimize contact with skin.

Respirators:
Wear a NIOSH/MSHA or European Standard EN 149 approved full-facepiece airline respirator in the positive pressure mode with emergency escape provisions. Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Not available.
Appearance:	Not available.
Odor:	None reported.
pH:	Not available.
Vapor Pressure:	1.3 hPa @ 60 C
Vapor Density:	Not available.
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	232 deg C @ 760.00mmHg
Freezing/Melting Point:	68.00 - 71.00 deg C

Decomposition Temperature: > 300 deg C
Solubility: carbon disulfide
Specific Gravity/Density: Not available.
Molecular Formula: C6H6ClN
Molecular Weight: 127.57

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
None reported.
Incompatibilities with Other Materials:
Acids, acid chlorides, acid anhydrides, strong oxidizing agents.
Hazardous Decomposition Products:
Hydrogen chloride, nitrogen oxides, carbon monoxide, carbon dioxide, nitrogen.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 106-47-8: BX0700000
LD50/LC50:
CAS# 106-47-8: Oral, mouse: LD50 = 100 mg/kg; Oral, rat: LD50 = 300 mg/kg; Skin, rabbit: LD50 = 360 mg/kg; Skin, rat: LD50 = 3200 mg/kg.
Carcinogenicity:
4-Chloroaniline -
ACGIH: A3 - Animal Carcinogen (listed as ANILINE).
California: carcinogen - initial date 10/01/94
NIOSH: occupational carcinogen (listed as ANILINE)
OSHA: Possible Select carcinogen
IARC: Group 3 carcinogen (listed as ANILINE).
Epidemiology:
No data available.
Teratogenicity:
No data available.
Reproductive Effects:
No data available.
Neurotoxicity:
No data available.
Mutagenicity:
No data available.
Other Studies:
No data available.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
Not available.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants:
None listed.
RCRA D-Series Chronic Toxicity Reference Levels: None listed.
RCRA F-Series: None listed.
RCRA P-Series: CAS# 106-47-8: waste number P024.
RCRA U-Series: None listed.
CAS# 106-47-8 is banned from land disposal according to RCRA.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
Shipping Name: CHLOROANILINES, SOLID
Hazard Class: 6.1
UN Number: UN2018
Packing Group: II

IMO
Shipping Name: CHLOROANILINES, SOLID
Hazard Class: 6.1
UN Number: 2018
Packing Group: II

IATA
Shipping Name: CHLOROANILINES, SOLID
Hazard Class: 6.1
UN Number: 2018
Packing Group: II

RID/ADR
Shipping Name: CHLOROANILINES, SOLID
Dangerous Goods Code: 6.1(12B)
UN Number: 2018

Canadian TDG
Shipping Name: CHLOROANILINES, SOLID
Hazard Class: 6.1
UN Number: UN2018

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA
CAS# 106-47-8 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.

SARA
Section 302 (RQ)
CAS# 106-47-8: final RQ = 1000 pounds (454 kg)
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 106-47-8: acute.
Section 313
This material contains 4-Chloroaniline (CAS# 106-47-8, 98 0%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:
CAS# 106-47-8 listed as ANILINE is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:
CAS# 106-47-8 is listed as a Hazardous Substance under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

4-Chloroaniline can be found on the following state right to know lists: California, (listed as ANILINE), New Jersey, Florida, (listed as ANILINE), Pennsylvania, Minnesota, (listed as ANILINE), Massachusetts.

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains 4-Chloroaniline, a chemical known to the state of California to cause cancer.

California No Significant Risk Level:

CAS# 106-47-8: no significant risk level = 100 ug/day (listed under ANILINE)

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T N

Risk Phrases:

R 23/24/25 Toxic by inhalation, in contact with skin and if swallowed.

R 33 Danger of cumulative effects.

R 50/53 Very toxic to aquatic organisms; may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 28 After contact with skin, wash immediately with plenty of ... (to be specified by the manufacturer).

S 36/37 Wear suitable protective clothing and gloves.

S 45 In case of accident of if you feel unwell, seek medical advice immediately (show the label where possible).

S 60 This material and/or its container must be disposed of as hazardous waste.

S 61 Avoid release to the environment. Refer to special instructions/Safety data sheets.

WGK (Water Danger/Protection)

CAS# 106-47-8: 3

Canada

CAS# 106-47-8 is listed on Canada's DSL/NDSL List.

This product does not have a WHMIS classification.

CAS# 106-47-8 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 106-47-8 (listed as aniline): OEL-ARAB Republic of Egypt:TWA 2 ppm (10 mg/m3);Skin. OEL-AUSTRALIA:TWA 2 ppm (10 mg/m3);Skin. OEL-AUSTRIA:TWA 2 ppm (8 mg/m3);Skin. OEL-BELGIUM:TWA 2 ppm (7.6 mg/m3);Skin. OEL-CZECHOSLOVAKIA:TWA 5 mg/m3;STEL 20 mg/m3 JAN9. OEL-DENMARK:TWA 1 ppm (4 mg/m3);Skin. OEL-FINLAND:TWA 2 ppm (7.6 mg/m3);STEL 4 ppm (15 mg/m3);Skin;CAR. OEL-FRANCE:TWA 2 ppm (10 mg/m3);Skin. OEL-GERMANY:TWA 2 ppm (8 mg/m3);Skin;Carcinogen. OEL-HUNGARY:TWA 5 mg/m3;STEL 10 mg/m3;Skin. OEL-INDIA:TWA 0.2 mg/m3;Skin. OEL-JAPAN:TWA 1 ppm (3.8 mg/m3);Skin. OEL-THE NETHERLANDS:TWA 5 ppm (19 mg/m3);Skin. OEL-THE PHILIPPINES:TWA 5 ppm (19 mg/m3);Skin. OEL-POLAND:TWA 5 mg/m3;STEL 20 mg/m3;Skin. OEL-RUSSIA:TWA 1 ppm;STEL 0.1 mg/m3;Skin. OEL-SWEDEN:TWA 1 ppm (4 mg/m3);STEL 2 ppm (8 mg/m3);Skin. OEL-SWITZERLAND:TWA 2 ppm (8 mg/m3);STEL 10 ppm (40 mg/m3);Skin. OEL-TURKEY:TWA 5 ppm (19 mg/m3);Skin. OEL-UNITED KINGDOM:TWA 2 ppm (10 mg/m3);STEL 5 ppm;Skin. OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV. OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 2/01/1996 Revision #2 Date: 11/13/1997

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Back to product information.

ACROS ORGANICS

HELP CATALOGS SEARCH ORDER LIST CONTENTS

MATERIAL SAFETY DATA SHEET

2-Chlorophenol, 98+%
99619

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: 2-Chlorophenol, 98+%

Company Identification: Acros Organics N.V.
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
95-57-8	2-Chlorophenol, 98+%		202-433-2

Hazard Symbols: XN
Risk Phrases: 20/21/22

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: Not available. Flash Point: 63 deg C.
Hygroscopic.
Target Organs: None.

Potential Health Effects
The toxicological properties of this material have not been investigated. Use appropriate procedures to prevent opportunities for direct contact with the skin or eyes and to prevent inhalation.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids.

Skin:
Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion:
Do NOT induce vomiting. Allow the victim to rinse his mouth and then to drink 2-4 cupfuls of water, and seek medical advice.

Inhalation:
Remove from exposure to fresh air immediately.
Notes to Physician:
Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.
Extinguishing Media:
In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.
Autoignition Temperature: 550 deg C (1,022.00 deg F)
Flash Point: 63 deg C (145.40 deg F)
NFPA Rating: health-3; flammability-2; reactivity-0
Explosion Limits, Lower: Not available.
Upper: Not available.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks:
Absorb spill with inert material, (e.g., dry sand or earth), then place into a chemical waste container. Clean up spills immediately, observing precautions in the Protective Equipment section.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Avoid contact with eyes, skin, and clothing. Avoid ingestion and inhalation.
Storage:
Store in a cool, dry place. Keep container closed when not in use.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits. Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
2-Chlorophenol, 98+%	none listed	none listed	none listed

OSHA Vacated PELs:
2-Chlorophenol, 98+%:
No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:
Wear safety glasses and chemical goggles if splashing

is possible.

Skin:

Wear appropriate protective gloves and clothing to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to minimize contact with skin.

Respirators:

Wear a NIOSH/MSHA or European Standard EN 149 approved full-facepiece airline respirator in the positive pressure mode with emergency escape provisions.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Not available.
Appearance:	Not available.
Odor:	None reported.
pH:	Not available.
Vapor Pressure:	1.3 mbar @ 12 C
Vapor Density:	Not available.
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	175.0 - 176.0 deg C @ 760.00m
Freezing/Melting Point:	8 deg C
Decomposition Temperature:	> 300 deg C
Solubility:	freely soluble in alcohol and ether
Specific Gravity/Density:	1.2410g/cm3
Molecular Formula:	C6H5ClO
Molecular Weight:	128.56

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Incompatible materials, strong oxidants.
Incompatibilities with Other Materials:
Acid chlorides - acid anhydrides - oxidizing agents.
Hazardous Decomposition Products:
Hydrogen chloride, carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 95-57-8: SK2625000
LD50/LC50:
CAS# 95-57-8: Oral, mouse: LD50 = 345 mg/kg; Oral, rat: LD50 = 670 mg/kg.
Carcinogenicity:
2-Chlorophenol, 98+% -
IARC: Group 2B carcinogen (listed as CHLOROPHENOL (MIXED ISOMERS

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
Not available.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.

RCRA D-Series Maximum Concentration of Contaminants:
None listed.
RCRA D-Series Chronic Toxicity Reference Levels: None listed.
RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 95-57-8: waste number U048.
CAS# 95-57-8 is banned from land disposal according to RCRA. .

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
Shipping Name: CHLOROPHENOLS, LIQUID
Hazard Class: 6.1
UN Number: 2021
Packing Group: III

IMO
Shipping Name: CHLOROPHENOLS, LIQUID
Hazard Class: 6.1
UN Number: 2021
Packing Group: III

IATA
Shipping Name: CHLOROPHENOLS, LIQUID
Hazard Class: 6.1
UN Number: 2021
Packing Group: III

RID/ADR
Shipping Name: CHLOROPHENOLS, LIQUID
Dangerous Goods Code: 6.1(17C)
UN Number: 2021

Canadian TDG
Shipping Name: CHLOROPHENOLS,LIQUID
Hazard Class: 6.1(9.2)
UN Number: UN2021

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA
CAS# 95-57-8 is listed on the TSCA inventory.

Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.

Section 12b
None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.

SARA

Section 302 (RQ)
CAS# 95-57-8: final RQ = 100 pounds (45.4 kg)

Section 302 (TPQ)
None of the chemicals in this product have a TPQ.

SARA Codes
CAS # 95-57-8: acute, chronic, flammable.

Section 313
This chemical is not at a high enough concentration to be reportable under Section 313.

Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 95-57-8 is listed as a Priority Pollutant under the Clean Water Act.
CAS# 95-57-8 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.

STATE
2-Chlorophenol, 98+% can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.
California No Significant Risk Level:
None of the chemicals in this product are listed.

European/International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols: XN
Risk Phrases:
R 20/21/22 Harmful by inhalation, in contact with skin and if swallowed.
Safety Phrases:
S 2 Keep out of reach of children.
S 28A After contact with skin, wash immediately with plenty of water.

WGK (Water Danger/Protection)
CAS# 95-57-8: 2

Canada
CAS# 95-57-8 is listed on Canada's DSL/NDSL List.
This product does not have a WHMIS classification.
CAS# 95-57-8 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 3/01/1994 Revision #1 Date: 3/04/1996

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

Back to product information.

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 6/25/93

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

DX1875

Product Name:
2,4-Dimethylphenol
Synonyms:
2,4-Xylenol
Chemical Family:
Phenol
Formula:
$C_8H_{10}O$
Molecular Weight.:
122.17

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
2,4-DIMETHYLPHENOL	105-67-9	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
HARMFUL IF SWALLOWED OR ABSORBED THROUGH SKIN.
CAUSES BURNS.
VAPOR IRRITATING.
COMBUSTIBLE LIQUID AND VAPOR.

Appearance:
Colorless liquid

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Harmful if swallowed or absorbed through skin. Corrosive to skin and eyes. Inhalation causes irritation to respiratory system, coughing, shortness of breath, chest pains. Absorption of large quantities can cause Central Nervous System and cardiovascular system impairment.

Medical Cond. Aggravated by Exposure:
Respiratory conditions

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Immediately flush thoroughly with large amounts of water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.
Remove contaminated clothing and wash before reuse.

5. FIRE FIGHTING MEASURES

Flash Point (F): 176F
Flammable Limits LEL (%): 1.4
Flammable Limits UEL (%): N/A
Extinguishing Media:

Use water, dry chemical, CO_2, or "alcohol" foam.

Fire Fighting Procedures:

Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:
Moderate fire hazard. Thermal decomposition produces acrid fumes.

6. ACCIDENTAL RELEASE MEASURES

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Harmful if swallowed or absorbed through skin. Corrosive to skin and eyes. Inhalation causes irritation to respiratory system, coughing, shortness of breath, chest pains. Absorption of large quantities can cause Central Nervous System and cardiovascular system impairment.

Medical Cond. Aggravated by Exposure:
Respiratory conditions

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
The material is not listed (IARC, NTP, OSHA) as cancer causing agent.

4. FIRST AID MEASURES

Emergency First Aid:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Immediately flush thoroughly with large amounts of water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.
Remove contaminated clothing and wash before reuse.

5. FIRE FIGHTING MEASURES

Flash Point (F): 176F
Flammable Limits LEL (%): 1.4
Flammable Limits UEL (%): N/A
Extinguishing Media:

Use water, dry chemical, CO_2, or "alcohol" foam.

Fire Fighting Procedures:

Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:
Moderate fire hazard. Thermal decomposition produces acrid fumes.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:
Keep container tightly closed. Store in a cool area away from ignition sources and oxidizers. Do not breathe vapor. Do not get in eyes, on skin, or on clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:

Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves must be worn to prevent skin contact (Viton or equivalent) Safety glasses with side shields must be worn at all times. Impervious protective clothing should be worn to prevent skin contact.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
2,4-DIMETHYLPHENOL							

ACGIH - TLV:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
2,4-DIMETHYLPHENOL							

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 211C
Melting Point (C) : 25C
Specific Gravity (H_20 = 1) : N/A
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%): N/A
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1): N/A
Solubility in Water (%) : Slight
Appearance :
Colorless liquid

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
CO_x

Conditions to Avoid:
Heat; contact with ignition sources.

Materials To Avoid:

```
( ) Water
( ) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
( ) Other:
```

11. TOXICOLOGICAL INFORMATION

Toxicity Data

```
orl-mus LD50: 809 mg/kg
orl-rat LD50: 3200 mg/kg
skn-rat LD50: 1040 mg/kg
```

Toxicological Findings:

Tests on laboratory animals indicate material may cause tumors.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers:

Treatment:
Material does not have an EPA Waste number and is not a listed waste, however consultation with a permitted waste disposal site (TSD) should be accomplished.
ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Xylenol

DOT ID Number :
UN2261

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
2,4-DIMETHYLPHENOL			100

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
2,4-DIMETHYLPHENOL		Y	1.0

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 1
Flammability : 2

Reactivity : 0
Special Hazards :

Revision History: 11/5/91

| = Revised Section

N/A = Not Available

N/E = None Establised

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ACROS ORGANICS

HELP CATALOGS SEARCH ORDER LIST CONTENTS

MATERIAL SAFETY DATA SHEET

2,4-Dichlorophenol, 99%
93183

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: 2,4-Dichlorophenol, 99%

Company Identification: Acros Organics N.V.
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
120-83-2	2,4-Dichlorophenol, 99%		204-429-6

Hazard Symbols: C N
Risk Phrases: 21/22 34 51/53

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: colourless.
Warning! May cause respiratory tract irritation. Dangerous to the environment. Cancer suspect agent. May be harmful if swallowed. May cause fetal effects based upon animal studies. May cause eye and skin irritation.
Target Organs: None.

Potential Health Effects

Eye:
May cause eye irritation.

Skin:
May cause skin irritation.

Ingestion:
May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May be harmful if swallowed.

Inhalation:
May cause respiratory tract irritation.

Chronic:
Not available.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids. Get medical aid immediately.

Skin:
Get medical aid. Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion:
If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid.

Inhalation:
Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:
Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.

Extinguishing Media:
In case of fire use water spray, dry chemical, carbon dioxide, or appropriate foam.

Autoignition Temperature: Not available.
Flash Point: 113 deg C (235.40 deg F)
NFPA Rating: flammability-1; reactivity-0
Explosion Limits, Lower: Not available.
Upper: Not available.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:
Sweep up or absorb material, then place into a suitable clean, dry, closed container for disposal.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Wash thoroughly after handling. Use only in a well ventilated area. Avoid contact with eyes, skin, and clothing. Avoid ingestion and inhalation.

Storage:
Store in a cool, dry place. Store in a tightly closed container.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
2,4-Dichlorophenol,	none listed	none listed	none listed

99%				

OSHA Vacated PELs:
2,4-Dichlorophenol, 99%:
No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin:
Wear appropriate protective gloves to prevent skin exposure.

Clothing:
Wear appropriate protective clothing to prevent skin exposure.

Respirators:
Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Crystals
Appearance:	colourless
Odor:	medicinal odor
pH:	Not available.
Vapor Pressure:	1 mm Hg @ 53 deg C
Vapor Density:	5.62
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	209.0 - 210.0 deg C @ 760.00m
Freezing/Melting Point:	42.00 - 44.00 deg C
Decomposition Temperature:	Not available.
Solubility:	Slightly soluble.
Specific Gravity/Density:	1.383@ 60°/25°C
Molecular Formula:	C6H4Cl2O
Molecular Weight:	163.00

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Not available.
Incompatibilities with Other Materials:
Oxidizing agents, acid chlorides, acid anhydrides.
Hazardous Decomposition Products:
Hydrogen chloride, carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 120-83-2: SK8575000
LD50/LC50:
CAS# 120-83-2: Oral, mouse: LD50 = 1276 mg/kg; Oral, rat: LD50 = 580 mg/kg.

Carcinogenicity:
2,4-Dichlorophenol, 99% -
IARC: Group 2B carcinogen (listed as CHLOROPHENOL (MIXED ISOMERS
Epidemiology:
No data available.
Teratogenicity:
No data available.
Reproductive Effects:
No data available.
Neurotoxicity:
No data available.
Mutagenicity:
No data available.
Other Studies:
No data available.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
Not available.
Environmental Fate:
Not available.
Physical/Chemical:
Not available.
Other:
Not available.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants:
None listed.
RCRA D-Series Chronic Toxicity Reference Levels: None
listed.
RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 120-83-2: waste number U081.
CAS# 120-83-2 is banned from land disposal according
to RCRA.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
Shipping Name: CHLOROPHENOLS, SOLID
Hazard Class: 6.1
UN Number: 2020
Packing Group: III
IMO
Shipping Name: CHLOROPHENOLS, SOLID
Hazard Class: 6.1
UN Number: 2020
Packing Group: III
IATA
Shipping Name: CHLOROPHENOLS, SOLID
Hazard Class: 6.1
UN Number: 2020
Packing Group: III
RID/ADR
Shipping Name: CHLOROPHENOLS, SOLID
Dangerous Goods Code: 6.1(17C)
UN Number: 2020
Canadian TDG
Shipping Name: CHLOROPHENOLS, SOLID

Hazard Class: 6.1(9.2)
UN Number: UN2020

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL
TSCA
CAS# 120-83-2 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
CAS# 120-83-2: export notification required - Section 4
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA
Section 302 (RQ)
CAS# 120-83-2: final RQ = 100 pounds (45.4 kg)
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 120-83-2: acute, chronic.
Section 313
This chemical is not at a high enough concentration to be reportable under Section 313.
No chemicals are reportable under Section 313.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 120-83-2 is listed as a Priority Pollutant under the Clean Water Act.
CAS# 120-83-2 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
2,4-Dichlorophenol, 99% can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.
California No Significant Risk Level:
None of the chemicals in this product are listed.
European/International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols: C N
Risk Phrases:
R 21/22 Harmful in contact with skin and if swallowed.
R 34 Causes burns.
R 51/53 Toxic to aquatic organisms; may cause long-term adverse effects in the aquatic environment.
Safety Phrases:
S 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S 36/37/39 Wear suitable protective clothing, gloves and eye/face protection.
S 45 In case of accident of if you feel unwell, seek medical advice immediately (show the label where possible).

S 61 Avoid release to the environment. Refer to special instructions/Safety data sheets.

WGK (Water Danger/Protection)

CAS# 120-83-2: 3

Canada

CAS# 120-83-2 is listed on Canada's DSL/NDSL List.

This product has a WHMIS classification of D1B, D2A.

CAS# 120-83-2 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 10/09/1991 Revision #3 Date: 2/23/1998

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Back to product information.

ACROS ORGANICS

HELP CATALOGS SEARCH ORDER LIST CONTENTS

MATERIAL SAFETY DATA SHEET

2,4,6-Trichlorophenol, 98%
83212

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: 2,4,6-Trichlorophenol, 98%

None.
Company Identification: Acros Organics N.V.
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
88-06-2	2,4,6-Trichlorophenol	98	201-795-9

Hazard Symbols: XN
Risk Phrases: 22 36/38 40

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: light beige.
Cancer suspect agent.
Target Organs: None.

Potential Health Effects
The toxicological properties of this material have not been investigated. Use appropriate procedures to prevent opportunities for direct contact with the skin or eyes and to prevent inhalation.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids.
Skin:
Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.
Ingestion:
Do NOT induce vomiting. Allow the victim to rinse his mouth and then

to drink 2-4 cupfuls of water, and seek medical advice.
Inhalation:
Remove from exposure to fresh air immediately.
Notes to Physician:
Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.
Extinguishing Media:
In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.
Autoignition Temperature: Not available.
Flash Point: 99 deg C (210.20 deg F)
NFPA Rating: Not published.
Explosion Limits, Lower: Not available.
Upper: Not available.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks:
Sweep up, then place into a suitable container for disposal.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Not available.
Storage:
Not available.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
2,4,6-Trichlorophenol	none listed	none listed	none listed

OSHA Vacated PELs:
2,4,6-Trichlorophenol:
No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:
Wear safety glasses and chemical goggles if splashing is possible.
Skin:
Wear appropriate protective gloves and clothing to prevent skin exposure.
Clothing:
Wear appropriate protective clothing to minimize

contact with skin.

Respirators:

Wear a NIOSH/MSHA or European Standard EN 149 approved full-facepiece airline respirator in the positive pressure mode with emergency escape provisions.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Not available.
Appearance:	light beige
Odor:	None reported.
pH:	Not available.
Vapor Pressure:	1 hPa @ 77 C
Vapor Density:	Not available.
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	246 deg C @ 760.00mm Hg
Freezing/Melting Point:	64 - 66 deg C
Decomposition Temperature:	Not available.
Solubility:	practically insoluble
Specific Gravity/Density:	Not available.
Molecular Formula:	C6H3Cl3O
Molecular Weight:	197.45

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
Not available.
Incompatibilities with Other Materials:
Acid chlorides - acid anhydrides - oxidizing agents.
Hazardous Decomposition Products:
Hydrogen chloride, carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 88-06-2: SN1575000
LD50/LC50:
CAS# 88-06-2: Oral, rat: LD50 = 820 mg/kg.
Carcinogenicity:
2,4,6-Trichlorophenol -
California: carcinogen - initial date 1/1/88
NTP: Suspect carcinogen
OSHA: Possible Select carcinogen
IARC: Group 2B carcinogen (listed as CHLOROPHENOL (MIXED ISOMERS

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
Not available.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants:
CAS# 88-06-2: waste number D042; regulatory level = 2.0 mg/L.
RCRA D-Series Chronic Toxicity Reference Levels: CAS# 88-06-2: chronic toxicity reference level = 0.02

mg/L.
RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: None listed.
Not listed as a material banned from land disposal according to RCRA.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
Shipping Name: CHLOROPHENOLS, SOLID
Hazard Class: 6.1
UN Number: UN2020
Packing Group: III

IMO
Shipping Name: CHLOROPHENOLS, SOLID
Hazard Class: 6.1
UN Number: 2020
Packing Group: III

IATA
Shipping Name: CHLOROPHENOLS, SOLID
Hazard Class: 6.1
UN Number: 2020
Packing Group: III

RID/ADR
Shipping Name: CHLOROPHENOLS, SOLID
Dangerous Goods Code: 6.1(17C)
UN Number: 2020

Canadian TDG
Shipping Name: CHLOROPHENOLS,SOLID
Hazard Class: 6.1(9.2)
UN Number: UN2020

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA
CAS# 88-06-2 is listed on the TSCA inventory.

Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.

Section 12b
None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.

SARA

Section 302 (RQ)
CAS# 88-06-2: final RQ = 10 pounds (4.54 kg)

Section 302 (TPQ)
None of the chemicals in this product have a TPQ.

Section 313
This material contains 2,4,6-Trichlorophenol (CAS# 88-06-2, 98%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:
CAS# 88-06-2 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean Water Act:
CAS# 88-06-2 is listed as a Hazardous Substance under the CWA.
CAS# 88-06-2 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

2,4,6-Trichlorophenol can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains 2,4,6-Trichlorophenol, a chemical known to the state of California to cause cancer.

California No Significant Risk Level:

CAS# 88-06-2: no significant risk level = 10 ug/day

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN

Risk Phrases:

R 22 Harmful if swallowed.
R 36/38 Irritating to eyes and skin.
R 40 Possible risks of irreversible effects.

Safety Phrases:

S 36/37 Wear suitable protective clothing and gloves.

WGK (Water Danger/Protection)

CAS# 88-06-2: No information available.

Canada

None of the chemicals in this product are listed on the DSL/NDSL list.
This product has a WHMIS classification of D1B, D2A.
CAS# 88-06-2 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 3/01/1994 Revision #2 Date: 9/02/1997

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Back to product information.

ACROS ORGANICS

HELP CATALOGS SEARCH ORDER LIST CONTENTS

MATERIAL SAFETY DATA SHEET

2-Nitroaniline, 98%
71554

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: 2-Nitroaniline, 98%

Company Identification: Acros Organics N.V.
One Reagent Lane
Fairlawn, NJ 07410
For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
88-74-4	2-Nitroaniline, 98%		201-855-4

Hazard Symbols: T N
Risk Phrases: 23/24/25 33 52/53

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW
Appearance: dark brown fine powder.

Target Organs: None.

Potential Health Effects
The toxicological properties of this material have not been investigated. Use appropriate procedures to prevent opportunities for direct contact with the skin or eyes and to prevent inhalation.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower lids.
Skin:
Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.
Ingestion:

Do NOT induce vomiting. Allow the victim to rinse his mouth and then to drink 2-4 cupfuls of water, and seek medical advice.

Inhalation:
Remove from exposure to fresh air immediately.

Notes to Physician:
Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.

Extinguishing Media:
In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.

Autoignition Temperature: 521 deg C (969.80 deg F)
Flash Point: 280 deg C (536.00 deg F)
NFPA Rating: Not published.
Explosion Limits, Lower: Not available.
Upper: Not available.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:
Sweep up, then place into a suitable container for disposal.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Not available.

Storage:
Poison room locked.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
2-Nitroaniline, 98%	2 ppm TWA; 7.6 mg/m3 TWA (listed under ANILINE).skin - potential for cutaneous absorption (listed under ANILINE).	NIOSH Potential Occupational Carcinogen - see Appendix A (listed under	5 ppm TWA; 19 mg/m3 TWA (listed under ANILINE).

OSHA Vacated PELs:
2-Nitroaniline, 98%:
2 ppm TWA; 8 mg/m3 TWA (listed under ANILINE)

Personal Protective Equipment

Eyes:
Wear safety glasses and chemical goggles if splashing is possible.

Skin:
Wear appropriate protective gloves and clothing to prevent skin exposure.

Clothing:
Wear appropriate protective clothing to minimize contact with skin.

Respirators:
Wear a NIOSH/MSHA or European Standard EN 149 approved full-facepiece airline respirator in the positive pressure mode with emergency escape provisions.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Not available.
Appearance:	Not available.
Odor:	None reported.
pH:	Not available.
Vapor Pressure:	Not available.
Vapor Density:	Not available.
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	284 deg C @ 760.00mm Hg
Freezing/Melting Point:	71.0 - 73.0 deg C
Decomposition Temperature:	280 deg C
Solubility:	1.1 g/l (20 c)
Specific Gravity/Density:	Not available.
Molecular Formula:	C6H6N2O2
Molecular Weight:	138.13

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.

Conditions to Avoid:
Not available.

Incompatibilities with Other Materials:
Acids - acid chlorides - acid anhydrides - chloroformates - strong oxidizing agents.

Hazardous Decomposition Products:
Nitrogen oxides, carbon monoxide, carbon dioxide, nitrogen.

Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 88-74-4: BY6650000

LD50/LC50:
CAS# 88-74-4: Oral, mouse: LD50 = 1070 mg/kg; Oral, rat: LD50 = 1600 mg/kg.

Carcinogenicity:
2-Nitroaniline, 98% -
ACGIH: A3 - Animal Carcinogen (listed as ANILINE).
California: carcinogen - initial date 1/1/90 (listed as ANILINE).
NIOSH: occupational carcinogen (listed as ANILINE)
OSHA: Possible select carcinogen (listed as ANILINE).
IARC: Group 3 carcinogen (listed as ANILINE).

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
Not available.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Dispose of in a manner consistent with federal, state, and local regulations.
RCRA D-Series Maximum Concentration of Contaminants:
None listed.
RCRA D-Series Chronic Toxicity Reference Levels: None listed.
RCRA F-Series: None listed.
RCRA P-Series: None listed.
RCRA U-Series: None listed.
Not listed as a material banned from land disposal according to RCRA.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
Shipping Name: NITROANILINES
Hazard Class: 6.1
UN Number: 1661
Packing Group: II

IMO
Shipping Name: NITROANILINES (O-, M-, P-)
Hazard Class: 6.1
UN Number: 1661
Packing Group: II

IATA
Shipping Name: NITROANILINES
Hazard Class: 6.1
UN Number: 1661
Packing Group: II

RID/ADR
Shipping Name: NITROANILINES (O-, M-, P-)
Dangerous Goods Code: 6.1(12B)
UN Number: 1661

Canadian TDG
Shipping Name: O NITROANILINE
Hazard Class: 6.1
UN Number: UN1661

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA
CAS# 88-74-4 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.

SARA
Section 302 (RQ)
None of the chemicals in this material have an RQ.
Section 302 (TPQ)
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 88-74-4: acute, chronic, reactive.
Section 313

This chemical is not at a high enough concentration to be reportable under Section 313.

Clean Air Act:

CAS# 88-74-4 listed as ANILINE is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

CAS# 88-74-4 is listed as a Hazardous Substance under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

2-Nitroaniline, 98% can be found on the following state right to know lists: California, (listed as ANILINE), New Jersey, (listed as ANILINE), Florida, (listed as ANILINE), Pennsylvania, (listed as ANILINE), Minnesota, (listed as ANILINE), Massachusetts, (listed as ANILINE).

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains 2-Nitroaniline, 98%, listed as `ANILINE', a chemical known to the state of California to cause cancer.

California No Significant Risk Level:

CAS# 88-74-4: no significant risk level = 100 ug/day (listed under ANILINE)

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T N

Risk Phrases:

R 23/24/25 Toxic by inhalation, in contact with skin and if swallowed.

R 33 Danger of cumulative effects.

R 52/53 Harmful to aquatic organisms; may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 36/37 Wear suitable protective clothing and gloves.

S 45 In case of accident of if you feel unwell, seek medical advice immediately (show the label where possible).

S 28B After contact with skin, wash immediately with plenty of water and soap.

S 61 Avoid release to the environment. Refer to special instructions/Safety data sheets.

WGK (Water Danger/Protection)

CAS# 88-74-4: 2

Canada

CAS# 88-74-4 is listed on Canada's DSL/NDSL List.

This product does not have a WHMIS classification.

CAS# 88-74-4 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

CAS# 88-74-4:. OEL-RUSSIA:STEL 0.5 mg/m3;Skin

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 3/09/1992 Revision #1 Date: 3/04/1996

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Back to product information.

MATERIAL SAFETY DATA SHEET (MSDS)

MATERIAL SAFETY DATA SHEET

EM SCIENCE

|1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Manufacturer.....:
EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 10/30/96

Information Phone Number.: 856-423-6300
Hours: Mon. to Fri. 8:30-5
Chemtrec Emergency Number: 800-424-9300
Hours: 24 hrs a day

Catalog Number(s):

FX0495

Product Name:
Furan
Synonyms:
Oxacyclopentadiene
Chemical Family:
Cyclic Ether
Formula:
C_4H_4O
Molecular Weight.:
68.08

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
Furan	110-00-9	100%

|3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW
EXTREMELY FLAMMABLE LIQUID AND VAPOR.
HARMFUL IF INHALED, SWALLOWED OR ABSORBED THROUGH SKIN.
POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA.
TENDS TO FORM EXPLOSIVE PEROXIDES ESPECIALLY WHEN ANHYDROUS.
May Cause Damage To Liver.
WARNING: This product contains a chemical(s) known to the State of

California to cause cancer.

Appearance:
Clear, colorless to light brown liquid; ethereal odor

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:
Harmful if swallowed, inhaled or absorbed through the skin. Can cause gastrointestinal congestion, narcosis, headache, lowering of blood pressure, nausea, liver damage.

Medical Cond. Aggravated by Exposure:
Liver conditions

Routes of Entry:
Inhalation, ingestion or skin contact.

Carcinogenicity:
Proven animal carcinogenic substance. Possible Cancer Hazard.
WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

4. FIRST AID MEASURES

Emergency First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.
Skin: Wash thoroughly with soap and water.
Eyes: Immediately flush thoroughly with water for at least 15 minutes.
Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.
Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.
Remove contaminated clothing and wash before reuse.

5. FIRE FIGHTING MEASURES

Flash Point (F): -32F (tcc)
Flammable Limits LEL (%): 2.30
Flammable Limits UEL (%): 14.30
Extinguishing Media:
Dry chemical, CO_2, water spray

Fire Fighting Procedures:
Wear self-contained breathing apparatus.

Fire & Explosion Hazards:
May form explosive peroxides on exposure to air

6. ACCIDENTAL RELEASE MEASURES

Spill Response:
Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.
EM SCIENCE recommends Spill-X absorbent agents for various types of spills. Additional information on the Spill-X products can be provided through the EM SCIENCE Technical Service Department (609) 423-6300. The following EM SCIENCE Spill-X absorbent is recommended for this product:

SX0863 Solvent Spill Treatment Kit

7. HANDLING AND STORAGE

Handling & Storage:
Keep container tightly closed. Store in a cool area away from ignition sources, acids and oxidizers. Do not breathe vapor. Do not get in eyes, on skin, or on clothing. Electrically ground all equipment when handling this product. Retained residue may make empty containers hazardous; use caution! Since the formation of unstable peroxides is possible, this material should always be tested before use. Washing with an aqueous solution of ferrous sulfate slightly acidified with sodium bisulfate will remove these peroxides.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:
Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:
Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves must be worn to prevent skin contact (Neoprene or equivalent) Safety glasses with side shields must be worn at all times. Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Impervious protective clothing should be worn to prevent skin contact.

Work/Hygenic Practices:
Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

	TWA		STEL		CL		
Component	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	Skin
Furan							

ACGIH - TLV:

Component	TWA PPM	TWA MG/M3	STEL PPM	STEL MG/M3	CL PPM	CL MG/M3	Skin
Furan							

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limts have been established.

9. PHYSICAL AND CHEMCIAL PROPERTIES

Boiling Point (C 760 mmHg) : 31C
Melting Point (C) : -86C
Specific Gravity (H_20 = 1) : 0.937
Vapor Pressure (mm Hg) : 493 20C
Percent Volatile by vol (%): 100%
Vapor Density (Air = 1) : 2.3
Evaporation Rate (BuAc = 1): Rapid
Solubility in Water (%) : Insoluble
Appearance :
Clear, colorless to light brown liquid; ethereal odor

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
CO_x

Conditions to Avoid:
Heat; contact with ignition sources. Do not distill to dryness. Contact with acids can initiate a violent exothermic reaction.

Materials To Avoid:

( ) Water
(X) Acids
( ) Bases
( ) Corrosives
(X) Oxidizers
( ) Other:

11. TOXICOLOGICAL INFORMATION

Toxicity Data

orl-dog LDLo: 234 mg/kg ihl-mus LC50: 120 mg/cu.m./1H

Toxicological Findings:
Tests on laboratory animals indicate material may produce adverse mutagenic effects.
Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: U124 D001

Treatment:
Incineration, fuels blending or recycle. Contact your local permitted waste disposal site (TSD) for permissible treatment sites. ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:
Furan

DOT ID Number :
UN2389

14. REGULATORY INFORMATION

TSCA Statement:
The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
Furan	Y	500	100

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
Furan			

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:

NFPA Hazard Ratings:

```
Health          : 1
Flammability    : 4
Reactivity      : 1
Special Hazards :
```

Revision History: 12/1/83 10/27/87 10/7/88 3/1/91 2/14/94

| = Revised Section

N/A = Not Available

N/E = None Establised

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APPENDIXE

Table 8-10 USEPA Occupational Safety & Health Guidance Manual for Hazardous Waste Site Activities

Table 8-10. Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers[a]

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

Source: Reference [13].

[a]For work levels of 250 kilocalories/hour.

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

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

Table 8-11. Signs and Symptoms of Heat Stress[a]

- Heat rash may result from continuous exposure to heat or humid air.
- Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:
  - muscle spasms
  - pain in the hands, feet, and abdomen
- Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include:
  - pale, cool, moist skin
  - heavy sweating
  - dizziness
  - nausea
  - fainting
- Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are:
  - red, hot, usually dry skin
  - lack of or reduced perspiration
  - nausea
  - dizziness and confusion
  - strong, rapid pulse
  - coma

[a]Source: Reference [6].

responses, and some of the precautionary and training measures that need to be taken to avoid PPE-induced injury.

The physiological factors may affect worker ability to function using PPE include:

- Physical condition.
- Level of acclimatization.
- Age.
- Gender.
- Weight.

Physical Condition

Physical fitness is a major factor influencing a person's ability to perform work under heat stress. The more fit someone is, the more work they can safely perform. At a given level of work, a fit person, relative to an unfit person, will have [5,8,15,16]:

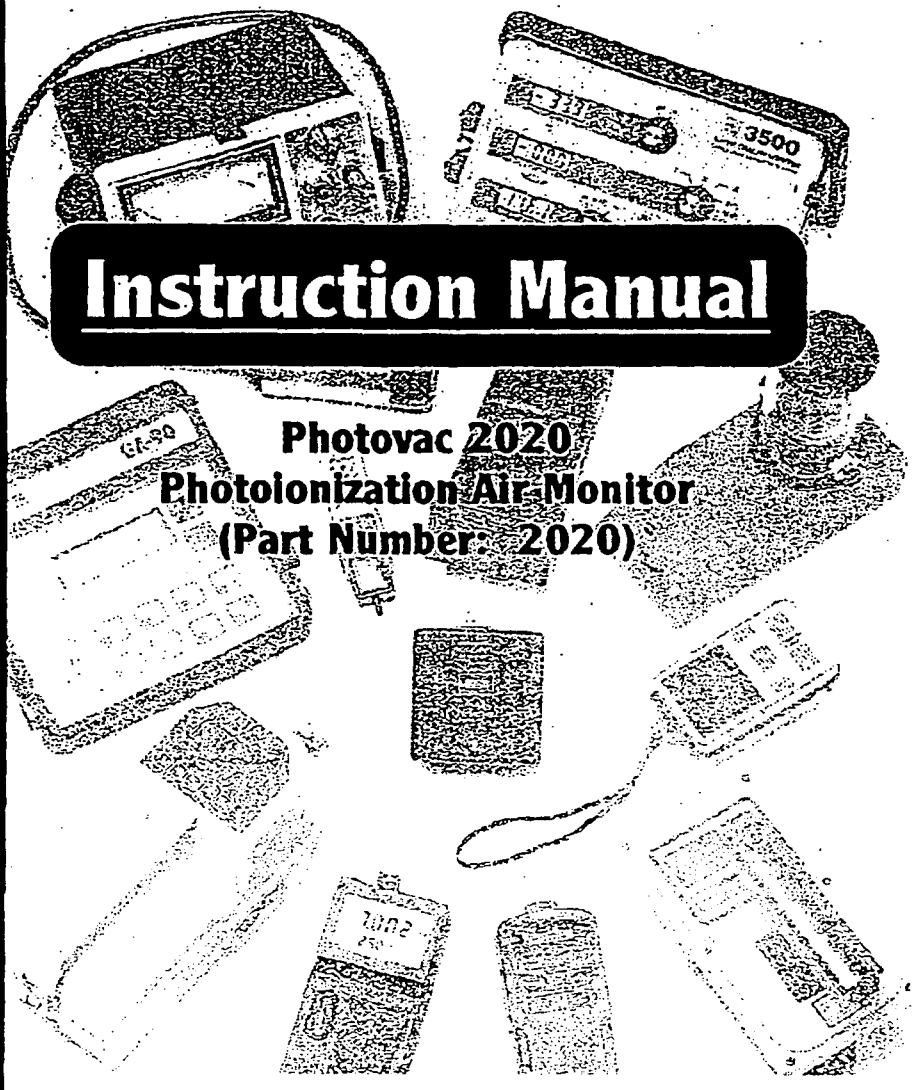
- Less physiological strain.
- A lower heart rate.
- A lower body temperature, which indicates less retained body heat (a rise in internal temperature precipitates heat injury).
- A more efficient sweating mechanism.
- Slightly lower oxygen consumption.
- Slightly lower carbon dioxide production.

Level of Acclimatization

The degree to which a worker's body has physiologically adjusted or acclimatized to working under hot conditions affects his or her ability to do work. Acclimatized individuals generally have lower heart rates and body temperatures than unacclimatized individuals [17], and sweat sooner and more profusely. This enables them to maintain lower skin and body temperatures at a given level of environmental heat and work loads than unacclimatized workers [18]. Sweat composition also becomes more dilute with acclimatization, which reduces salt loss [8].

APPENDIX F

Manufacturers O&M Manual



Instruction Manual

Photovac 2020
Photoionization Air Monitor
(Part Number: 2020)

Photovac
Photoionization
Air Monitor 2020

(P/N: 2020)

INSTRUCTION MANUAL

HAZCO

1-800-332-0435

User's Manual

2020

PHOTOIONIZATION AIR MONITOR

PHOTOVAC

ıgistered to the ISO 9002 International Quality Standard

Warning: Limitation of Liability

The ultimate responsibility of the consequences of use of toxic compounds rests with the user. Photovac's role is as a supplier of instrumentation to assist in the early detection of hazardous conditions involving such compounds.

2020 represents a major advance in this field and, as with all complex instruments, it is vitally important to ensure that 2020 is maintained in accordance with Photovac's instructions and that proper calibration is regularly performed.

As with any complex device, 2020 is subject to failure and, while Photovac has taken, and continues to take, all possible precautions to (a) reduce the possibility of failure, and (b) warn the user in the event of failure, circumstances may occasionally occur in which there is a failure despite such precautions on Photovac's part. Photovac regrets that it cannot accept liability for damages of any kind caused as a result of either failure of the user to follow instructions or of 2020 to perform.

2020

Photoionization Air Monitor

User's Manual

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FCC Warning

THIS EQUIPMENT HAS BEEN TESTED AND FOUND TO COMPLY WITH THE LIMITS FOR A CLASS B DIGITAL DEVICE, PURSUANT TO SUBPART B, CLASS B OF PART 15 OF THE FCC RULES. THESE LIMITS ARE DESIGNED TO PROVIDE REASONABLE PROTECTION AGAINST HARMFUL INTERFERENCE WHEN THE EQUIPMENT IS OPERATED IN A COMMERCIAL ENVIRONMENT. THIS EQUIPMENT GENERATES, USES AND CAN RADIATE RADIO FREQUENCY ENERGY AND, IF NOT INSTALLED AND USED IN ACCORDANCE WITH THE INSTRUCTION MANUAL, MAY CAUSE HARMFUL INTERFERENCE TO RADIO COMMUNICATIONS. OPERATION OF THIS EQUIPMENT IN A RESIDENTIAL AREA IS LIKELY TO CAUSE HARMFUL INTERFERENCE IN WHICH CASE THE USER WILL BE REQUIRED TO CORRECT THE INTERFERENCE AT HIS OWN EXPENSE.

1. Introduction

1.1. About this Manual

This manual provides detailed instructions for setup, operation and maintenance of the Photovac 2020™ Photoionization Air Monitor.

Before unpacking the instrument, please read Section 1.2 Warnings and Safety Practices. This section describes possible hazards that might injure the user, damage the instrument or compromise its operation. Some general safety information is also provided.

To help you learn to use 2020 quickly, this manual is organized by tasks beginning with a tutorial and description of operation in Chapter 2. More detailed operational instructions are provided in Chapter 3. Accessories is covered in Chapter 4. Routine maintenance is covered in Chapter 5. Troubleshooting techniques are covered in Chapter 6. Chapter 7 provides a technical description of 2020.

The 2020 manual uses a few conventions for key names on the keypad and for text that is shown on the display.

UPPERCASE	Fixed key names are denoted by uppercase text.
"Display Text"	Text that appears on the 2020 status display is in quotation marks. Soft key names are also shown in quotation marks.

<Angle Brackets>	Computer keyboard names are denoted by angle brackets, e.g. <Ctrl>.
C:\2020	Text that must be typed in using the computer keyboard is shown in italics.

In the text you will find various warnings and notes.

> **Warning:** A warning indicates an operation that could cause personal injury if precautions are not followed.

> **Note:** A note indicates an operation that could cause instrument damage if precautions are not followed. A note also indicates significant information.

1.2. Warnings and Safety Practices

Please read this section before operating 2020.

1.2.1. Compressed Gases

Cylinders of compressed gas, such as calibration gas, must be handled with extreme care. For safety, the calibration gas cylinders must be secured before use.

Please observe the following handling procedures:

1. Do not mutilate cylinders.
2. Do not expose the cylinders to direct sunlight.
3. Do not heat the cylinders. The cylinders may rupture at high temperatures.
4. Use only the specified regulator for the calibration gas. Confirm regulator type and material with your specialty gas supplier.
5. Always secure cylinders before removing the cylinder valve protection cap.
6. Do not drag or roll cylinders. Use a cylinder hand truck to move large cylinders.
7. Wear safety glasses when working with compressed gases.
8. Store cylinders in an upright position.

9. Do not store cylinders in a hazardous location.
10. Store cylinders away from possible sources of sparks.
11. Keep regulators and related equipment in the same gas service. Do not change service or adapt equipment without consulting your gas supplier.

1.2.2. Regulators for Compressed Gases

When connecting a regulator to a large cylinder:

1. Ensure cylinder valve and regulator connection match.
2. Ensure regulator construction materials are compatible with the gas, and that the cylinder pressure gauge will withstand the cylinder pressure.
3. Turn the pressure control valve all the way out (close the cylinder).
4. Turn the regulator outlet to off.
5. Open the gas cylinder valve slowly and check for leaks.
6. Adjust the delivery pressure.
7. Open the regulator outlet valve.

1.2.3. Calibration Gas

Adequate ventilation must be provided when 2020 is being calibrated.

If compound threshold limit values (TLV™) are exceeded, you should use a gas bag for sampling and calibration.

To determine the TLV of the compounds contained in the calibration gas, refer to the Material Safety Data Sheet (MSDS) supplied with your calibration gas cylinder. See Section 3.3 for details of calibration using a gas bag.

1.2.4. Battery Pack Care

Leaving 2020 for more than 3 months, without turning it on, may result in the loss of recorded data and setup parameters. If 2020 is not used for long periods of time, turn the instrument on for a few

hours every month to avoid loss of data. See Section 1.5 for instructions on charging the battery.

Please observe the following:

1. For replacement battery pack use only Photovac Part No. 350009.
2. Do not dispose of the battery pack in a fire. The cell may explode. Check with local codes for possible special disposal instructions. This battery pack must be disposed of properly or returned for recycling to the nearest Photovac facility.
3. Do not open or mutilate the battery pack.
4. Exercise care in handling battery packs in order not to short the terminals with conducting materials such as rings, bracelets and keys. The battery or conductor may overheat and cause burns.
5. Charge the battery pack using the AC adapter provided with or identified for use with this product only in accordance with the instructions and limitations specified in this manual. For AC adapter use only Photovac Part No. 350002 (North America) or 365001 (Europe).

1.2.5. Excessive Heat and Cold

Do not expose the instrument to intense sunlight for prolonged periods.

Exposure to excessive heat or cold may result in erroneous readings.

1.3. Unpacking

The following accessories are included with your 2020:

1. Sample Probe
2. User's Manual
3. Multi-Tool
4. AC Adapter or AC Adapter with AC Line Cord
5. Wrist Strap
6. Replacement Sample Inlet Filters (10 pieces)
7. Reference Card

Ensure all of these accessories have been included with the instrument. If any items are missing or damaged, contact Photovac immediately.

1.4. Support Equipment and Consumables

1.4.1. Calibration

For normal operation these items are required:

1. Calibration Gas Regulator (Photovac Part No. 350006).
2. Calibration gas containing 100 ppm isobutylene. (Photovac Part No. 350012). Other concentrations of the calibration gas may be required. This will depend on your application.
3. Zero air. Occasionally, clean, ambient air is suitable for calibration.

   Alternatively you can use a gas sampling bag and a source of hydrocarbon free air. Air should not have more than 0.1 ppm total hydrocarbons (THC).

   If you will be using large tanks of gas, specify a single stage, high purity regulator with a CGA 590 connection at the inlet. The regulator should also have a 1/8" parallel, compression fitting with which to connect the regulator to the gas bag adapter. The delivery pressure must be adjustable to between 5 and 20 psig (34.5 and 138 kPa). You may obtain a gas bag and gas bag adapter. (Photovac Part No. 395072 - gas bag, 395073 - gas bag and adapter)
4. If compound threshold limit values (TLVs) are exceeded, you should use a gas bag for sampling and calibration.

   To determine the TLV of the compounds contained in the calibration gas, refer to the Material Safety Data Sheet (MSDS) supplied with your calibration gas cylinder.

   If you will be using a gas bag for calibration, you should obtain the calibration kit (Photovac Part No. 390033). The calibration kit contains a regulator, a gas sampling bag and a gas bag adapter. See Section 3.3 for details of calibration using a gas bag.

1.4.2. Field Operation

For field operation, a 2020 Field Kit (Photovac Part No. 350005) is available. The field kit includes a cable kit, a carrying case and a calibration regulator, spare battery pack and a cylinder of calibration gas.

Refer to the check list in Section 3.7 for additional items. Ensure you have all the necessary accessories and equipment before beginning field operation.

1.4.3. Printer

2020 may be used with a printer to generate printed reports. The printer must have a printing width of at least 65 characters and must use fixed spaced fonts. See Section 4.1 for details of connecting a printer to 2020.

If you are using a parallel printer, you will need the Photovac serial to parallel converter (Photovac Part No. 380145). See Section 4.6 for details of connecting and operating 2020 with a serial to parallel converter.

1.4.4. Computer

2020 may also be connected to a computer. The computer must be 100% compatible with an IBM PC. You can use the cable kit (Photovac Part No. 350011) to connect 2020 to the computer.

You will also need terminal emulation software. Software packages such as Crosstalk®, and Procomm® are recommended for use with 2020. If you are using Microsoft® Windows™ you do not need to purchase any separate software. If you are already using another type of communication or terminal emulation software package, it is not necessary to purchase separate software for 2020. See Section 4.2 for details.

1.5. Battery Charging

Before beginning operation of 2020, the battery pack must be charged. You can also remove the battery pack and replace it with a fully charged, spare battery pack (Photovac Part No. 350009).

1.5.1. Removing and Replacing the Battery Pack

1. If the instrument has been turned on, turn it off by pressing the ON/OFF key momentarily and then releasing it.

> **Note:** If you do not turn 2020 off before removing the battery pack, you will reset the instrument and you will lose all logged data and setup parameters.

2. Locate the battery hatch on the back of the instrument. See Figure 1.
3. Loosen the two screws in the battery hatch.
4. The battery hatch can now be removed.
5. Lift the battery pack out of the case and carefully disconnect the connector from 2020.
6. Attach the connector from the charged battery pack to the 2020.

> **Note:** The connector is polarized. It will only fit one way. Do not force the connection.

7. Place the battery pack in the 2020 case. Ensure the battery wires are not pinched or strained.
8. Replace the battery hatch and then replace the two screws. Do not over-tighten the screws as you will damage the case.

1.5.2. Charging the Battery Pack

> **Note:** Only use the AC adapter specified for use with 2020. Using another AC adapter will result in damage to the battery pack, 2020 or the adapter itself.

1. Plug the AC adapter into the jack located on the back of the 2020. See Figure 1.
2. Plug the AC adapter into an AC outlet. If you are using the European AC adapter, ensure the correct plug is installed on the line cord. If it is not correct for the wall outlet in your area then it must be replaced. See Appendix 8.3.

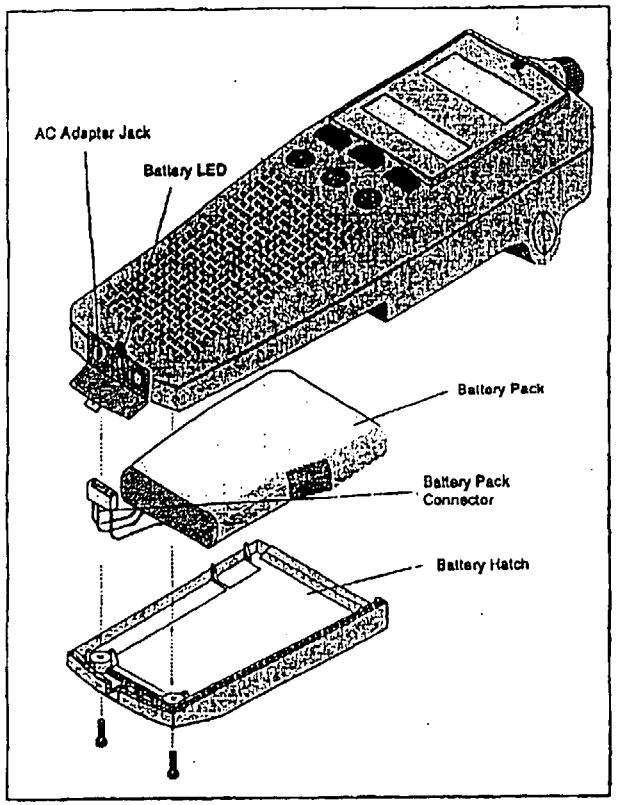

Figure 1 Battery Pack Removal and Replacement

3. The LED on the 2020 indicates the charge state. Red indicates the battery is being charged. Green indicates the battery is fully charged and ready for use.

   It is normal for a fully charged battery to indicate it is charging (red light) when first plugged in. The LED will turn green as the battery charges.

4. When the battery pack is fully charged remove the AC adapter, first from the wall outlet and then from 2020.

Charging a fully discharged battery pack will take approximately 4 hours.

You must charge the battery pack in the instrument. While the battery pack is charging you can use all the features of 2020.

Leaving the AC adapter connected to 2020 will not harm the battery or the AC adapter in any way. If 2020 is to be left indefinitely, leave it connected to the AC adapter so that the battery will be fully charged and ready for operation.

On average a fully charged battery pack will provide 8 hours of continuous operation. Battery life is shorter if the instrument is turned off and then on again repeatedly or if the backlighting is turned on.

1.6. Overview

2020 measures the concentration of airborne photoionizable gases and vapors and automatically displays and records these concentrations. It does not distinguish between individual pollutants. The reading displayed represents the total concentration of all photoionizable chemicals present in the sample. 2020 is factory set to display concentration in units of ppm or mg/m³.

2020 operates automatically. The meter display updates itself every second. You can read concentrations directly from the meter display. If you are using the dilution probe (Photovac Part No. 350013) you must multiply the displayed reading by the dilution factor. See Section 4.5 for details.

2020 is always performing short term exposure limit (STEL), time weighted average (TWA) and PEAK calculations. You can view any of these results, but only one mode may be viewed at a time.

2020 has many datalogging options. You can select an averaging interval, or you can use manual operation. If you select an averaging interval, the minimum, maximum, and average concentrations measured in each period are automatically recorded in 2020's datalogging memory. 2020 can log up to 1000 entries

In manual operation, 2020 prompts you to locate a site and then to record a background and sample readings for the site. You can record up to 1000 manual entries. There is no averaging of data in manual operation.

Recorded data can be reviewed on the display, sent to a printer in either tabular or graphical format, or sent to a computer. Data are recorded by date and time.

2020 has 6 keys for alphanumeric entry and for accessing 2020's functions. The keys are used to set up and calibrate 2020. They allow you to manipulate the concentration data in various ways.

All information entered with the keys and stored in 2020's memory is retained when the instrument is switched off. The clock and calendar continue to operate and do not need to be set each time 2020 is turned on.

2. Tutorial Session

2.1. Displays

The 2020 has a meter display for reporting detected concentration, and a status display used to display status information and guide you through configuration options. All functions of the 2020 will be controlled or reported using one of these displays.

2.1.1. Meter Display

The meter display is a 4 digit display. It will always be used for reporting detected concentration. When the detector and pump are off, the meter display will be blank.

In order to accommodate the range of concentrations 2020 can detect, the meter reading will be reported using one of 2 resolutions. A resolution of 0.1 will be used for concentrations below 100 ppm, and a resolution of 1 will be used for concentrations above 100 ppm.

The meter display reports PEAK, MAX, STEL or TWA concentration. The update rate is dependent on the reading being reported. See Section 2.5 for a description of these measurements.

2.1.2. Status Display

The status display is a 2 line by 16 character display. The top line is used to display status information and prompts you for information. The bottom line is used for soft key names. Up to 3 names can be

displayed for the 3 soft keys. If a name does not appear for a soft key, then the soft key has no associated function.

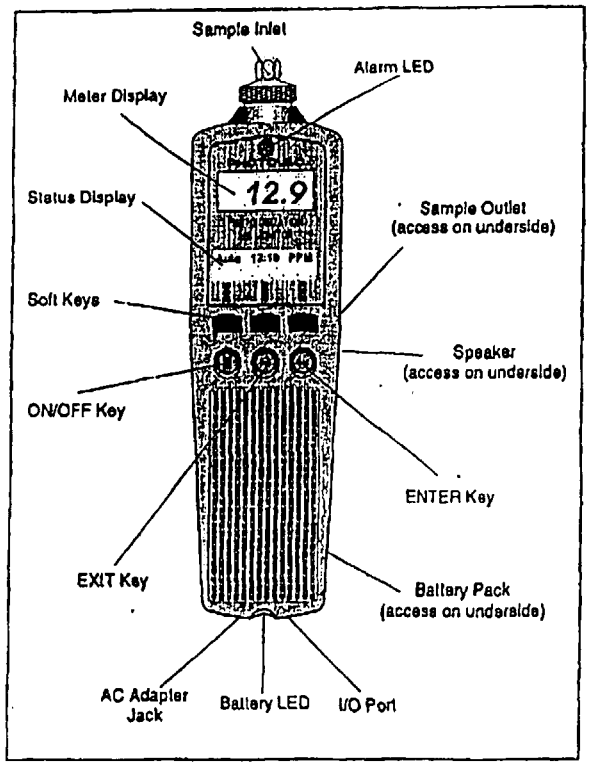

Figure 2 Layout of 2020

2.2. Keys

2.2.1. Fixed Keys

The three round keys below the soft keys each have a fixed function. The first key is the ON/OFF key, the middle key is the EXIT key and the last key is the ENTER key.

The ON/OFF key is used to both turn power on to the 2020 as well as turn the power off. To turn on 2020, press the ON/OFF key. To turn the power of, press the ON/OFF key and hold it down for 2 seconds, and then release it. This is done to prevent accidental power off.

The EXIT key provides a way of returning to the default display. In the functional map, the soft keys allow you to advance and the EXIT key provides a way to go back. See Figure 3. If you are at the root entry of the menu, EXIT will return you to the default display.

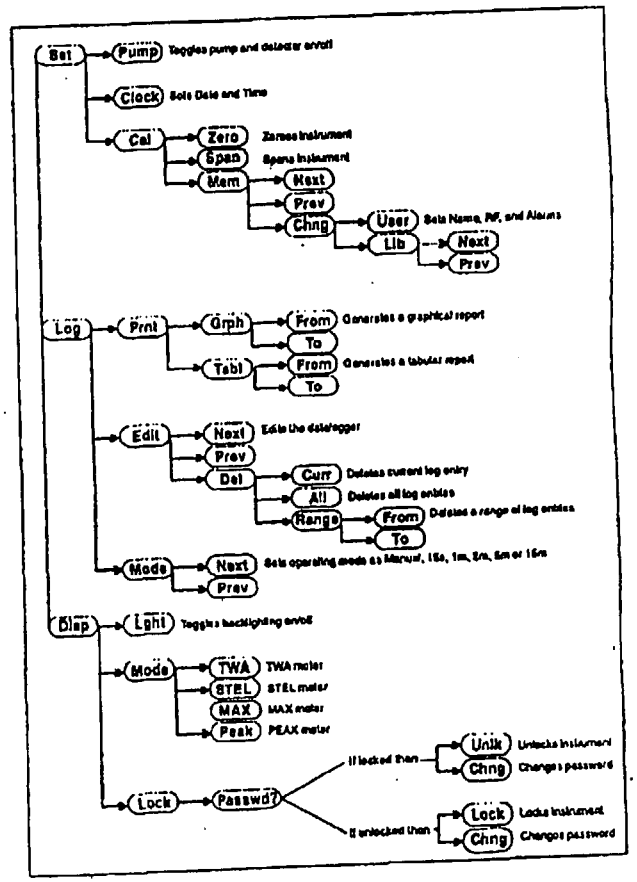

Figure 3 Function Map

The ENTER key has a context sensitive function. When you are operating or navigating through the function map, the ENTER key is used to exit the functions and return you to the default display. When entering data such as a name, number, date or time, ENTER is used to confirm the entry.

2.2.2. Soft Keys

The three soft keys on 2020 are located directly below the status display. Each key has varying functions for configuring 2020, editing the datalogger, and controlling the display. Since only three soft keys are available, each function is broken down into a path. A map, showing each path and the resulting functions, is shown in Figure 3.

2.2.3. Entering Text With the Soft Keys

For all information that you must enter, the left, center and right soft keys correspond to the up, down, and right arrow. See Figure 4.

The up and down arrows are used to change the character highlighted by the cursor. The right arrow is used to advance the cursor to the next character on the right. When the cursor is advanced past the right most character, it wraps around to the first character again. To accept the changes, press the ENTER key. To ignore the changes, press EXIT.

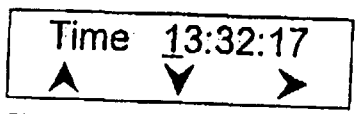

Figure 4 Soft Arrow Keys

Formatting characters, such as the colon (:) in the time, the decimal (.) in a concentration, and the slash (/) in date are skipped when advancing the cursor.

All inputs use an 8 character input, which is displayed on the right side of the top line of the status display. The prompt, describing the input, occupies the left half of the top line. The soft keys are defined on the bottom line of the status display.

2.3. Beginning Operation

2.3.1. Turning 2020 On

1. Turn 2020 on by pressing the ON/OFF key. See Figure 2 for the location of the ON/OFF key.
2. 2020 will display the software version number. Wait for the 2020 to proceed to the default display.
3. Allow 10 minutes for the instrument to warm-up and stabilize.

2.3.2. Default Display

The meter display shows the detected concentration. The resolution of the display changes with the magnitude of the reading. A reading of 0 to 99.9 will be displayed with a resolution of 0.1 ppm or mg/m³. A reading greater than 99.9 will be shown with a resolution of 1 ppm or mg/m³. The meter will display concentrations up to 2000 ppm or 2000 mg/m³.

The status display is used to display the instrument status, date, time, units and active soft keys. Figure 5 shows the status displays.

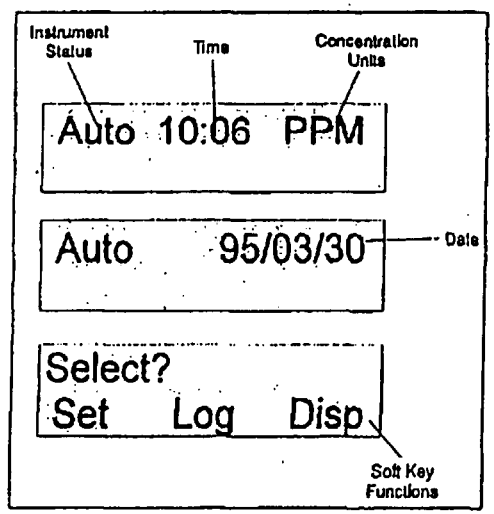

Figure 5 Status Displays

1. Press the "Set", "Clock" and "Time" key and ensure the correct time is entered. Press the ENTER key and ensure the correct date has been entered.
2. Ensure the battery pack is fully charged. If you are unsure about the status of the battery, replace the battery pack with one that is fully charged. See Section 1.5.
3. Program and calibrate all the Cal Memories you need. See Section 3.4. After calibration is complete, sample the calibration gas and the bag of zero air to ensure 2020 has been calibrated correctly.
4. Select the correct operating mode. See Section 2.8.2.
5. Reset the TWA accumulator, the STEL moving average and the MAX. See Section 2.5.
6. You may want to delete all entries from the datalogger to avoid confusion between different days' data and to avoid running out of space in the datalogger. See Section 2.7.2.

4. Connecting Accessories

4.1. Printer

The printer must have a printing width of at least 65 characters and must use fixed spaced fonts. The serial communication parameters on 2020 have been fixed at 9600 baud, no parity, 8 data bits and 1 stop bit. Your printer must be able to match these settings.

If you are using a parallel printer, you will need the Photovac serial to parallel converter (Photovac Part No. 380145). See Section 4.3 for details of connecting and operating 2020 with a serial to parallel converter.

1. Turn 2020 off.

Note:	You must turn the instrument off before connecting or disconnecting the printer cable.

2. Connect the printer cable (Photovac Part No. 350011) to the I/O port on the back of the 2020 and then to the serial port on the printer.
3. Turn 2020 on.
4. The serial communication parameters on 2020 have been fixed. It communicates at 9600 baud, no parity, 8 data bits and 1 stop bit. You must set your printer accordingly.
5. Use the "Grph" and "Tabl" keys as detailed in Sections 2.7.3.

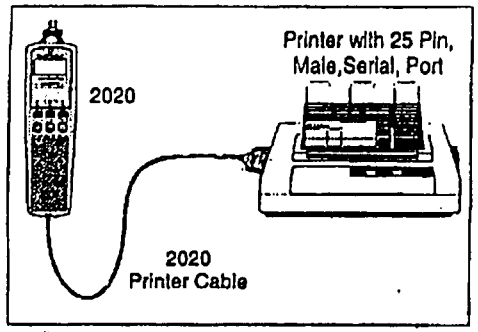

Figure 12 Connecting 2020 to a Serial Printer

If this arrangement does not produce the desired results, see Section 6.4.

4.2. Computer

2020 can send information stored in its datalogger to a computer. This option may be used if you need to prepare reports based on 2020's recorded data. This feature may also be used if you need the recorded data in a format that can be imported into a spreadsheet or database for further calculations.

You may need to keep more data than can be logged by 2020. If this is the case you have two options: you may print the data before they are deleted from the datalogger and keep the printed reports, or you may store the data on disk for later use. You may not, however, load data that have been stored on disk back into 2020.

In order to establish communication with 2020 and receive data stored in the datalogger, the computer must be set up to emulate a terminal. In order to do this you will need a communications software package that will allow you to transfer data from 2020 to a computer. Software packages such as Crosstalk, and Procomm are recommended for use with 2020. Crosstalk XVI will be used as an example in the instructions below.

If you are using Microsoft Windows you do not need to purchase any separate software. Instructions for downloading information to Windows' Terminal program are also provided.

If you are already using another type of communication or terminal emulation software package, it is not necessary to purchase a copy of

Crosstalk or Procomm. Use your communications package to set up the computer to receive data at 9600 baud, no parity, 8 data bits and 1 stop bit. Refer to the user's manual, provided with your software, for specific details.

Once data have been transferred to Crosstalk, they must be saved to a floppy or hard disk. In order to manipulate the data, you must import the data either as a text file into a spreadsheet, where the data may be parsed and converted to numeric data, or into a text editor or word processor where the data may be viewed and edited.

The instructions below will provide you with the most basic information for using 2020 with communications software. Please refer to the software user's manual for specific details of operation.

4.2.1. Using Crosstalk

The following instructions are for Crosstalk XVI Version 3.71. The commands may vary with the version of Crosstalk you are using. To initiate communications between 2020 and the computer:

1. Start Crosstalk. The Status Screen will appear.
2. At the bottom of the Status Screen there will be a highlighted bar with the word Command?. If the word Command? does not appear press the <Esc> key on the computer keyboard.
3. Type *SP* and press <Enter>. This will allow you to set the baud rate at which the computer will receive data from 2020. Type 9600 and press <Enter>.
4. On 2020 the number of data bits has been fixed at 8, stop bits has been fixed at 1. You must set up Crosstalk accordingly. Type *DA* and press <Enter>. Type in *8* and press <Enter>.
5. Type in *ST* and press <Enter>. Type in *1* and press <Enter>.
6. Type in *PA* and press <Enter>. Type in *None* and press <Enter>. This sets the parity to None
7. Turn 2020 off.

Note: You must turn the instrument off before connecting or disconnecting the printer cable.

8. 2020 must be connected to a serial port. Use the printer cable (Photovac Part No. 350011) to connect 2020 to one of the

computer's serial ports. Take note of which serial port you are using. Normally you will use Com1 or Com2.

9. If the 2020 printer cable plugs directly into the port on the computer without the gender changer or the 9 to 25 pin adapter (null modem), you are most probably connected to a parallel port. You will need at least one of the adapter cables to connect 2020 to a serial port. See Section 6.6.

10. Type *PO* and press <Enter>. Type in *1* if you connected 2020 to Com1 or type in 2 if you connected 2020 to Com2 and press <Enter>. If you connected 2020 to another serial port enter the corresponding number.

11. Type *MO* and press <Enter>. Type in *A* to change the mode to answer.

12. In order to capture the data and store them on a disk you must turn the Crosstalk capture command on and specify a disk to which the data can be stored. Type *CA* and press <Enter>.

13. Now type in the disk drive and the name of the file where you want the data stored. For example if you want to store the data in a file called 2020 on a floppy disk in drive A, then type *A:\2020.dta* and press <Enter>.

14. If the word Command? does not appear at the bottom of the Crosstalk Capture Screen, press <Esc>.

15. You have now set up Crosstalk to communicate with 2020. Type *GO L* to begin the downloading session. The Status Screen will disappear and the Capture Screen will appear.

16. Press the ENTER key. Select "Log", "Prnt" and then select "Grph" or "Tabl".

17. Select a start time using the "Next" and "Prev" keys. Hold down the "Next" and "Prev" to scroll through the data quickly.

18. Press the ENTER key, and select the stop time. All entries between, and including, the start and stop entries will be sent to the computer.

19. When all the data have been sent, press <Esc>. Type *CA off* and press <Enter>. This will turn the capture option off and write the captured file to the disk drive you specified in step #13.

20. Press <Home> to return to the Status Screen.

21. Type *QU* and press <Enter>. This will end your communications session.

Convert the file to a text file or a print file using the MS-DOS® Copy Command:

22. To convert the file to a text file, at the DOS prompt type: *Copy 2020.dta 2020.txt*

23. To convert the file to a print file, at the DOS prompt type: *Copy 2020.dta 2020.prn*

Once the file has been converted to a text file you can use a text editor to view and edit the contents.

If you are not comfortable with the Crosstalk commands used above, you should familiarize yourself with these commands by reading the Crosstalk user's manual. It is important to understand each of the commands in order to ensure both Crosstalk and 2020 are set up correctly.

4.2.2. Using Microsoft Windows

If you are using Microsoft Windows you do not need to purchase any separate software. The rules for connecting 2020 to the serial port still apply. See steps #7 to 9 in the procedure above.

In order to use these instructions, you must be familiar with Microsoft Windows Version 3.1 and it must be installed and running on your computer.

To initiate communications between 2020 and Windows:

1. Start Windows and then start the Terminal Program. The Terminal Program may be in the Accessories Program Group. Its location will depend on how you have set up Windows.

2. Open the Settings Window and select Communications.

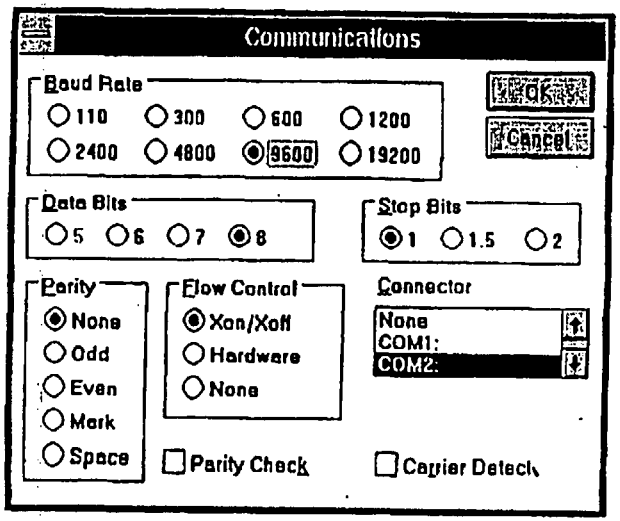

Figure 13 Terminal Program's Communication Dialog Box

3. Select the correct Baud Rate, Data Bits, Stop Bits, Parity and Connector. Select Xon/Xoff for the Flow Control option. Leave the Parity Check and Carrier Detect options off. Select OK to close the dialog box and accept the changes.

4. Open the Transfers Window and select Receive Text File. A Receive Text File dialog box will open. See Figure 14.

5. Type in the desired path and filename for the data that are to be downloaded. Ensure the path is correct.

   Ensure the file name has a .txt extension. The .txt extension will make it easier to use the downloaded data later.

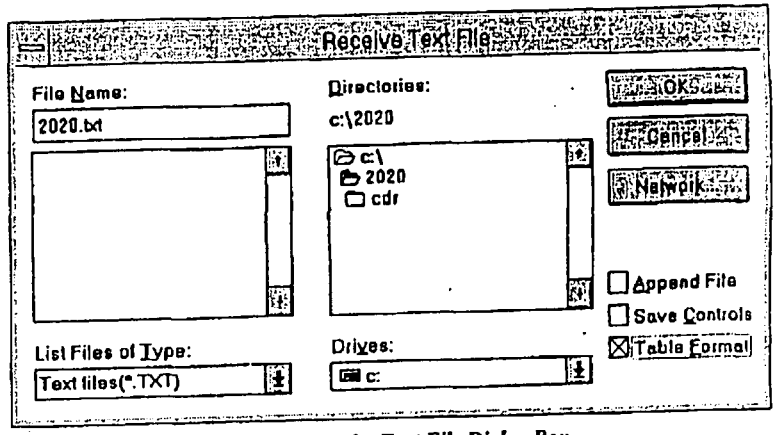

Figure 14 Terminal Program's Transfer Text File Dialog Box

6. Select the Table Format option and then select OK. At the bottom of the screen the message, "Receiving Data" is displayed.

7. Press the ENTER key. Select "Log", "Prnt" and then select "Grph" or "Tabl".

8. Select a start time using the "Next" and "Prev" keys. Hold down the "Next" and "Prev" keys to scroll through the data quickly.

9. Press the ENTER key, and select the stop time. All entries between, and including, the start and stop entries will be sent to the computer.

10. To terminate communications select Stop from the bottom of the screen.

The logged data can now be copied or cut to the Windows Clipboard and pasted into a text editor, such as Windows' Notepad, or a spreadsheet for editing.

Refer to the Microsoft Windows User's Guide for detailed instructions on installation and operation of Microsoft Windows.

4.3. Serial to Parallel Converter

This device allows 2020, which is only capable of serial communication, to communicate with a parallel device. This will be most useful for printing, as most printers utilize parallel communications.

The printer must have a printing width of at least 65 characters and must use fixed spaced fonts. The serial communication parameters on 2020 have been fixed at 9600 baud, no parity, 8 data bits and 1 stop bit. Your converter must be set to match these settings.

4.3.1. DIP Switch Settings

The DIP switch settings are very important and must be set correctly in order to correctly communicate with 2020. 2020 will always be the serial device so the data flow direction will be serial to parallel.

To configure the serial port of the converter:

1. Locate the DIP switches located on the side of the converter.

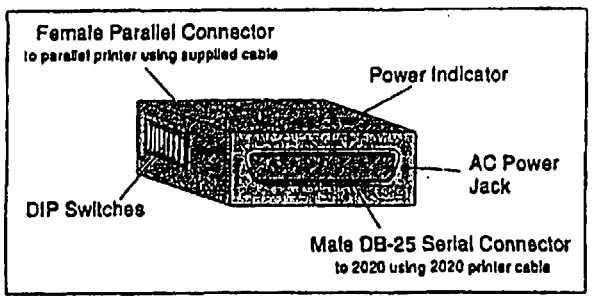

Figure 15 Layout of Serial to Parallel Converter

2. Determine the baud rate at which the converter will be receiving data from the instrument. The value you set here must match 2020.
3. Use the first three DIP switches to set the baud rate to 9600. See Table 5.

Baud Rate	SW1	SW2	SW3
9600	On	Off	On

Table 5 DIP Switch Settings for Baud Rate

4. Switch 4 sets the data bits. Off = 7 Bits. On = 8 Bits. Set the data bits to 8.
5. Use Switches 5 and 6 to set the parity to none.

Parity	SW5	SW6
None	Off	Off

Table 6 DIP Switch Settings for Parity

6. Switch 7 sets the Handshake mode. Off = Xon/Xoff. On = DTR. Set the Handshake mode to Xon/Xoff.
7. Use switch 8 to set the data flow direction to serial to parallel. Off = Serial to Parallel. On = Parallel to Serial.
8. Check your settings. It is imperative that you have the correct settings or you will be unable to establish communications. Your settings should match those in Table 7.

SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
On	Off	On	On	Off	Off	Off	Off

Table 7 DIP Switch Settings

4.3.2. Using 2020 with the Serial to Parallel Converter

1. Turn 2020 off.

> **Note:** You must turn the instrument off before connecting or disconnecting the printer cable.

2. Unplug the converter from the AC outlet.
3. Use the cable kit (Photovac Part No. 350011) to connect the 2020 I/O connector to the converter.
4. Use the parallel cable, supplied with the converter, to connect the converter and the printer. If this cable is not suitable, see Section 6.5 for the cable requirements.

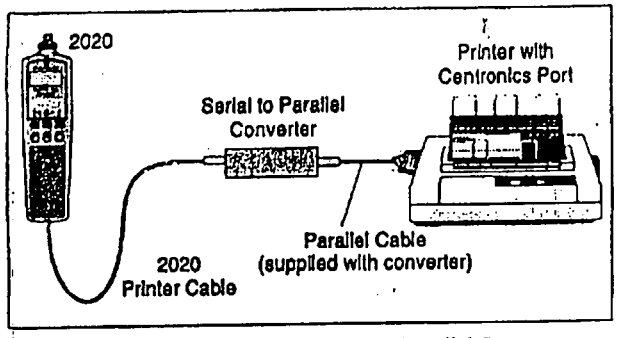

Figure 16 Connecting 2020 to the Serial to Parallel Converter

5. Plug the converter into an AC outlet.
6. Turn 2020 on.
7. Ensure the printer has been setup correctly. It must be on-line. Ensure paper is available and has been aligned properly.
8. Press the ENTER key. Select "Log", "Prnt" and then select "Grph" or "Tabl".
9. Select a start time using the "Next" and "Prev" keys. Hold down the "Next" and "Prev" keys to scroll through the data quickly.
10. Press the ENTER key, and select the stop time. All entries between, and including, the start and stop entries will be sent to the printer.

4.4. Sample Line

A 3 meter (9') sample line (Photovac Part No. 390006) may be connected to the 2020 inlet for remote sampling. Connect the sample line to the inlet using the fittings supplied with the sample line.

Note:	When using the sample line, be especially careful not to aspirate liquids or solids as they will damage 2020.

4.5. Dilution Probe

4.5.1. Description

The dilution probe attaches to the underside of 2020 and allows 2020 to read concentrations up to 20000 ppm isobutylene equivalent units.

A metering valve controls the ratio of sample to zero air. 2020's pump draws air through both the dilution probe inlet and through the charcoal filter. You set the metering valve so that 2020 reads 10% of the actual sample concentration. Zero air is created by drawing room air through a charcoal filter.

2020 is calibrated with 100 ppm isobutylene. The dilution probe is then connected to the 2020 inlet and the dilution probe—2020 system is calibrated with 100 ppm isobutylene. For high accuracy operation, the dilution probe is calibrated with 1000 ppm isobutylene.

4.5.2. Assembling the Dilution Probe

1. Slide the charcoal filter tube into the 1/4" compression nut on the zero air inlet of the dilution probe. See Figure 17.

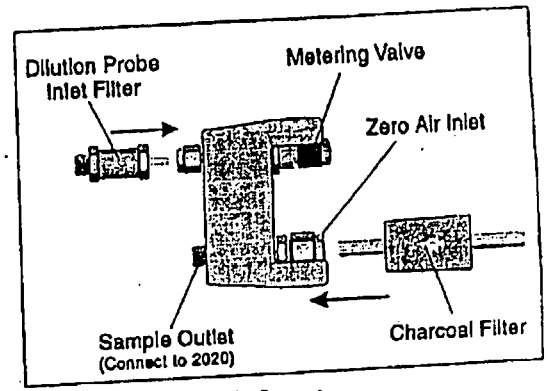

Figure 17 Dilution Probe Layout

2. Finger-tighten the nut. Then use a wrench to tighten the nut 3/4 of a turn further. This will compress the ferrules onto the tube.

3. Slide the inlet filter into the 1/8" compression nut on the sample inlet of the dilution probe. See Figure 17.

4. Finger-tighten the nut and then use a wrench to tighten the nut 3/4 of a turn further. This will compress the ferrules onto the filter tube.

4.5.3. Installing the Dilution Probe

1. Remove the two screws from the bottom of the 2020 control housing.

2. Use the long mounting screws supplied with the dilution probe to connect the mounting bracket to the 2020 bottom housing. See Figure 18.

3. Use the short mounting screws and the washers to connect the dilution probe to the mounting bracket.

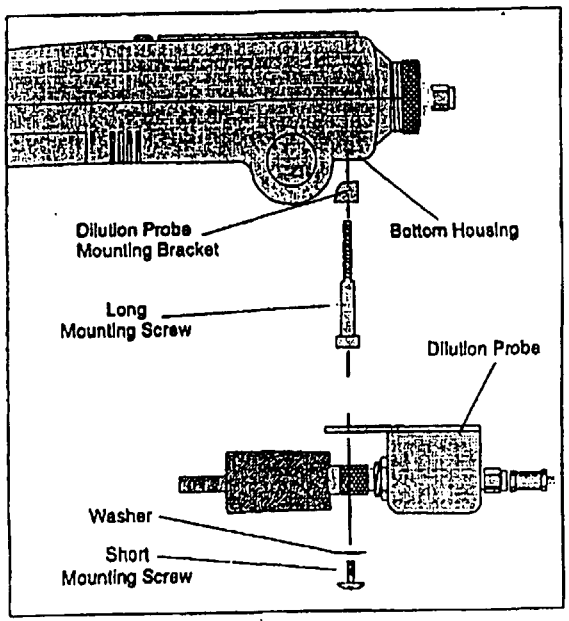

Figure 18 Installing the Dilution Probe

4.5.4. Calibration with the Dilution Probe

2020 must be calibrated in order to display concentration in units equivalent to ppm.

Occasionally clean ambient air will be suitable as zero air. If there is any doubt, use a commercial source of zero grade air and a regulator or second sampling bag. Span gas of the desired compound and concentration is also required and may be obtained from a specialty gas supplier. See Appendix B.4.

Isobutylene at 100 ppm in air is recommended as span gas (Photovac Part No. 350012). If you are using another type of span gas, you must obtain the required gas and concentration. If compound threshold limit values (TLVs) are exceeded, you should use a gas bag for calibration.

Calibrate the instrument as follows:

1. Calibrate 2020 as outlined in Section 3.2.2 or 3.3.2.

2. Use the tubing supplied with the probe to connect the dilution probe to the 2020 inlet.

3. If you are using gas bags, flush and fill the gas bags with 100 ppm isobutylene.

4. Use the hex wrench to loosen the screw in the metering valve handle. Do not remove the hex screw.

5. Connect the adapter tubing from the flow-match regulator to the inlet.. If you are using gas bags, connect the gas bag adapter to the dilution probe inlet.

6. Ensure the calibration gas cylinder is upright and open the regulator until the float is 1/8" from its rest position. Do not set the flow rate too high.

7. Adjust the metering valve until the display reads 10% of the actual span gas concentration.

8. Use the hex wrench to tighten the screw and lock the metering valve handle.

9. The dilution probe is now calibrated and ready for use. Disconnect the adapter tubing or the gas bag from the inlet.

> Note: When the dilution probe is connected to 2020, the displayed readings are always 10% of the actual reading.

4.5.5. High Accuracy Operation

The 2020–dilution probe system can be calibrated for higher accuracy operation. 2020 is calibrated with 100 ppm isobutylene and the dilution probe is calibrated with 1000 ppm isobutylene.

1. Calibrate the 2020 as described in Section 3.2.2 or 3.3.2. Use 100 ppm isobutylene as the calibration gas.
2. Connect the dilution probe to the 2020 inlet.
3. If you are calibrating directly from the calibration tank, Connect the adapter tubing from the regulator to the 2020 inlet.

   Ensure the calibration gas cylinder is upright, and open the regulator by turning the valve counterclockwise. Open the regulator until the ball is 1/8" from its rest position. Do not set the flow rate too high.
4. If you are using gas bags, flush and fill the gas bags with 1000 ppm isobutylene. It is advisable to obtain a second calibration kit (Photovac Part No. 390033) for the 1000 ppm isobutylene. See Section 3.3.1 for details of filling the gas bags.
5. Adjust the metering valve until the display reads 10% of the actual isobutylene gas concentration.

4.6. Replacement Detector Lamps

4.6.1. General Information

2020 is supplied with a UV lamp which produces an energy of 10.6 electron-volts (eV). With this standard lamp installed, 2020 responds well to gases and vapors which ionize at 10.6 eV or less. For special applications, 2020's response can be changed by using lamps of other energies. The 11.7 eV lamp is covered in Section 4.6.2. You can obtain more information on lamps of other energies from the Photovac Applications Group.

4.6.2. 11.7 eV UV Lamp

With an 11.7 eV lamp installed, 2020 functions as a leak detector responding to gases and vapors which ionize at 11.7 eV or less. The 11.7 eV lamp may be useful for detecting leaks of chemicals not ionized by the 10.6 eV lamp. This lamp is intended for special applications only. It is not suitable for normal operation, because of limitations of the lamp window material.

The 11.7 eV lamp window material is Lithium Fluoride (LiF). Unlike other lamp windows, LiF readily absorbs water from atmospheric humidity. When contaminated by moisture, the window loses its ability to transmit UV light.

> Note: Never touch the window or let liquid water near it.

LiF is composed of two light elements which are easily disrupted within the crystal lattice by the UV light generated by the lamp. Disruption of the lattice causes the crystal to turn a yellowish color, and again performance declines.

Because of the lamp window limitations, the lifetime of the 11.7 eV lamp is restricted and it must be used sparingly according to these instructions:

1. Remove the 11.7 eV lamp from the supplied dessicant bottle and install the lamp according to the instructions in Section 5.2.1.
2. Calibrate 2020 as outlined in Section 3.2 or 3.3.
3. Recalibrate 2020 every 15 minutes of operation.
4. Every hour of operation, switch off 2020 and examine the lamp window for yellowing. If the window is yellow, then remove the lamp and regenerate the window according to the procedure below.
5. After use, remove the lamp from 2020 and store it in the supplied dessicant bottle.

To regenerate the 11.7 eV lamp window:

1. Clean the lamp window with dry aluminum oxide powder on a dry cotton swab. Do not use methanol or water.
2. Aluminum oxide may be obtained from most chemical supply companies. When ordering specify 3.0 micron powder.

3. Heat the lamp in a 150°C (300°F) oven for 8 hours or more.
4. Allow the lamp to cool before use.
5. Alternatively, the lamp window can be regenerated without heat by storing the lamp in a dessicator for at least 5 days.

4.7. DC Power Cord

2020 can be connected to a car battery through the cigarette lighter with the DC power cord.

1. Turn the instrument off by pressing the ON/OFF key for 2 seconds.
2. Connect the DC power cord (Photovac Part No. 390004) to the 2020 AC adapter jack on the rear of the instrument.
3. Connect the other end of the DC power cord to the cigarette lighter in the car.
4. Turn the instrument on again by pressing the ON/OFF key.

If the car is running, ensure the car exhaust does not contaminate your samples.

5. Routine Maintenance

5.1. Battery Charging

A fully charged battery pack powers 2020 for approximately 8 hours. If the instrument is to be used for more than 8 hours, carry a spare battery pack (Photovac Part No. 350009). When the first one has been discharged, replace it with the spare.

> **Note:** If you do not turn 2020 off before removing the battery pack, you will reset the instrument and you will lose all logged data and setup parameters.

When the instrument status displays "LBat", the battery pack requires charging. When the "LBat" status is displayed, you have 30 minutes of operation left. 2020 will turn itself off before the battery pack becomes critically low.

Upon return from field work, charge the battery packs as outlined in Section 1.5. Use only the AC adapter specified for use with 2020.

If you do not require portable operation, you can use 2020 while it is connected to the AC adapter

The AC adapter automatically charges at a high charge rate until the battery pack is fully charged. It then maintains the full charge with a low continuous charge rate indefinitely so there is no danger of over-charging.

When the LED, on the back of 2020, is red, the battery is charging. When the LED turns green, the battery is fully charged and ready for use.

> **Note:** Leaving 2020 for more than 3 months without turning it on may result in the loss of recorded data and setup parameters. If 2020 is not used for long periods of time, turn the instrument on for a few hours every month to avoid loss of data.

5.2. Maintenance of the UV Lamp

5.2.1. Removing and Replacing the UV Lamp

1. Ensure the instrument is turned off.

> **Warning:** You must turn the instrument off before removing the lamp cover!

2. Use the 2020 multi-tool to remove the lamp housing cover.
3. Tilt 2020 slightly and remove the UV lamp.

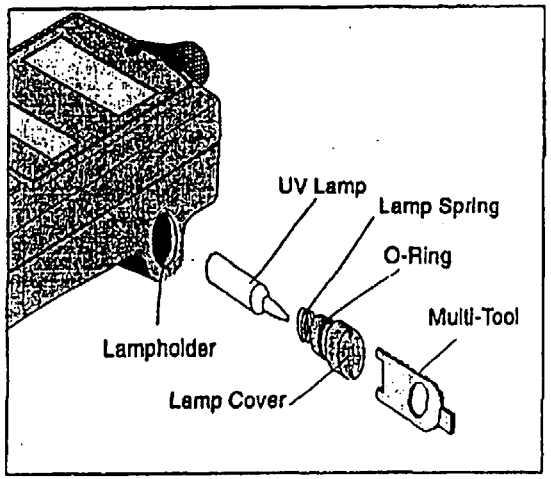

Figure 19 Removing the UV Lamp

> **Warning:** Do not touch the wire grid inside the detector cell. Any dust or dirt in the detector cell can be blown out with a gentle jet of compressed air.
>
> Do not insert any object, other than the UV lamp, into the lampholder.

4. Discard the o-ring and spring supplied with the replacement lamp.
5. Without touching the lamp window, place the new lamp into the 2020 lampholder, window first. See Figure 19.

> **Note:** If you have a UV lamp with a white serial number label, it is possible that the UV lamp may not fit into the lampholder. Do not force the lamp into the lampholder. See Section 6.3.

6. Replace the lamp housing cover. Tighten the cover down with the multi-tool. Do not overtighten.
7. Calibrate all the Cal Memories that you are using and then continue normal operation.

5.2.2. Cleaning the UV Lamp Window

During the course of normal operation, a film builds up on the window of the UV lamp. The rate at which the film develops depends on the type and concentration of the gases and vapors being sampled and results from the UV light interacting with them.

Hot gases and vapors may contribute to a decrease in sensitivity because they may condense on the lamp window. Condensation may eventually evaporate off the window, but it will usually leave a residue that must be removed by cleaning the lamp window.

As a guide, clean the window every 24 hours of operation.

1. To remove the film, gently rub the window of the lamp with a lint free tissue moistened with methanol. Use only HPLC grade or spectroscopic grade methanol to clean the lamp window.
2. Allow the window to dry and then, without touching the window, place it back into 2020.
3. Calibrate all the Cal Memories that you are using and then continue normal operation.

5.3. Replacing the Sample Inlet Filter

2020 is equipped with a combined dust and water filter to reduce detector contamination. As the filter collects dust, 2020's inlet flow rate and sensitivity decrease. The filter will not allow water to pass through, but the filter will not stop all solvents.

Note: Do not aspirate liquid samples with 2020!

Replace the filter on a weekly basis, or more frequently if 2020 is used in a dusty or wet environment. You must replace the filter if 2020 has been exposed to liquid water. If you are sampling hot gases or vapors, condensation in the sample line may also affect the filter. The pump will sound labored when the filter requires replacement.

1. Turn the instrument off. Unscrew the filter housing from the detector housing. Be careful not to lose the O-ring seal.

Note: Each filter is protected by a piece of blue plastic. Remove the plastic before installing the filter in 2020.

2. Remove the Teflon/Polypropylene filter and install the new filter (Photovac Part No. 396000 or 396015). Place the filter so that the Teflon side is facing down in the filter housing and the mesh side is facing the 2020.

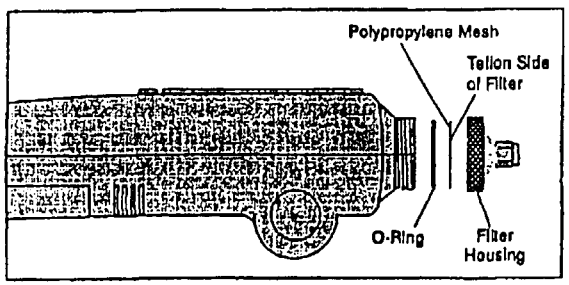

Figure 20 Replacing the Inlet Filter

Handle the filter disk only by the edges. The mesh may be damaged or contaminated by excessive handling. Use forceps if possible.

3. Replace the filter housing.

4. Calibrate all Cal Memories, that you are using, and then continue normal operation.

Warning: Do not operate 2020 without an inlet filter.

5.4. Maintenance of the Dilution Probe

5.4.1. Charcoal Filter

The charcoal filter will remove hydrocarbon contaminants for up to 4000 ppm-hours. This means that the filter will last for 1 hour removing 4000 ppm of hydrocarbon contaminants or will last for 4 hours removing 1000 ppm. The exact time will be determined by the operating environment. You will notice an increased hydrocarbon background when the filter requires replacement.

To replace the charcoal filter:

1. Loosen, but do not remove, the 1/4" compression fitting on the dilution probe zero air inlet and remove the charcoal filter from the dilution probe. See Figure 17 Dilution Probe Layout
2. Slide the replacement charcoal filter tube into the compression nut. (Photovac Part No. 395067).
3. Finger-tighten the nut. Then use a wrench to tighten the nut 3/4 of a turn further. This will compress the ferrules onto the tube.

When the dilution probe is not in use, place the charcoal filter in its plastic bag and store it in a clean, dry place.

5.4.2. Inlet Filter

The dilution probe is equipped with a dust filter to reduce detector contamination. As the filter collects dust, the inlet flow rate and sensitivity decrease. Replace the filter every 240 hours of operation, or more frequently if the instrument is used in a dusty environment.

Note: Do not operate 2020 or the dilution probe without an inlet filter.

1. Turn 2020 off and remove the dilution probe from the instrument.

2. Hold the filter housing near the housing with a 9/16" wrench. See Figure 21.

3. Unscrew the top of the filter housing with another 9/16" wrench. Be careful not to lose the filter spring.

4. Remove the spring and filter. Install the new filter, open end first. Press the filter into place so it will seal at the bottom of the filter housing. Replace the filter spring and the top of the filter housing.

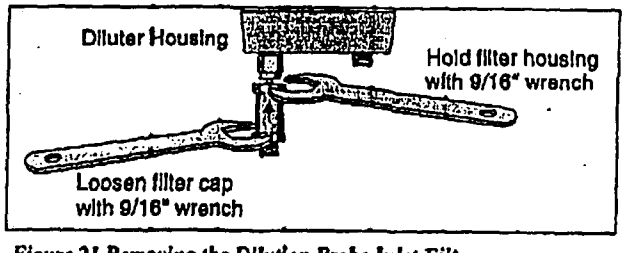

Figure 21 Removing the Dilution Probe Inlet Filter

5. Tighten the top nut while holding the bottom one stationary with the wrench.

6. Calibrate both 2020 and the dilution probe before continuing normal operation. See Section 4.5.4

6. Troubleshooting

6.1. General Information

If you have a service related question about 2020, consult this manual first. If you cannot find the answer in this documentation, contact the Photovac Service Department.

When you call, you should have your 2020 in front of you. You should also have this manual at hand. Lastly, please have the following information ready:

1. A description of what happened and what you were doing when the problem occurred.
2. Any corrective action that you have tried.
3. The exact wording of any messages that appeared on the display.

6.2. Fault Messages

When the "Fault" status is displayed, 2020's operation is compromised.

Fault1: Signal from zero gas is too high.

Cause: Another fault occurred while 2020 is setting its zero point, then this fault is displayed.

Action: Ensure no faults are occurring and calibrate 2020 again.

Cause: Contamination of sample line, sample probe or fittings before the detector.

Action: Clean or replace the sample line, sample probe or the inlet filter. See Section 5.3.

Cause: Span gas and zero air are mixed up.

Action: Ensure clean air is used to zero 2020. If you are using gas bags, mark the calibration and zero gas bags clearly.

Cause: Ambient air is contaminated.

Action: If you are unsure about the quality of ambient air, use a supply of commercial zero grade air to zero 2020. See Section 3.1.3.

Fault2: Signal from span gas is too small.

Cause: Span gas and zero air mixed up.

Action: Ensure clean air is used to zero 2020. If you are using gas bags, mark the calibration and zero gas bags clearly.

Action: Ensure the span gas is of a reliable concentration.

Cause: UV lamp window is dirty.

Action: Clean the UV lamp window. See Section 5.2.2

Cause: UV lamp is failing.

Action: Install a new UV lamp. See Section 5.2.1.

Cause: Incompatible application.

Action: The concentration and sample gas are incompatible for use with 2020.

Fault3: UV lamp fault. UV lamp intensity has not started.

Cause: UV lamp has not started immediately.

Action: This fault may be seen momentarily when 2020 is first turned on. Allow 30 seconds for the UV lamp to start and the fault to clear.

Cause: UV lamp serial number label is blocking the photocell.

Action: If you have a UV lamp with a white serial number label, it is possible that the label is blocking the photocell. Rotate the lamp approximately 90° and then try to start 2020 again. If the fault persists, replace the lamp.

Cause: UV lamp not installed.

Action: Install a UV lamp. See Section 5.2.1.

Cause: UV lamp has failed.

Action: Install a new UV lamp. See Section 5.2.1.

Cause: Electronic problem.

Action: If a new UV lamp still generates this fault, then contact the Photovac Service Department.

Fault4: Pump current too low or too high.

Cause: If pump sounds labored, then the pump is operating beyond normal operating parameters.

Action: Check for an obstruction in the sample line. Make sure sample line, sample probe or inlet filter are not plugged.

Action: Replace the inlet filter. See Section 5.3.

Action: Ensure the sample outlet, located on the underside of 2020, is not obstructed.

Cause: UV lamp is too wide, causing flow to be restricted.

Action: If you have a UV lamp with a white serial number label, it is possible that the lamp is too wide for the lampholder. Contact Photovac Service.

Cause: 2020 has been exposed to a solvent that can pass through the inlet filter and liquid has been aspirated.

Action: Contact the Photovac Service Department.

Cause: The pump has failed.

Action: Contact Photovac Service.

6.3. Troubleshooting

Problem: Very low or no instrument response detected, yet compounds are known to be present.

Cause: 2020 has not been calibrated properly.

Action: Ensure the calibration gas is of a reliable concentration and then calibrate the instrument as outlined in Section 3.1 or 3.3. After the instrument has been calibrated, sample the bag of calibration gas. A reading equivalent to the calibration gas should be displayed. If not, contact the Photovac Service Department.

Action: Disconnect the battery charger before calibrating 2020. Section 3.1 or 3.3 for calibration instructions.

Cause: Cal Memories have not been programmed correctly.

Action: Program all the Cal Memories you require for your application. You must use the correct calibration gas and concentration for each Cal Memory. See Section 3.4.

Cause: Response factor has been set to zero.

Action: Enter the correct response factor. Refer to Appendix 8.6 for a list of response factors. If the compound is not listed in Appendix 8.6 or you are measuring gas mixtures, then enter a value of 1.0.

Cause: You are not using the correct Cal Memory.

Action: Select the correct Cal Memory for your application. See Section 3.2.2 or 3.3.2.

Cause: Detector is leaking. A decrease in sensitivity may be due to a leak in the detector.

Action: Ensure the UV lamp has been installed correctly. See Section 5.2.1.

Action: Ensure the lamp cover has been tightened down. Do not overtighten the cover.

Action: Ensure the o-ring seal on the lamp cover is positioned correctly. See Section 5.2.1.

Cause: UV lamp is too long, causing flow to be restricted.

Action: If you have a UV lamp with a white serial number label, it is possible that the lamp is too long for the lampholder. Replace the lamp and contact Photovac Service. See Section 5.2.1.

Cause: UV lamp is too wide, causing flow to be restricted.

Action: If you have a UV lamp with a white serial number label, it is possible that the lamp is too wide for the lampholder. Contact Photovac Service.

Cause: Sampling environment is extremely humid.

Action: The 2020 detector has been designed to operate under high humidity conditions. Under extreme conditions you may notice decreased response due to humidity. Water vapor is not ionized by the PID, but it does scatter and absorb the light and results in a lower reading.

Cause: UV lamp is failing.

Action: Install a new UV lamp. See Section 5.2.1.

Cause: High concentration of non-ionizable compounds.

Action: Chemical compounds, such as methane, with IPs greater than the 10.6 eV scatter and absorb the UV light. Sensitivity may be decreased significantly. This application may be incompatible with 2020. Contact the Photovac Applications Group.

Problem: Erroneously high readings.

Cause: Sampling environment is extremely humid.

Action: Water vapor may contain mineral salts which carry a charge. The water vapor becomes an electrolytic solution which becomes ionized when it enters the detector. Atmospheric water in areas around the sea or stagnant water may produce a response in the absence of

contaminants. The same effect may be seen when conducting ground water investigations in areas where the water is hard because it contains a significant concentration of minerals.

Cause: 2020 has not been calibrated properly.

Action: Ensure the calibration gas is of a reliable concentration and then calibrate the instrument as outlined in Section 3.1 or 3.3. After the instrument has been calibrated, sample the bag of calibration gas. A reading equivalent to the calibration gas should be displayed. If not, contact the Photovac Service Department.

Cause: Cal Memories have not been programmed correctly.

Action: Program all the Cal Memories you require for your application. You must use the correct calibration gas and concentration for each Cal Memory. See Section 3.4.

Cause: You are not using the correct Cal Memory.

Action: Select the correct Cal Memory for your application. See Section 3.2.2 or 3.3.2.

Note: It does not matter which Cal Memory is selected or which response factor is entered, 2020's response is not specific to any one compound. The reading displayed represents the total concentration of all ionizable compounds in the sample.

Cause: Detector has been short circuited by foreign matter in the detector cell.

Action: Do not touch the wire grid inside the detector cell. Use a gentle jet of compressed air to remove any dust or dirt in the detector cell.

Warning: Do not insert any object, other than the UV lamp, into the lampholder.

Cause: There is an undetermined problem.

Action: Contact the Photovac Service Department.

Problem: Date and time settings are not retained.

Cause: 2020 has not been used for 3 months or more and the internal battery (not the external battery pack) has discharged.

Action: Connect 2020 to the AC adapter and turn 2020 on. Turn the pump off. See Section 2.6.1. While 2020 is running the internal battery is charging. Leave the instrument running for approximately 24 hours.

Problem: Instrument status shows "Over".

Cause: High concentrations of gases and vapors will cause a rapid change in signal level. The detector and associated electronics may become temporarily saturated.

Action: Wait a few seconds for the status to return to normal. PIDs are designed to detect relatively low concentrations of gases and vapors. Exposure to very high concentrations may result in a very high or maximum response.

Cause: The detector has become saturated.

Action: Move 2020 to a location where it can sample clean air. Sample clean air until the reading stabilizes around 0.

Cause: Detector has been short circuited by foreign matter in the detector cell.

Action: Do not touch the wire grid inside the detector cell. Use a gentle jet of compressed air to remove any dust or dirt in the detector cell.

Warning: Do not insert any object, other than the UV lamp, into the lampholder.

Cause: There is an undetermined problem.

Action: Contact the Photovac Service Department.

Problem: Display is blank.

Cause: Battery pack is critically low.

Action: Replace the battery pack or connect 2020 to the AC adapter.

4. The instrument status will change to "Loc".
5. Select the required Cal Memory for this location. Press ENTER and select "Set", "Cal" and then "Mem". Use the "Next" and "Prev" keys to select the desired Cal Memory.
6. Press the ENTER key and locate the first site on your schedule. The middle soft key is used to advance to the next measurement when you are operating in manual mode. Press the "Next" key. If you are not using manual operation, the "Next" key is not shown.
7. The instrument status will change to "Bkgd". A background measurement must be made. When you have an accurate background, press "Next". 2020 will record the displayed concentration when you press the "Next" key.
8. The instrument status will now be "Samp". Take a sample measurement. When you have an accurate sample, press "Next". 2020 will record the displayed concentration when you press the "Next" key.
9. The instrument status will again be "Loc". Go to the next site on your schedule.

When you have completed your monitoring you can download the contents of the datalogger to a computer and then add the 2020 data to your spreadsheet.

If you change from manual operation to an averaging interval, you will lose the contents the datalogger. Print or save the data to disk before changing the interval. See Sections 2.7.3 and 4.2 for printing and saving logged data.

3.7. Preparing for Field Operation

3.7.1. Field Check List

When using 2020 for field operation, the following items should be carried into the field to reduce or eliminate down time of the instrument.

If you are going to be in the field for a single 8-10 hour day, then you should include the following accessories:

- Spare battery pack (Photovac Part No. 350009)
- Spare UV lamp ((Photovac Part No. 390011)
- 2020 multi-tool (Photovac Part No. 396012)
- Sample line (Photovac Part No. 390006)
- Calibration kit(s) (Photovac Part No. 390033)
- Calibration regulator (Photovac Part No. 350006)
- Tank(s) of calibration gas (Photovac Part No. 350012)
- Spare gas bag for zero air (Photovac Part No. 396017)
- Gas bag adapter for zero air (Photovac Part No. 396010)
- Supply of commercial zero air
- Spare inlet filters (Photovac Part No. 396015 or 396000)
- Dilution probe (Photovac Part No. 350013)
- Spare charcoal filters for the dilution probe (Photovac Part No. 395067)
- Carrying case (Photovac Part No. 350010)
- User's manual (Photovac Part No. 350001)
- DC power cord (Photovac Part No. 350004)

Table 3 Check List for Field Operation

If you will be in the field for more than one day you should include the following additional items:

- AC adapter (Photovac Part No. 350001 or 350002)
- Printer (Photovac Part No. 380120)
- Cable kit (Photovac Part No. 350011)
- Computer and associated cables
- Serial to parallel converter (Photovac Part No. 380145)

Table 4 Additional Field Items

3.7.2. Operational Check List

Before beginning field work, set up and calibrate 2020 for your particular application. Ensure the instrument is in working order before heading into the field:

> Note: Even if 2020 has been calibrated with a specific compound, its response is not specific and the presence of another ionizable impurity may render the numerical result invalid.

It is often impractical to carry a range of different standards into the field. Approximate results can be obtained by calibrating 2020 with the recommended span gas and entering the appropriate response factor. The response factor is based on the ratio of the response of the specific compound to the response of the span gas. The response factor multiplies 2020's reading then displays and records it.

Appendix 8.6 provides response factors from which approximations can be made for guidance purposes. Data extrapolated from the use of response factors must be regarded as interim and approximate only. Appendix 8.6 should be used only for concentrations up to 500 ppm of the specific compound, as response factors change with concentration.

3.5.2. Using Response Factors

1. Select "Set", "Cal" and "Chng" and select the desired Cal Memory (1 to 15) with the "Next" and "Prev" keys.
2. Select "Chng". Select "User" or "Lib"
3. If you selected "User", enter the name, response factor and alarm levels. If you selected "Lib", use the "Next" and "Prev" keys to select the required library entry.
4. Calibrate 2020 with zero air and 100 ppm isobutylene as described in Section 3.2.2 or 3.3.2.
5. Expose 2020 to the sample. The displayed reading is the approximate concentration of the specific compound.

> Note: The response factors in Appendix 8.6 serve only as a guide to concentrations measured by 2020.

Results are expected to be accurate to within +/-10 ppm or +/-25% of the displayed result, whichever is greater. Accuracy of response factors to other gases and vapors may differ from those listed in Appendix 8.6.

3.6. Manual Operation

As part of manual operation, you setup 2020 to monitor various locations. Since each location may contain different compounds and concentration ranges you can program a Cal Memory and the associated response factor and alarm level for up to 15 different applications. In this way you can sample numerous locations without having to re-calibrate 2020 at each location.

Prepare a monitoring schedule for you application. Your schedule should contain a list of sites that must be monitored and the Cal Memory that must be used when monitoring the site. Also include any reference information that will help you define the site and the monitoring application. If you create your schedule using spreadsheet software, you can later download 2020 data to a computer and then copy it into the spreadsheet for further calculations.

Once you have programmed 2020, and prepared a list of sites to be monitored, you will move around to each location and manually log data at each site.

1. You must determine the number of calibration standards that will be required to perform manual monitoring for your application. Program all the calibration memories that you need. See Section 3.4.

> Note: It does not matter which Cal Memory is selected or which response factor is entered, 2020's response is not specific to any one compound. The reading displayed always represents the total concentration of all ionizable compounds in the sample.

2. Ensure the 2020 is in PEAK mode. To change the mode, press ENTER and select "Disp". Press "Mode" and select PEAK.
3. Switch to manual operation. Press ENTER and then "Log". Select "Mode". Use the "Next" and "Prev" keys to scroll through the list. When Manual is displayed press ENTER. When you switch between interval and manual operation, the datalogger will be cleared. Press "YES" to confirm your selection and clear the datalogger. If you do not want to lose your previously recorded data, press "NO", then print or save the data to disk before changing to manual operation. See Sections 2.7.3 and 4.2 for printing and saving logged data.

If the compound is not listed in Appendix 8.6 or you are measuring gas mixtures, then enter a value of 1.0. The concentration detected by 2020 will be multiplied by the response factor before it is displayed and logged.

8. Connect the supply of zero air. If you are using a gas bag with zero air, open the bag and connect the gas bag adapter to the inlet.
9. Select "Set", "Cal" and "Zero". The 2020 sets its zero point.
10. Select "Set", "Cal" and "Span". The 2020 asks for the span gas concentration. Enter the known span gas concentration, without pressing the ENTER key to confirm it.
11. Open the bag and then connect the gas bag adapter to the inlet. Press ENTER. 2020 sets its response factor.

> Note: Readings may fluctuate slightly as the gas bag empties. Do not allow 2020 to evacuate the bag completely.

12. When the display reverts to the default display, 2020 is calibrated and ready for use. Remove the span gas bag from the inlet.

If the 2020 is powered off in the middle of zeroing or spanning, it will power on displaying a Cal status. This indicates that you need to calibrate 2020. While the Cal status is active, all alarms are inactive.

3.4. Programming the Cal Memories

2020 has 15 Cal Memories and can be calibrated with 15 different span gases or response factors if desired. To program the Cal Memories:

1. If you will be calibrating directly from the portable cylinder, connect a flow-match regulator (Photovac Part No. 350006) to each tank. You must use a separate regulator for each compound to prevent cross contamination.

   If you are using gas bags, prepare the bags of calibration gas as outlined in Section 3.3. Use a different gas bag and gas bag adapter for each concentration and for each type of calibration gas. You can use the same gas bag to zero all the Cal Memories, however, you must refill the bag for each Cal Memory.

2. Select "Set", "Cal" and "Chng".
3. Select the desired Cal Memory (1 to 15) with the "Next" and "Prev" keys.
4. Press "Chng" to change the parameters of the Cal Memory. Select "User" or "Lib".
5. If you selected "User", enter the name, response factor and alarm levels.
6. If you entered "Lib", use the "Next" and "Prev" keys to select the required library. See Appendix 8.7 for a list of Library entries.

> Note: It does not matter which Cal Memory is selected or which response factor is entered, 2020's response is not specific to any one compound. The reading displayed represents the total concentration of all ionizable compounds in the sample.

7. Calibrate the instrument as described in Section 3.2.2 or 3.3.2. When the calibration is completed, the calibration information is automatically stored in the selected Cal Memory.
8. Repeat this procedure for each Cal Memory you need.

Whenever the instrument is calibrated, 2020 updates the selected Cal Memory only. Each Cal Memory must be calibrated at least once a day. Frequency of calibration will depend on ambient conditions and instrument response. If ambient conditions change or the response has drifted, a calibration must be performed for each Cal Memory to ensure reliable operation.

3.5. Response Factors for Gases and Vapors

3.5.1. General Information

In situations where only a single pure compound is present in air, 2020 should be calibrated with a standard of that *specific compound* as span gas. 2020's 15 Cal Memories can be used to store calibration information for 15 different span gases.

The displayed reading will always be influenced by any other photoionizable compounds present in the air sample.

If you are using a portable tank of calibration gas (Photovac Part No. 395066), connect the regulator (Photovac Part No. 600649) directly to the tank.

If you are using a large cylinder of calibration gas, you must obtain a high purity regulator as specified in Section 1.4. Isobutylene in air is usually supplied with a standard CGA 590 cylinder valve outlet. Obtain a regulator with the matching fitting. Connect the regulator to the tank of calibration gas. Tighten the regulator onto the tank with a wrench. Do not over-tighten.

> Note: Do not force the connection.
>
> Do not use Teflon tape with CGA fittings. In general, these fittings are designed for metal to metal sealing.
>
> Do not use adapters to connect one CGA fitting to another type of CGA fitting. If the regulator does not match the outlet on your calibration tank, contact your specialty gas supplier.

2. Attach the knurled nut on the gas bag adapter to the regulator. Finger-tighten the fitting.

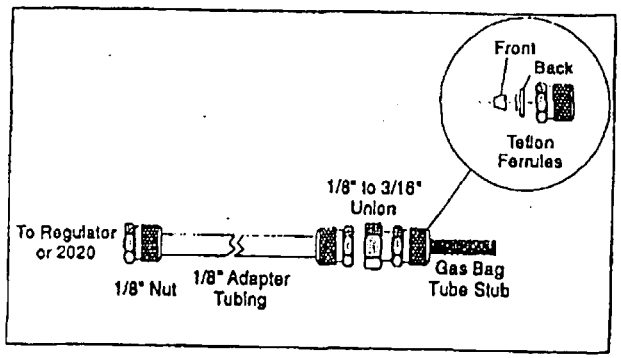

Figure 11 Gas Bag Adapter

3. Loosen the knurled nut on the reducing union of the gas bag adapter.

> Note: Do not remove the nut from the union as the Teflon ferrules contained inside the nut may be lost. See Figure 11.

4. Insert the tube stub from the gas bag into the knurled nut. Tighten the knurled nut and ensure the tube stub is secure. If the gas bag is not secure, ensure you have inserted the tube stub far enough into the knurled nut. Do not over-tighten the fitting.

> Note: Over-tightening the Teflon ferrules will result in damage to the ferrules!

5. The union should be connected to the gas bag adapter. If it is not, then tighten the nut on the adapter tube to the union.
6. Flush and fill the gas bag. See Appendix 8.5 for instructions.
7. Remove the knurled nut on the adapter tube from the regulator.
8. Repeat this procedure, if necessary, to prepare a bag of zero air.

> Note: Do not use the same gas bag or gas bag adapter for the bag of zero air. You will contaminate the bag of zero air.

3.3.2. Calibrating 2020 with a Gas Bag

1. Press the ENTER key.
2. Select "Set", "Cal" and then "Mem".
3. Select the desired Cal Memory. 2020 has 15 Cal Memories and can be calibrated with 15 different span gases or response factors if required. Only one Cal Memory can be used at a time. Each Cal Memory stores a different response factor, zero point, sensitivity, and alarm levels.
4. Select "Chng" and then "User". Enter a name for the calibration memory.
5. Press the ENTER key and enter a response factor.
6. Press the ENTER key and enter an alarm level for each mode.
7. Press the ENTER key and enter a response factor. Refer to Appendix 8.6 for a list of Response Factors.

> Note: Disconnect 2020 from the AC adapter before beginning calibration.

3.2. Calibration Using the Flow-Match Regulator

3.2.1. Connecting the Flow-Match Regulator to the Cylinder

> Warning: Observe proper handling procedure for all gases! See Section 1.2.1.

1. Connect the regulator to the calibration gas cylinder.

   If you are using a portable tank of calibration gas (Photovac Part No. 350012), connect the regulator (Photovac Part No. 350006) directly to the tank.

2. When the regulator is connected properly, you can read the cylinder contents from the regulator gauge.

3. Connect the adapter tubing to the regulator.

3.2.2. Calibrating 2020 with the Flow-Match Regulator

1. Ensure the sample probe is connected to the inlet.

2. Press the ENTER key.

3. Select "Set", "Cal" and then "Mem".

4. Select the desired Cal Memory. 2020 has 15 Cal Memories and can be calibrated with 15 different span gases or response factors if required. Only one Cal Memory can be used at a time. Each Cal Memory stores a different response factor, zero point, sensitivity, and alarm levels.

5. Select "Chng" and then "User". Enter a name for the calibration memory.

   Press the ENTER key and enter a response factor (RF). Refer to Appendix 8.6 for a list of Response Factors. If the compound is not listed in Appendix 8.6 or you are measuring gas mixtures, then enter a value of 1.0. The concentration detected by 2020 will be multiplied by the response factor before it is displayed and logged.

6. Press the ENTER key and enter an alarm level for STEL, TWA and PEAK.

7. Press ENTER and expose 2020 to a supply of zero air.

8. Select "Set", "Cal" and "Zero". Allow 2020 to set its zero point.

9. Select "Set", "Cal" and "Span". 2020 asks for the span gas concentration. Enter the known span gas concentration, without pressing the ENTER key to confirm it.

10. Insert the adapter tubing from the regulator into the sample probe.

11. Ensure the calibration gas cylinder is upright and open the regulator by turning the valve counterclockwise. Open the regulator until the ball is 1/8" from its rest position. Do not set the flow rate too high.

12. Press the ENTER key. 2020 sets its sensitivity.

13. When the display reverts to the default display, 2020 is calibrated and ready for use.

14. Remove the adapter tubing from the inlet and close the regulator.

If the 2020 is powered off in the middle of zeroing or spanning, it will power on displaying a Cal status. This indicates that you need to calibrate 2020.

> Note: While the Cal status is active, all alarms are deactivated.

3.3. Calibration Using a Gas Bag

3.3.1. Preparing the Calibration Gas Bag and the Zero Air Bag

Use the calibration kit (Photovac Part No. 390033) as follows:

> Warning: Observe proper handling techniques for all gases! See Section 1.2.

1. Connect the regulator to the calibration gas cylinder.

2. You will be prompted for a password. If no password has been entered, then press the ENTER key. If a password has been entered, enter the correct password and then press the ENTER key.

3. If you want to enter a password, press "Chng" and enter a password. The password can be up to 4 numerical characters. Press the ENTER key to accept the password.

Note: If you change the password, make sure you record the setting. Once the instrument is locked, there is no way to unlock it without losing all your data.

4. Press "Lock" to lock 2020. The message "Lock is on" will be displayed. If "Unlk" is displayed, 2020 is already locked.

2.8.4. Unlock

If you try to calibrate 2020 while it is locked you will see the message "Error: LOCKED! See Disp". To gain access:

1. Press EXIT and then press "Disp".
2. Press "Lock", enter the password and press ENTER. Once the password has been entered and verified, press "Unlk" to unlock the instrument.
3. Press ENTER and continue with calibration.

3. Detailed Operation

3.1. General Information

2020 must be calibrated in order to display concentration in ppm or mg/m³ units equivalent to the calibration gas. First, a supply of zero air which contains no ionizable gases or vapors, is used to set 2020's zero point. Then, calibration gas, containing a known concentration of a photoionizable gas or vapor, is used to set the sensitivity.

Occasionally clean ambient air will be suitable as zero air. Due to 2020's sensitivity, outdoor air is usually unsuitable for calibration. For best results, use a commercial source of zero grade air and a second regulator. Zero air should have not more than 0.1 ppm total hydrocarbons (THC).

If compound threshold limit values (TLVs) are exceeded, you should use a gas bag for sampling and calibration.

To determine the TLV of the compounds contained in the calibration gas, refer to the Material Safety Data Sheet (MSDS) supplied with your calibration gas cylinder.

If you will be using a gas bag for calibration, you should obtain the calibration kit (Photovac Part No. 390033). The calibration kit contains a regulator, a gas sampling bag and a gas bag adapter. See 3.3 for details of calibration using a gas bag.

1. Press the ENTER key. Select "Log", "Prnt" and then select "Grph" or "Tabl".
2. Select a start time using the "Next" and "Prev" keys. Hold down the "Next" and "Prev" to scroll through the data quickly.
3. Press the ENTER key, and select the stop time. All entries between, and including, the start and stop entries will be printed.

While printing, the 2020 displays a busy message. Do not try to perform additional functions while 2020 is printing. Pressing EXIT will abort the printout.

Although interval and manual mode generate different reports, the format of the reports is similar. For interval data, the column headings for the results are Min, Avg and Max. For manual data, the column headings are BkGd, Sample and Diff.

2.8. Display Functions

The Display function is used to control and configure 2020's display options. These options control the backlighting, select the display format, and lock the display to prevent access. Figure 10 shows a map of the Display functions.

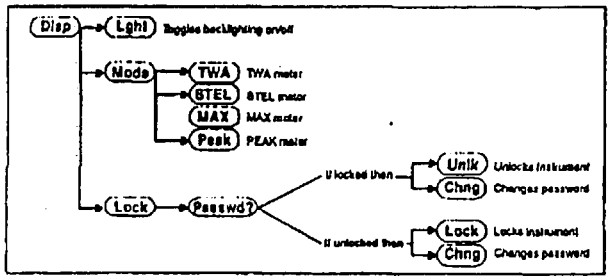

Figure 10 Display Function Map

2.8.1. Light

The Light function is used to switch the backlighting on and off.

1. Press the ENTER key.
2. Select "Disp" and then press "Lght". If the backlighting was off, it will be turned on.
3. Press EXIT to return to the function display.

To extend the operating life of the battery pack, turn the backlighting off when it is not required.

2.8.2. Mode

The Mode function is used to select the display type. You can select TWA, STEL, MAX, and PEAK.

1. Press the ENTER key.
2. Select "Disp" and then press "Mode". Select the mode you want to view. The current mode is not assigned a soft key.

   For example, if the current mode is TWA, then when you press the "Mode" key, "PEAK", "STEL" and "MAX" will be displayed.

When you have selected the new display mode, the meter display and status display will be updated to reflect the new mode. See Section 2.5. for a detailed description of each mode.

2.8.3. Lock

The "Lock" key is used to prevent access to 2020's sensitive options. Sensitive options are those which can affect 2020's readings. These include selecting a calibration memory, zeroing the instrument and spanning the instrument. If any one of these functions are selected when the instrument is locked, 2020 will prompt you to unlock the instrument before you can access the functions.

To lock 2020:

1. Press the ENTER key. Press "Disp" and then select "Lock".

displayed. Hold down the keys to scroll through the data more quickly.

1. To delete entries from the datalogger, press "Del". You can delete the current entry, all entries or a range of entries.

> Note: Deleted information cannot be recovered. You should play back and print or download the contents of the datalogger before deleting any information.

2. To delete the current entry, press "Curr". You will be prompted to confirm your selection. Press "YES" to delete the last displayed entry. Press "NO" to return to the Delete options.
3. If you want to delete the entire contents of the datalogger, press "All". You will be prompted to confirm your selection. Press "YES" to delete all entries. Press "NO" to return to the Delete options.
4. If you want to delete a range of entries you must select a start and stop time. Press "Range" and use the "Next" and "Prev" keys to select the start time.
5. Press the ENTER key, and select the stop time. All entries between, and including, the start and stop entries will be deleted.

> Note: Deleting entries from the middle of the datalogger will not free space to store more entries. Deleting entries from the start of the datalogger, or at the end of the datalogger will free usable space.

2.7.3. Print

You can print logged data in tabular or graphical format. You must have a printer connected to 2020 in order to use the print options. See Section 4.1 for instructions on connecting and configuring a printer for use with 2020. See Section 4.3 for instructions on connecting the serial to parallel converter to 2020 and to the printer.

When you are using interval operation, the date, time and instrument status are printed along with the minimum, average and maximum concentration of each averaging interval. See Figure 8.

2020 Report

Date	Time	Status	Min	Avg	Max
95/03/07	11:24:21	OK	3.5	15.4	62.7
95/03/07	11:24:36	OK	2.7	8.8	46.3
95/03/07	11:24:51	OK	12.2	57.9	98.2
95/03/07	11:25:06	OK	2.9	53.1	98.5
95/03/07	11:25:21	OK	3.5	232	230
95/03/07	11:25:36	OK	40.7	360	496
95/03/07	11:25:51	ALPK	60.3	606	916
95/03/07	11:26:06	ALPK	129	943	1832
95/03/07	11:26:21	ALPK	4.9	705	1702
95/03/07	11:26:36	OK	3.4	3.9	5.7

Figure 8 Tabular Report (Averaging Interval)

The graphical report prints a range of entries from the datalogger. 2020 stores one set of readings (Min, Avg and Max) for each averaging interval. In each averaging interval the graphed minimum is the minimum of all the stored readings in that interval. The graphed Avg is the average of all the stored readings for the interval and the Max is the maximum of all the recorded maximum readings. In manual operation, the background, sample and the difference are printed.

A minus sign is used to draw the graph from the minimum to the average. Plus signs are used to graph the area between average and maximum. See Figure 9.

```
                                  2020 Report

                                                                        20001
Date      Time   Status |0
95/03/07 11:24:21 OK     ++
95/03/07 11:24:36 OK     +
95/03/07 11:24:51 OK     -+
95/03/07 11:25:06 OK     -+
95/03/07 11:25:21 OK     ----+
95/03/07 11:25:36 OK     -------+++
95/03/07 11:25:51 ALPK    -----------------+
95/03/07 11:26:06 ALPK    ---------------+++++++++++++++++++
95/03/07 11:26:21 ALPK   -------------++++++++++++++++++++
95/03/07 11:26:36 OK     +
```

Figure 9 Graphical Report (Averaging Interval)

In manual operation the date and time are printed. A minus sign is used to draw the graph from the background to the difference. Plus signs are used to graph the area between difference and sample. Difference is calculated by subtracting the background from the sample.

3. When the required entry is displayed, press the ENTER key to select it. All the Cal Memory parameters will now be copied from the selected library entry to the current calibration memory.

4. Press the "User" key to review the Cal Memory settings.

   The "User" key is used to edit the Cal Memory information manually. 2020 will move you through each step by prompting for the name, response factor, PEAK, STEL and TWA alarms. "User" will be covered in more detail in Chapter 3.

   You can change any of the values entered in the Cal Memory. Changes, made to the library information that has been loaded into a Cal Memory, will have no effect on the original library entry.

5. Press the ENTER key to proceed to the next step.

2.7. Log Functions

The Log functions provide options for reporting, editing and configuring 2020's built in datalogger. Figure 7 shows a map of the Log functions.

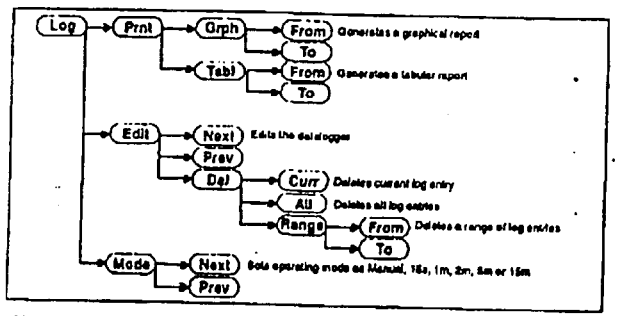

Figure 7 Log Function Map

2.7.1. Mode

2020 has two operating modes; manual and interval. When operating the 2020 in manual mode, each log entry contains a background and sample reading. In interval mode, 2020

automatically records the minimum, maximum and average readings at the preset interval. The 2020 also records date, time and status with each entry in the datalogger.

You can set an averaging interval of: 15 seconds, 1 minute, 2 minutes, 5 minutes or 15 minutes. 2020's datalogger can store 1000 entries. The interval you select will determine the period of operation. At the end of the period, the datalogger will be full and you will see an "Elog" status.

Averaging Interval	Hours of Operation to Fill Datalogger
15 s	4.1
1 m	16
2 m	33
5 m	83
15 m	250

Table 2 Averaging Intervals and Periods

To change the datalogging mode:

1. Press the ENTER key.
2. Press "Log" and select the "Mode" key.
3. Use the "Next" and "Prev" keys to scroll through the list.
4. Press the ENTER key. If you select manual operation, the datalogger will be cleared.

When you switch between an averaging interval and manual operation, the datalogger will be cleared. Before the datalogger is cleared, 2020 will confirm your selection with the prompt "Are you sure?". Press "YES" to confirm your selection and clear the datalogger. *If you do not want to lose your previously recorded data,* press "NO", then print or save the data to disk before changing to manual operation. See Sections 2.7.3, and 4.2 for printing and saving logged data.

2.7.2. Edit

Edit allows you to review and delete the contents of the datalogger. To review the contents of the datalogger, use the "Next" and "Prev" keys. The average concentration and the time it was recorded are

2.6.1. Pump

The Pump function is used to control the pump. After selecting Set Pump, 2020 responds by displaying the new pump status.

The detector is also turned off when you turn the pump off. This prevents the detector from being damaged when there is no sample flowing through the detector.

When the pump and the detector are off, the meter display will be blank. Turn the pump and detector off when concentration measurements are not necessary, and 2020 will only be used for reviewing data or generating reports. By operating the instrument with the pump and detector off when you do not need them, you will conserve the battery and ultraviolet (UV) lamp.

1. Press the ENTER key. The top line of the status display changes to "Select?". The bottom line displays 3 soft key names; "Set", "Log" and "Disp".
2. Press the soft key below "Set".
3. The names of the soft keys change to reflect the Set options. The display now shows 3 devices which can be set: "Clock", "Pump", and "Cal". Press the "Pump" key.
4. The 2020 turns the pump off. If the pump was off, pressing "Pump" will turn the pump on.
5. A message will be displayed to show you the status of the pump. 2020 reverts back to the previous menu after a few seconds.
6. To return to the default display, press the ENTER key.

2.6.2. Clock

The Clock function is used to set both the current date and time.

1. Press the ENTER key.
2. Press the "Set" key.
3. When the names of the soft keys change, press the "Clock" key.

   The up and down arrows are used to change the character underlined by the cursor. The right arrow is used to advance the cursor to the next character on the right. When the cursor is advanced past the right most character, it wraps around to the first character again.

   Formatting characters, such as the colon (:) in the time and the slash (/) in the date are skipped when advancing the cursor.
4. Use the "arrow keys" to enter the correct time. The time is formatted as Hour:Minute:Second.
5. Press the ENTER key to confirm the time and move to the date option.
6. When setting the date, the 2020 prompts you for the current date formatted as Year/Month/Day. Use the "arrow keys" to enter the correct date.
7. Press the ENTER key to confirm the date and return to the Set options. You can wait for the display to timeout or press ENTER to return to the default display.

2.6.3. Cal

Cal allows you to setup and calibrate 2020. You have three options under the Cal function: "Zero", "Span" and "Mem".

A calibration memory consists of a name, a response factor, and PEAK, TWA and STEL alarm levels.

The "Zero" and "Span" keys will be covered in detail in Section 3.1.

To edit the calibration memory, select "Mem" and then "Chng". The 2020 prompts you with two new soft keys; "User" and "Lib".

2.6.4. Library

Library selections simplify Cal Memory programming, and provide standard response factors for approximately 70 applications. "Lib" allows you to select an entry from a pre-programmed Library. The name, response factor and three alarm levels are all set from the library. To select a library entry to program the selected Cal Memory:

1. Select "Lib".
2. Use the "Next" and "Prev" keys to scroll through the list. See Appendix 8.7 for a list of the library entries.

2.5. STEL, TWA, MAX and PEAK Operation

The 2020's meter display can be configured to show one of 4 values: STEL, TWA, PEAK and MAX.

2.5.1. Short Term Exposure Limit (STEL) Mode

The Short Term Exposure Limit (STEL) mode displays the concentration as a 15 minute moving average. 2020 maintains 15 samples, each representing a one minute averaging interval.

Once every minute, the oldest of the 15 samples is replaced with a new one minute average. This moving average provides a 15 minute average of the last 15 minutes with a one minute update rate. Since the average is calculated using 15 one minute averages, the meter display will only update once every minute.

STEL is set to zero each time the instrument is turned on. Since STEL is a 15 minute moving average, there is no need to clear or reset the STEL.

STEL calculations are always being performed by 2020. You can display the results of the calculations by selecting STEL as the Display mode. See Section 2.8.2 for details of switching between display modes.

2.5.2. Time Weighted Average (TWA) Mode

The TWA accumulator sums concentrations every second until 8 hours of data have been combined. If this value exceeds the TWA alarm setting, a TWA alarm is generated. The TWA is not calculated using a moving average. Once 8 hours of data have been summed, the accumulation stops. In order to reset the TWA accumulator, press the "Clr" key.

This sum will only be complete after 8 hours, so the meter displays the current sum divided by 8 hours. While you are in TWA mode, the time on the status display will show the number of minutes and hours of data that TWA has accumulated. When this reaches 8:00 or 8 hours, 2020 stops accumulating data and the TWA is complete.

TWA calculations are always being performed by 2020. You can display the results of the calculations by selecting TWA as the Display mode. See Section 2.8.2 for details of switching between display modes.

2.5.3. MAX Mode

The MAX mode displays the maximum signal, with the date and time that it was recorded. 2020 continues to log data according to the selected averaging interval, but only the maximum detected concentration is displayed on the meter display.

The right soft key is used to clear the meter when displaying MAX. The "Clr" key only affects the reading that the meter is displaying. For example, if you display the MAX reading, and you press "Clr", only the MAX value is cleared. The TWA is still accumulating in the background.

2.5.4. PEAK Mode

The PEAK mode displays the current detected concentration. The reading is updated once a second. In the background, the 2020 datalogger is sampling the concentration and measuring minimum, maximum, and average concentrations for the selected averaging interval. At the end of every interval, one entry is placed in the datalogger until the datalogger is full. See Section 2.8.2 for details of switching between display modes.

2.6. Set Functions

Set functions are used to setup 2020. There are 3 functions which can be set on the 2020; Calibration, Pump and Clock. Figure 6 shows a map detailing the Set functions and the key presses required for accessing them.

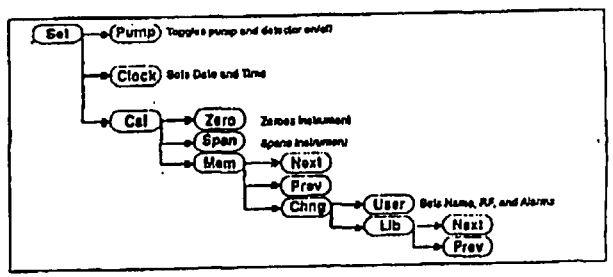

Figure 6 Set Function Map

The default display provides the following information; instrument status, current detected concentration, time, date and measurement units. The status display toggles between showing time and units and then the date.

When the display mode is MAX, the date and time correspond to the date and time the MAX concentration was recorded. In TWA mode, the time represents the number of hours and minutes during which the TWA has been accumulating. For PEAK and STEL monitoring, the date and time correspond to the current date and time.

2.4. Monitoring

2.4.1. Instrument Status

The instrument status is shown on the left of the first line of the status display and on the Table and Graph outputs. Each status has a priority assigned to it. If more than one status is in effect, then the status with the highest priority is displayed until the condition is corrected or until the option is turned off. Table 1 is a list of the possible status messages.

Status	Description
Falt1	Zero fault. See Section 6.2.
Falt2	Span fault. See Section 6.2.
Falt3	Lamp fault. See Section 6.2.
Falt4	Pump fault. See Section 6.2.
Cal	Will not be observed on the display during normal operation as various calibration prompt messages are displayed during calibration. If the instrument is turned off during calibration, Cal will be displayed when 2020 is turned on again to indicate the last calibration was incomplete.
Over	Instrument over range. The detector electronics have become saturated. See Section 6.2.
ALPK	Detected concentration exceeds the PEAK alarm level.
ALST	STEL alarm level has been exceeded.
ALTW	TWA alarm level has been exceeded.
LBat	Battery pack power is low.
ELog	The datalogger is full.

Table 1 Instrument Status

Status	Description
TWA	TWA display mode.
MAX	MAX display mode.
STEL	STEL display mode.
Auto	PEAK display mode.
Loc	Locate site. Used for manual operation.
BkGd	Record background reading. Used for manual operation.
Samp	Record sample reading. Used for manual operation.

Table 1 Instrument Status

2.4.2. Alarms

While operating the instrument, any one of three alarm conditions can occur. To accurately identify the source of the alarm, each type of alarm has been given a unique status. See Table 1.

In addition to the status, 2020 also has an audio alarm and an alarm LED. To conserve power the 2020 alternates between the LED and audio. Different alarms are identified by the frequency at which the 2020 alternates between the audio and LED; Peak alarm 5 times per second, STEL alarm 2.5 times per second, and TWA alarm is 1.25 times per second.

The left soft key is used for acknowledging alarms, and is named "Ack". If no alarm exists, then the "Ack" key is not shown. To clear the alarm, press the "Ack" key. Once acknowledged, the alarm indicators are cleared. The alarm status will remain until the alarm condition clears.

2020 updates the peak concentration once every second. Following every update, the peak concentration is compared to the peak alarm level, and if exceeded, an alarm is triggered.

If 15 minute average exceeds the STEL, a STEL alarm is generated.

The TWA alarm is generated when the current average of concentration, since the TWA was last cleared, has exceeded the TWA exposure limit.

During calibration, all alarms are disabled. Once the calibration is complete the alarms are re-enabled.

Cause: The battery pack is not connected to the instrument correctly.

Action: Ensure the battery pack connector is securely attached to the connector on 2020. See Section 1.5.

Cause: There is an undetermined problem.

Action: Reset 2020. Turn the instrument on and disconnect the battery pack as outlined in Section 1.5.1. You must leave the instrument while you disconnect the battery pack. This will reset the instrument. Reconnect the battery pack and close the battery hatch.

Action: Contact the Photovac Service Department.

Problem: Sample flow rate is less than 300 ml/min.

Cause: Inlet filter has not been installed properly.

Action: Ensure that the inlet filter has been installed correctly. See Section 5.3.

Cause: UV lamp is too long, causing flow to be restricted.

Action: If you have a UV lamp with a white serial number label, it is possible that the lamp is too long for the lampholder. Replace the lamp and contact the Photovac Service Department. See Section 5.2.1.

Cause: UV lamp is too wide, causing flow to be restricted.

Action: If you have a UV lamp with a white serial number label, it is possible that the lamp is too wide for the lampholder. Contact the Photovac Service Department.

Cause: Inlet filter is plugged.

Action: Replace inlet filter. See Section 5.3.

Cause: 2020 has been exposed to a solvent that can pass through the inlet filter and liquid has been aspirated.

Action: Contact the Photovac Service Department.

Cause: Sample outlet is obstructed.

Action: Ensure the sample outlet in not obstructed in any way.

Cause: Pump has been damaged.

Action: Contact the Photovac Service Department.

Problem: Liquid has been aspirated.

Cause: 2020 has been exposed to a solvent that can pass through the inlet filter.

Action: Contact the Photovac Service Department.

Problem: Corrosive gases and vapors have been sampled.

Cause: 2020 has been exposed to corrosive gases and vapors.

Action: Corrosive gases and vapors can affect the electrodes within the detector as well as the lamp window. Prolonged exposure to corrosive materials may result in permanent fogging or etching of the window. If 2020 is exposed to corrosive material, contact the Photovac Service Department.

6.4. Printer Troubleshooting

Problem: Printer will not print.

Cause: Printer is not connected properly.

Action: Make sure that you have the correct cable for your instrument. Ensure that the printer cable is properly connected. If you are using the serial to parallel converter ensure the cables are properly connected to the converter, to the instrument and to the printer.

Note: Turn the converter and the instrument off before connecting the cables.

Cause: Mechanical problem with the printer.

Action: Make sure that the printer is plugged in and turned on.

Action: Make sure that the printer is on-line, as shown on its control panel.

Action: Check the ribbon, the print wheel or cartridge, and the paper supply.

Cause: The serial to parallel converter is not turned on.

Action: Ensure the serial to parallel converter is connected to the AC adapter and the adapter is plugged into an AC outlet. The red LED on the top of the converter will be on.

Cause: Printer cable is not configured correctly.

Action: In order to modify the existing printer cable, the pinout information for the printer connector is required. Refer to the printer user's manual for specific details. The pinouts for the 2020 printer cable are shown in Figure 22. If modifying the cable is not possible, take the electrical and pinout information to a computer store where a suitable adapter may be obtained.

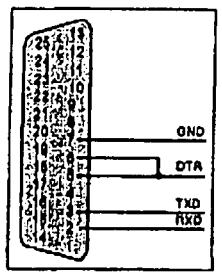

Figure 22 Printer Cable Configuration

Cause: Printer is not configured properly.

Action: Many printers have a set of configuration (DIP) switches. Generally, Photovac instruments expect these switches to be set in the factory default settings.

Many printers have switches for enabling automatic line feeds when receiving a carriage return. These switches should be set to carriage returns only, which is normally the factory default setting.

Some printers have switches or control panels that enable you to set the printer for different modes, such as sans serif, letter quality, or compressed text. Do not use these controls. If you do use them, you may cause your tabular or graphed output to be printed incorrectly.

Cause: Serial card is installed in the printer.

Action: If a serial card is installed in your printer, you do not need the serial to parallel converter. Disconnect the converter and connect the instrument directly to the printer.

Problem: Data are printed or downloaded correctly at first but become garbled.

Cause: Baud rate may be set too high.

Action: Ensure the baud of the printer is set to 9600 baud.

6.5. Serial to Parallel Converter Troubleshooting

You must use the correct type of cable to ensure trouble free data transmission. The length of the cable at the parallel side must not exceed 15 feet. On the serial side, use only the 2020 printer cable and suitable adapter.

When you are connecting the parallel side of the converter to a Centronics 36 pin, female connector, use a straight wired cable with 36 conductors and a Centronics 36 pin, male connector at each end. This cable is supplied with the converter.

When you are connecting the parallel side of the converter to a Centronics 36 pin, male connector, use a straight wired cable with 36 conductors and a Centronics 36 pin, female connector at one end and a Centronics 36 pin, male connector at the other end.

If you are connecting the parallel side of the converter to a female DB-25 pin connector use a straight wired cable with a DB-25 pin, male connector on one end and a 36 pin, Centronics, male connector on the other end. The pin assignments for all parallel port signals are listed below.

Pin #	Name	I/O Parallel to Serial	I/O Serial to Parallel
1	/Strobe	In	Out
2-9	Data0-7	In	Out
10	/Acknlg	Out	Not Used
11	Busy	Out	—
12	PE	Pull Low	Pull High
13	Select	Pull High	Pull Low
14	/Auto FF	Not Used	Not Used
15	NC	Not Used	Not Used
16	Ground	—	—
17	NC	Not Used	Not Used
18	NC	Not Used	Not Used
19-30	Ground	—	—
31	/Init	Not Used	Out
32	/Error	Pull High	Pull High
33	Ground	—	—
34	NC	Not Used	Not Used
35	NC	Not Used	Not Used
36	/Slct In	Not Used	Not Used

Table 8 Serial to Parallel Converter Parallel Port Signals

The pin assignments for all serial port signals are listed below.

Pin #	Name	I/O Parallel to Serial	I/O Serial to Parallel
1	Frame Ground	—	—
2	TXD	Out	Out
3	RXD	In	In
6	DSR	In	—
7	GND	—	—
20	DTR	—	Out

Table 9 Serial to Parallel Converter Serial Port Signals

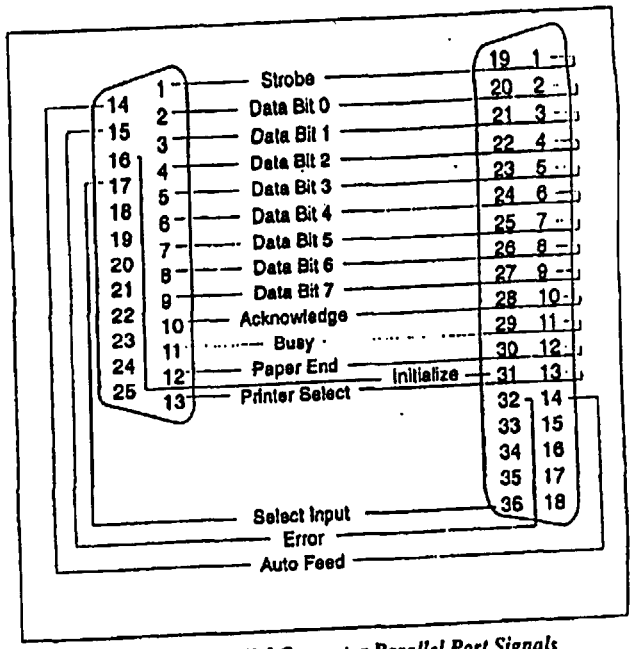

Figure 23 Serial to Parallel Converter Parallel Port Signals

Note: A DB-25, female connector is sometimes a parallel port. Do not connect the serial port of the converter to a parallel port.

6.6. Establishing Computer Communications

If, after having followed the procedure in Section 4.2, communications cannot be established with a computer, the problem may lie with the hardware connections or the printer cable configuration.

1. Ensure 2020 is connected to the serial port of the computer.

   The serial port will usually be a male connector, typically 9 pins on an IBM-AT® and compatibles and 25 pins on an IBM-XT® and compatibles. The 25 (or more) pin female connector is usually a parallel port. An exception to this rule is Tandy® Computers, which use a female 25 pin connector for the serial port. 2020 cannot be connected to a parallel port unless you are

using the serial to parallel converter. (Photovac Part No. 380145)

If you do not have a free serial port on you computer and you want to connect 2020 to the parallel port, you will need the serial to parallel converter. Connect 2020 to the serial port on the converter and then connect the computer to the parallel port. If the port on the computer is anything other than a female, 36 pin Centronics connector you will need an adapter in order to use the cable supplied with the converter. See Section 6.5 for more details.

2. Ensure the cable being used is compatible with the device.

   An IBM-AT and compatibles with a 9 pin serial connector will first require a null modem to switch pins 2 and 3. Next a gender changer that converts the male DB-25 connector on the printer cable from male 25 pins to female 9 pins is required. These two adapters have been combined into one, which is supplied in the 2020 cable kit.

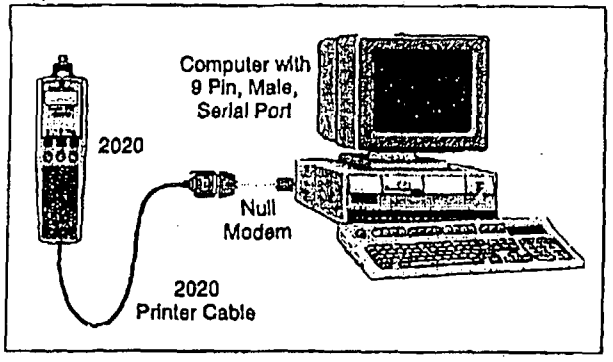

Figure 24 Connecting 2020 Using the Null Modem Cable

An IBM-XT and compatibles should not require a null modem but will require a gender changer. A gender changer will convert the male DB-25 connector on the printer cable to a female connector. A gender changer is supplied with the 2020 printer kit.

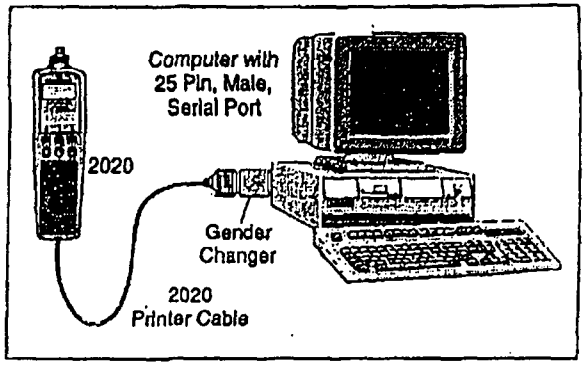

Figure 25 Connecting 2020 Using the Gender Changer

The pin definitions of interest are listed in Table 11. Only pins 2 and 3 are shown since these are the problem pins:

Pin #	2020	IBM-AT	IBM-XT
2	RXD	RXD	TXD
3	TXD	TXD	RXD

Table 10 Serial Port Pin Definitions

Pins 2 and 3 should be mismatched between 2020 and the computer. Ensure this is the case. It is also possible that the cable being used may switch pins 2 and 3, even if it is not necessary. The cable may be a null modem. IBM-XT cables are usually null modems, since a null modem is required for connection to a printer.

If you are using an IBM-AT and find that a null modem is not required it is possible that an IBM-XT serial port has been added to an expansion slot and thus does not require a null modem. The opposite may be the case if an IBM-AT serial port was added to an IBM-XT expansion slot, in which case the null modem is required.

3. Ensure all hardware is working properly.

   Use a printer to test both 2020 and the computer. Connect 2020 to the printer and ensure that this arrangement produces the desired results. If the correct printout is obtained, then the 2020 and the printer cable are okay.

Now connect the computer to the printer and ensure this works. If the desired printout is obtained this ensures the computer parts are handling data correctly.

7. Technical Description

7.1. General Operation

2020 is a microprocessor controlled air monitor for measuring the presence of photoionizable chemicals in air at parts-per-million levels. The block diagram in Figure 26 shows the main components of 2020.

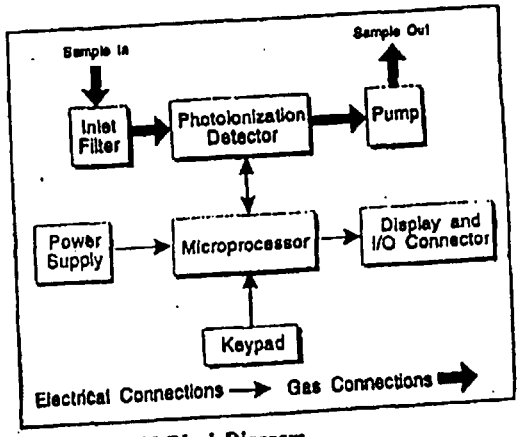

Figure 26 2020 Block Diagram

The microprocessor controls the components of the instrument and interprets and records the signal generated by the photoionization

detector (PID). Recorded data and setup information entered into the microprocessor's memory are retained when 2020 is turned off.

A pump continuously pulls the air under test through 2020's PID. The PID converts the concentration of photoionizable chemicals in the sample into an electrical signal. The microprocessor subtracts any background from the signal and divides this signal by a sensitivity obtained by calibrating with a standard gas of known concentration. This concentration appears on 2020's display and, depending on the values entered through 2020's keypad, an alarm status may be displayed and an audio signal may be heard.

2020 can detect thousands of different types of airborne gases and vapors and its response depends on the type as well as the concentration. 2020 does not distinguish one type of chemical from another, but displays a number indicating the total concentration of all photoionizable compounds in the sample.

A standard of isobutylene at a known concentration may be used for setting the sensitivity. If 2020 is calibrated with isobutylene, it displays concentrations in units equivalent to ppm of isobutylene. If isobutylene were the only photoionizable chemical in the sample, then 2020 would display its concentration directly.

2020 responds more or less readily to other chemicals than it does to isobutylene. Because it has a medium sensitivity to isobutylene, this gas has been chosen as a reliable means of reporting an average concentration of total ionizables present.

For special applications, gases other than isobutylene can be used to calibrate 2020.

7.2. Photoionization Detector

2020's PID is shown in

Figure 27. The PID measures the concentration of photoionizable chemicals in the gas stream from the sample inlet and produces an electrical signal for the microprocessor.

A UV lamp generates photons which ionize specific molecules in the gas stream. The permanent air gases (argon, carbon dioxide, nitrogen, oxygen, water vapor etc.) require a relatively high energy for ionization, and are not ionized by the UV photons. Many of the chemicals considered pollutants, including most hydrocarbons, are ionized.

The gas stream is directed into the PID through a small port at the center of the UV lamp window and through a series of larger ports around the perimeter of the lamp window. This arrangement permits a high sample flow rate and short response.

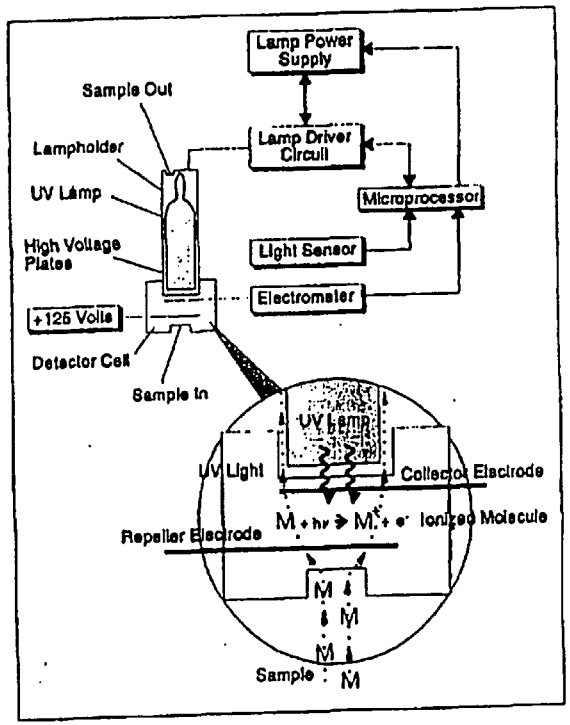

Figure 27 Photoionization Detector

The ionized molecules in the detector cell are subjected to a continuous electric field between the repeller electrode and the collector electrode. The ions move in the electric field, generating a current which is proportional to the concentration of the ionized molecules in the detector cell. An electrometer circuit converts the current to a voltage which is then fed to the microprocessor.

The detector lamp is operated by a high voltage lamp driver circuit which delivers high voltage energy to the lamp through plates in the

lampholder. The lamp driver power supply is controlled by the microprocessor based on a feedback signal from a light sensor on the driver circuit board.

7.3. Calibration

Periodic calibration is required to compensate for 2020 output changes due to inlet filter restriction, ionization chamber cleanliness, pump wear and other factors.

During calibration, 2020 is first exposed to zero air. A small signal is generated. This zero signal is stored by the microprocessor.

2020 is next exposed to span gas. This span gas signal is stored by the microprocessor. The microprocessor subtracts the zero signal from the span gas signal and divides the difference by the user-entered span gas concentration. The resulting sensitivity is stored in the selected Cal Memory with the zero signal and the alarm levels. This number is then multiplied by the response factor and displayed.

2020 readings are always relative to the calibration gas. After calibration with isobutylene, 2020 will respond directly in units equivalent to isobutylene. Most volatile organic compounds will be detected by 2020. It cannot distinguish between isobutylene and other ionizable compounds. A reading of 10 ppm indicates all ionizable compounds that are present have generated an ion current proportional to 10 ppm of isobutylene. The reading is actually 10 ppm isobutylene equivalent units. 2020 readings give an indication of the total ionizables present and their concentration relative to the calibration gas.

7.4. Datalogger

7.4.1. Interval Operation

The microprocessor accumulates all readings in an averaging interval, that you select, and determines the minimum, average and maximum readings. It stores these numbers along with the highest priority instrument status and the most recent time and date. The datalogger can store 1000 of these entries.

These recorded data can now be reviewed and edited. Recorded data can also be printed as either a table or a graph. For each averaging interval, 2020 prints the minimum of all the minima, the average of all the readings for the interval and the maximum of all the maxima.

In PEAK mode, the reading is updated once a second. In the background, the 2020 datalogger is sampling the concentration and measuring min, max, and average concentrations for the selected averaging interval. At the end of every interval, one entry is placed in the datalogger until the datalogger is full.

The MAX mode displays the maximum signal, with the date and time that it was recorded. 2020 continues to log data according to the selected averaging interval, but only the maximum detected concentration is displayed on the meter display.

In STEL mode, 15 samples are combined to form a 15 minute average. Once every minute, the oldest of the 15 samples is replaced with a new one minute average. This moving average provides a 15 minute average with a one minute update rate so the meter display will only update once every minute. STEL is set to zero each time the instrument is turned on.

STEL calculations are always being performed by 2020. You can display the results of the calculations by selecting STEL as the Display mode

TWA mode sums concentrations every second until 8 hours of data have been accumulated. Once 8 hours of data have been summed, the accumulation stops.

This sum will only be complete after 8 hours, so the meter displays the current sum divided by 8 hours. While you are in TWA mode, the time on the status display will show the number of minutes and hours of data that TWA has accumulated. When this reaches 8 hours, 2020 stops accumulating data and the TWA is complete.

TWA calculations are always being performed by 2020. You can display the results of the calculations by selecting TWA as the Display mode.

7.4.2. Manual Mode

In manual operation you are prompted to locate a specific sampling site and then record both a background and a sample entry in the datalogger. 2020 stores these numbers along with the highest priority instrument status and the most recent time and date.

Recorded data can also be printed as either a table or a graph. The difference between the sample and background is calculated and shown on the printed output.

8. Appendices

8.1. Specifications

Size:	25.4 cm (10") long, 7.6 cm (3") wide, 5 cm (2") high
Weight:	0.8 kgs (1.75 lbs)
Detector:	Instant on photoionization detector.
Keypad:	6 silicone keys with tactile feedback
Status Display:	2-line, 16-character dot-matrix, backlit, liquid crystal display for alphanumeric readouts soft key display.
Meter Display:	4 digit, 7 segment display for real time concentration readout.
Datalogger memory:	16 kilobytes or 1000 entries
Serial output:	RS-232, 9600 baud, 8 data bits with no parity, for tabular and graphic printouts and connection to an IBM compatible computer
Audio output:	95 decibels @ 2048 Hz, on Alarm
Inlet connection:	1/8" compression fitting
Battery type:	Nickel cadmium rechargeable cell with intelligent charger

Charge/discharge time:	4 hr/8 hr
Battery charger:	Automatically charges and maintains full charge in battery pack
Materials in sample stream:	Stainless steel, Teflon®, Viton®, polypropylene, nitrile chorobutadiene rubber, nickel
Inlet filter:	Replaceable Teflon/Polypropylene, 1 um
Inlet flow rate:	Greater than 300 mL/min.
Operating temperature range:	0 to 40°C
Operating humidity range:	0 to 100% relative humidity (non-condensing)
Operating concentration range:	0.5 to 2000 ppm, isobutylene
Accuracy:	+/-10% or +/-2 ppm, whichever is greater
Precision:	1% of calibration (calibrated with 100 ppm isobutylene)
Response time:	Less than 3 seconds to 90%
Detection limit:	0.5 ppm isobutylene
Dilution probe:	Normal calibration: concentrations between 100 to 20000 ppm +/- 20% High accuracy calibration: concentrations between 100 to 1000 ppm +/- 15%. Concentrations between 1000 to 20000 ppm +/- 20%

Note: Specifications subject to change without notice.

8.2. Warranty

2020 is warranted for one year against defects in materials and workmanship.

Photovac warrants that its manufactured product will be free from defects in materials and workmanship for a period of one (1) year

from the date of receipt by the Customer. This may be voided if, in the opinion of Photovac, the product has been abused or treated in a negligent manner so as to cause damage or failure. Negligent use includes, but is not limited to, exposure of the internal parts of the equipment to water. Damage caused thereby is expressly excluded from this Warranty.

Consumable supplies and parts routinely replaced are not warranted.

Photovac and its vendors disclaim any implied warranty of merchantability or fitness for a particular purpose. Photovac and its vendors will not be liable for any indirect, special, incidental, or consequential damages, irrespective of whether Photovac or the vendor has advance notice of the possibility of such damages.

Photovac's sole liability under this warranty is limited to the repair or replacement of the product at its Service/Repair facility and return to the Customer.

When Photovac is made aware of a problem which would be eligible for remedy under Warranty, it will issue a Return Authorization Number to the Customer. No return will be accepted unless such authorization has been obtained. The customer is responsible for insurance and shipping to the designated Photovac Service/Repair facility.

In USA:

Photovac Monitoring Instruments
25-B Jefryn Boulevard West
Deer Park, New York
11729

Tel:(516)254-4330
Fax:(516)254-4284

In Canada:

Photovac Incorporated
330 Cochrane Drive
Markham, Ontario
Canada, L3R 8E5

Tel: (905)477-8088
Fax: (905)477-8220

In Europe:

Photovac Europa
Sondervang 19
DK 4100 Ringsted
Denmark

Tel: +45-5767-5008
Fax: +45-5767-5018

In all other areas contact your Photovac representative.

8.3. Installing Alternate AC Plug on the Battery Charger

In most cases 2020 will be shipped with an AC line cord that will fit the AC wall outlet in your area. If this cannot be done, you may need to obtain an AC line cord suitable for the AC receptacle in your area.

The AC line cord, attached plug and receptacle must be marked with your country's certification mark and the cord must have a Harmonization (HAR) mark.

The line cord must be rated for either 100 to 120 VAC at 60 Hz or 220 to 240 VAC at 50 Hz. The voltage rating will depend on the voltage in your area.

Contact your Photovac representative to obtain more information.

8.4. Calibration Gas Supplier

The recommended span gas is isobutylene in air. 100 ppm isobutylene in air may be obtained from Photovac. (Photovac Part No. 350012, 395066).

The exact concentration will be determined by your application. Other concentrations and other gases may be obtained from Scott Specialty Gases Inc. When ordering, specify a Scotty® V or Mini-Mix™ Cylinder.

Scott Specialty Gases Inc.
1290 Combermere Street
Troy, Michigan 48083

Telephone (within the USA): 1-800-774-9447
Telephone (outside USA): 1-810-589-2950
Fax: 810-589-2134

8.5. Using the Gas Bag

1. Turn the knurled plastic knob counterclockwise to loosen it, then use the knurled collar on the valve tube to gently push the valve tube in, toward the bag.
2. Turn the regulator knob counterclockwise about half a turn to start the flow of gas. Fill the gas bag about half full and then close the regulator.

3. Open the syringe port and empty the bag. Flush the bag a few times with the calibration gas and then fill it.

4. To close the gas bag valve, gently pull the valve tube away from the bag, then turn the knurled plastic knob clockwise to tighten it against the valve tube.

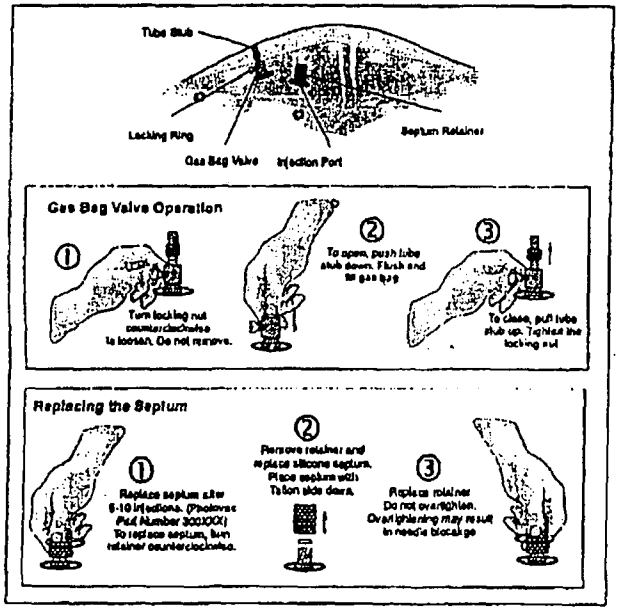

Figure 28 Using the Gas Bag

8.6. Response Factors

The response factors were determined over the range 5 - 500 ppm, based on a 100 ppm isobutylene calibration. isobutylene RF = 1.0. The following formula was used for calculation of response factors:

$$\text{Response Factor} = \frac{\text{Actual Concentration}}{\text{2020 Response}}$$

A response factor less than 1.0 indicates a compound response better than that of isobutylene. A response factor greater than 1.0 indicates a lower response than that of isobutylene.

> **Note:** It does not matter which Cal Memory is selected or which *response factor is entered, 2020's response is not specific to* any one compound. The reading displayed represents the total concentration of all ionizable compounds in the sample.

When using response factors, results are expected to be accurate to +/- 10 ppm or +/- 25%, whichever is greater.

Compound	Response Factor
Acetaldehyde	6.6
Acetone	1.2
Acrolein (2-Propenal)	3.3
Allyl Chloride (3-Chloro-1-Propene)	4.0
Benzene	0.5
Bromoform (Tribromomethane)	2.2*
1,3-Butadiene	0.8
n-Butanol	3.1
n-Butyl Acetate	2.2
n-Butyl Acrylate	1.6
n-Butyl Mercaptan (Butanethiol)	0.5
Carbon Disulfide	1.2
Chlorobenzene	0.4
Crotonaldehyde (2-Butenal)	1.2*
Cumene (Isopropylbenzene)	0.6*
Cyclohexane	1.3
Cyclohexanone	0.9*
1,2-Dichlorobenzene (ortho-)	0.5*
cis-1,2-Dichloroethylene	0.8
trans-1,2-Dichloroethylene	0.4
N,N-Dimethylformamide (DMF)	0.8*
1,4-Dioxane	1.3
Epichlorohydrin	4.5*
Ethanol	9.5

Table 11 Response Factors

Compound	Response Factor
Ethyl Acetate	3.8
Ethyl Acrylate	2.2
Ethylbenzene	0.5*
Ethyl Cellosolve (2-Ethoxyethanol)	1.0*
Ethyl Ether (Diethyl Ether)	1.1*
Ethyl Mercaptan (Ethanethiol)	0.6
Ethylene	9.6
n-Heptane	2.3*
n-Hexane	4.5
Hydrogen Sulfide	3.3
Isoamyl Acetate	1.6*
Isobutyl Acetate	2.0
Isobutyraldehyde	1.2
Isopentane	8.1
Isoprene (2-Methyl-1,3-Butadiene)	0.6
Isopropanol	3.8
Isopropyl Acetate	2.2
Isopropyl Ether	0.8*
Methyl Bromide (Bromomethane)	1.7
Methyl Ethyl Ketone (2-Butanone)	0.8
Methyl Isobutyl Ketone	0.9*
Methyl Mercaptan	0.5
Methyl Methacrylate	1.4*
Methyl tert-Butyl Ether (MTBE)	0.8
Monomethylamine	1.0
n-Nonane	1.2*
iso-Octane (2,2,4-Trimethylpentane)	1.3*
n-Pentane	8.8
n-Propanol	3.6
Propionaldehyde (Propanal)	11.0
n-Propyl Acetate	2.9
Propylene	1.2
Propylene Oxide	5.8
Styrene	0.4*

Table 11 Response Factors - continued

Compound	Response Factor
Tetrachloroethylene (Perchloroethylene)	0.6
Tetrahydrofuran	1.6
Toluene	0.5
Trichloroethylene (TCE)	0.5
Trimethylamine	0.8
Vinyl Acetate	1.3*
Vinyl Bromide	0.4
Vinyl Chloride (Chloroethylene)	1.8
Vinylidene Chloride (1,1-DCE)	0.8
meta -Xylene	0.5*
ortho -Xylene	0.5*
para-Xylene	0.5*

Table 11 Response Factors - continued

Note:

1. Standards used for determination of response factors were from certified gas cylinders, +/- 2% analytical accuracy.
2. Response factors denoted with an asterisk (*) were determined over the range 25 - 250 ppm. These standards were prepared by addition of neat liquid to zero air.

8.7. Library Entries

Library selections simplify Cal Memory programming, and provide standard response factors and alarm levels for approximately 70 applications. The name, response factor and three alarm levels are all set from the library.

You can change any of the values entered in the Cal Memory. Changes, made to the library information that has been loaded into a Cal Memory, will have no effect on the original library entry.

Note: It does not matter which library or Cal Memory is selected or which response factor is entered, 2020's response is not specific to any one compound. The reading displayed represents the total concentration of all ionizable compounds in the sample.

See Section 2.6.4 for details on using libraries to program the Cal memories.

Compound	Code	RF
Acetaldehyde	ACETAL	6.6
Acetone	ACETONE	1.2
Acrolein (2-Propenal) 3	ACROLEIN	3.3
Allyl Chloride (3-Chloro-1-Propene) 3	ALLCHLOR	4.0
Benzene	BENZENE	0.5
Bromoform (Tribromomethane) 3	BROMFORM	2.2
1,3-Butadiene	13BUTADI	0.8
n-Butanol	nBUTANOL	3.1
n-Butyl Acetate	nBUTACET	2.2
n-Butyl Acrylate	nBUTACRY	1.6
n-Butyl Mercaptan (Butanethiol) 4	nBUTMERC	0.5
Carbon Disulfide	CS2	1.2
Chlorobenzene	CHLOBENZ	0.4
Crotonaldehyde (2-Butenal)	CROTONAL	1.2
Cumene (Isopropylbenzene)	CUMENE	0.6
Cyclohexane	CYCHEXAN	1.3
Cyclohexanone	CYCHEXON	0.9
1,2-Dichlorobenzene (ortho-)	12DCBENZ	0.5
cis-1,2-Dichloroethylene	cis12DCE	0.8
trans-1,2-Dichloroethylene	trn12DCE	0.4
N,N-Dimethylformamide (DMF)	N,N-DMF	0.8
1,4-Dioxane	DIOXANE	1.3
Epichlorohydrin 3	EPICLHYD	4.5
Ethanol	ETHANOL	9.5
Ethyl Acetate	ETHYACET	3.8
Ethyl Acrylate	ETHYACRY	2.2
Ethylbenzene	ETBENZEN	0.5
Ethyl Cellosolve (2-Ethoxyethanol)	ETHCELLO	1.0
Ethyl Ether (Diethyl Ether)	ETHETHER	1.1
Ethyl Mercaptan (Ethanethiol) 4	ETHMERC	0.6
Ethylene 5	ETHYLENE	9.6
n-Heptane	nHEPTANE	2.3
n-Hexane	nHEXANE	4.5

Table 12 Library Entries

Compound	Code	RF
Hydrogen Sulfide	H2S	3.3
Isoamyl Acetate	IAMYACET	1.6
Isobutyl Acetate	IBUTACET	2.0
Isobutyraldehyde 6	IBUTALDE	1.2
Isopentane	IPENTANE	8.1
Isoprene (2-Methyl-1,3-Butadiene) 6	ISOPRENE	0.6
Isopropanol	IPA	3.8
Isopropyl Acetate	IPACETAT	2.2
Isopropyl Ether	IPROPETH	0.8
Methyl Bromide (Bromomethane)	MeBROM	1.7
Methyl Ethyl Ketone	MEK	0.8
Methyl Isobutyl Ketone	MIBK	0.9
Methyl Mercaptan (Methanethiol) 4	METHMERC	0.5
Methyl Methacrylate	MeMeACRY	1.4
Methyl tert-Butyl Ether (MTBE)	MTBE	0.8
Monomethylamine	MMeAMINE	1.0
n-Nonane	nNONANE	1.2
iso-Octane (2,2,4-Trimethylpentane)	IOCTANE	1.3
n-Pentane	nPENTANE	8.8
n-Propanol	nPA	3.6
Propionaldehyde (Propanal) 3	PROPANAL	11.0
n-Propyl Acetate	nPROACET	2.92.9
Propylene 5	PROPYLEN	1.2
Propylene Oxide	PROPOXID	5.8
Styrene	STYRENE	0.4
Tetrachloroethylene (PCE)	PCE	0.6
Tetrahydrofuran	THF	1.6
Toluene	TOLUENE	0.5
Trichloroethylene	TCE	0.5
Trimethylamine	TRMeAMIN	0.8
Vinyl Acetate	VINACET	1.3
Vinyl Bromide	VINBROM	0.4
Vinyl Chloride (Chloroethylene)	VINCHLOR	1.8

Table 12 Library Entries - continued

Compound	Code	RF
Vinylidene Chloride (1,1-DCE)	1,1-DCE	0.8
meta-Xylene	mXYLENE	0.5
ortho-Xylene	oXYLENE	0.5
para-Xylene	pXYLENE	0.5

Table 12 Library Entries - continued

Notes

1 Peak alarm levels have been established as the TLV-Ceiling concentration, or the TLV-STEL concentration in those cases where no TLV-Ceiling value exists.

2 In cases where no STEL exists for a compound, the STEL value has been established as equivalent to the TWA value.

3 In cases where recommended exposure limits are below the detection limit for the compound in question, the estimated lower limit of detection has been substituted for those values.

4 2020 is not suitable for monitoring of these compounds at ACGIH recommended levels.

5 A 1000 ppm TWA has been established for those compounds which are "Simple Asphyxiants", and for which no exposure value exists.

6 For those compounds which lack established exposure levels, an arbitrary value of 200 ppm has been established for the TWA, STEL and PEAK alarms.

8.8. References

1. Maslansky, Carol J. and Steven P. Maslansky. *Air Monitoring Instrumentation.* New York: Van Nostrand Reinhold, 1993

2. American Conference of Governmental Industrial Hygienists. *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (1994-1995).* Reprinted with permission

Note: The TLV/BEI™ publication is revised annually.

3. Scott Specialty Gases, Catalog, 1994

4. National Institute for Occupationational Safety and Health. *Recommendations for Occupational Safety and Health, Compendium of Policy Documents and Statements*, January 1992.

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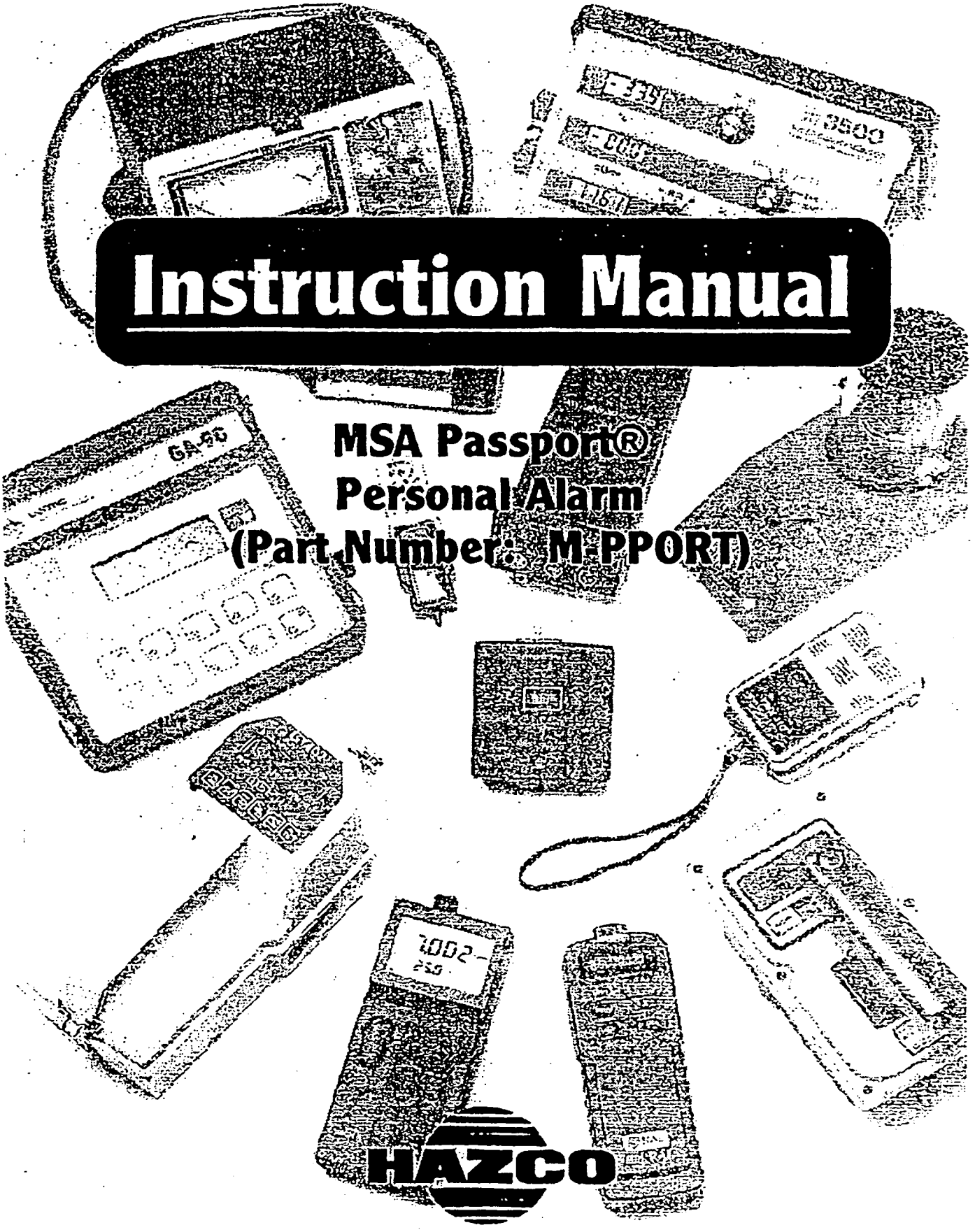
Instruction Manual

MSA Passport®
Personal Alarm
(Part Number: M-PPORT)



HAZCO

1-800-332-0435

MSA

Passport® Personal Alarm

Instruction Manual

⚠ WARNING

THIS MANUAL MUST BE CAREFULLY READ BY ALL INDIVIDUALS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR USING OR SERVICING THE PRODUCT. Like any piece of complex equipment, the PASSPORT PERSONAL ALARM will perform as designed only if it is used and serviced in accordance with the manufacturer's instructions. OTHERWISE IT COULD FAIL TO PERFORM AS DESIGNED AND PERSONS WHO RELY ON THIS PRODUCT FOR THEIR SAFETY COULD SUSTAIN SEVERE PERSONAL INJURY OR DEATH.

The warranties made by Mine Safety Appliances Company with respect to the product are voided if the product is not used and serviced in accordance with the instructions in this manual. Please protect yourself and others by following them. We encourage our customers to write or call regarding this equipment prior to use or for any additional information relative to use or repairs.

⚠ CAUTION

For safety reasons, this equipment must be operated by qualified personnel only. Read and understand the instruction manual completely before operating.

In the U.S., to contact your nearest stocking location, dial toll-free 1-800-MSA-2222. To contact MSA International, dial 1-412-967-3000 or 1-800-MSA-7777.

This manual pertains to instruments with Serial Number prefix "C".

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Manufactured by
MSA INSTRUMENT DIVISION
P.O. Box 427, Pittsburgh, Pennsylvania 15230

(L) Rev 4 803917

Important

The Passport Personal Alarm has three keypad versions:

- Two U.S. versions -
  - original model
  - current production model
- International version (shipped outside U.S.).

The three versions are *functionally identical* and are differentiated by the keypad pushbuttons on the Passport Alarm front panel.

The U.S. versions use English words on the pushbutton descriptions, while the International version uses internationally-recognized symbols (or icons).

Illustrations in this manual are representative of the U.S. current production version (FIGURE 2). Refer to FIGURE 1 for the U.S. original version and FIGURE 3 for the International equivalents to the front panel pushbuttons.

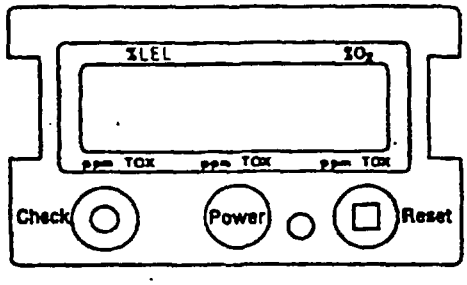

Figure 1. U.S. Version - Original

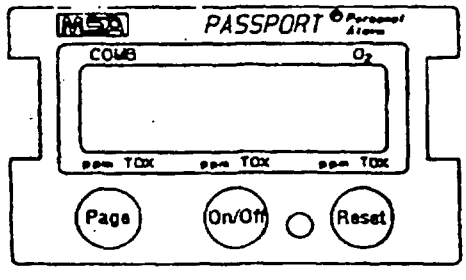

Figure 2. U.S. Version - Current Production

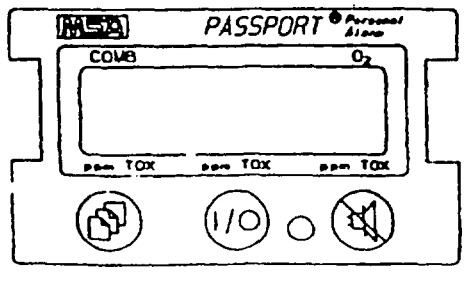

Figure 3. International Version

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Chapter 1
Safety and General Limitations

Certifications

Tests completed by MSA verify that the Passport Personal Alarm meets applicable industry and government standards (as of date of manufacture), including those for Electromagnetic Interference.

Electromagnetic Interference

This equipment has been type tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This equipment was tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment OFF and ON, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio TV technician for help.

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the CRTC.

⚠ WARNING

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

GENERAL LIMITATIONS and ⚠ WARNINGS

The Passport Alarm detects gases and vapors in air only. It cannot measure combustible or toxic gases in:

- **reducing atmospheres**
- **furnace stacks**
- **environments with inert gas backgrounds**

Do not use the Passport Alarm to measure combustible or toxic gases when the amount of oxygen is:

- **deficient**
- **enriched**

The Passport Alarm measures combustible gases and vapors. It cannot measure the presence of combustible:

- **airborne mists such as lubricating oils**
- **airborne dusts such as grain or coal dust**

The Passport Alarm contains sensors which detect specific toxic gases. The instrument must be used to detect only those specific gases. Other toxic hazards may be present; the Passport Alarm is not intended to detect these other hazards.

Certain materials such as:

- **silicone**
- **silicates**
- **lead-containing compounds such as leaded gasoline**

tend to desensitize the combustible gas sensor, thereby giving erroneously low readings. Calibration checks must be made frequently if such materials are suspected to be present in the tested atmosphere.

If you do not recalibrate, the instrument may give false readings and endanger life and health.

For best accuracy, calibrate at the pressure of intended use. Readings will be inaccurate if the Passport Alarm is used to take samples that are at:

- low atmospheric pressure (below calibration pressure)
- high atmospheric pressure (above calibration pressure)

Combustible gases will burn or explode only when the fuel/air mixture is within certain proportions. The minimum concentration of a particular combustible gas in air which can be ignited is defined as the Lower Explosive Limit (LEL). In some references, the term Lower Flammability Limit (LFL) is used.

Combustible gas readings with an OVER alarm in the display indicate an amount of gas which may be above the Lower Explosive Limit (LEL) or above 5% methane (CH_4) by volume. Such readings are beyond the accurate range of the sensor. (See Chapter 4 for limits.)

When sampling with accessory sampling lines, the shortest possible length should be used to minimize the time needed to obtain a valid reading.

When sampling over liquids, the end of the sampling line must not touch the surface of the liquid. Otherwise, liquids may enter the instrument, causing internal damage. In addition, sample gas may be blocked from entering the line, and a false reading may occur.

Obstruction of the sensor holes in the instrument case causes erroneous readings. These holes must be kept open at all times. Do not use compressed air to clean the sensor holes; excessive pressure at the face of the sensors could damage them.

Do not use MSA Lead Inhibitor Filters with this instrument. Loss of sensitivity may result.

Battery packs must be recharged in a non-hazardous location free of combustible gases and vapors.

Dispose of used batteries in accordance with local health and safety regulations.

A calibration check should be included as part of a routine inspection of this instrument to ensure it is operating properly and readings are accurate. See the Passport Portable Alarm Technical Manual for calibration procedure details and calibration kit part numbers.

⚠ CAUTIONS

Acid gases, such as carbon dioxide, will shorten the service life of the oxygen sensor.

Do not push on the center of the oxygen or the toxic gas sensor. Be especially careful when installing or replacing a sensor. Damage to the sensor may result.

This instrument is designed for use only with the battery chargers listed in this manual. Use of other battery chargers may result in damage to the battery pack and instrument.

Use only genuine MSA replacement parts when performing any maintenance procedures described in this manual. Substitution of components may seriously impair instrument performance, alter intrinsic safety characteristics, or void agency approvals.

Repair or alteration of the Passport Alarm beyond the procedures described in this manual could cause the instrument to fail to perform properly.

Chapter 2
Using the Passport Personal Alarm

It is your responsibility to know how to use the Passport Personal Alarm. When used properly, the Passport Alarm will alert you to the presence of combustible gases and vapors and to atmospheres that are rich or deficient in oxygen. It will also alert you to the presence of specific toxic gases if it is equipped with sensors for those gases. These conditions are displayed clearly and simultaneously on the face of the instrument.

Alarm levels are set at the factory and meet the most commonly accepted standards; see Chapter 4 for details. Setpoints can be changed to meet specific conditions.

Preparation

Battery Pack Installation

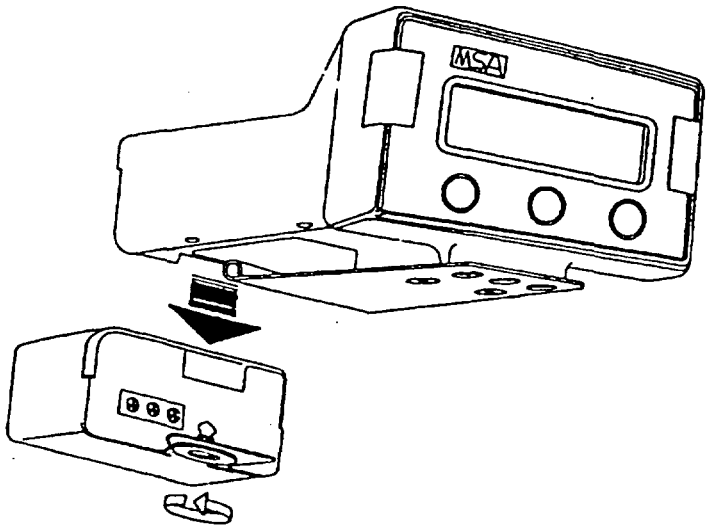

Figure 2-1.
Battery Pack Installation

1. Slide the battery pack toward the sensor face of the instrument, and turn the "quarter-turn fastener" on the bottom of the instrument in a clockwise direction.

2. The instrument responds:
   - backlight flashes
   - screen flashes
   - alarm sounds
   - alarm lights flash
   - major electronic components are tested automatically

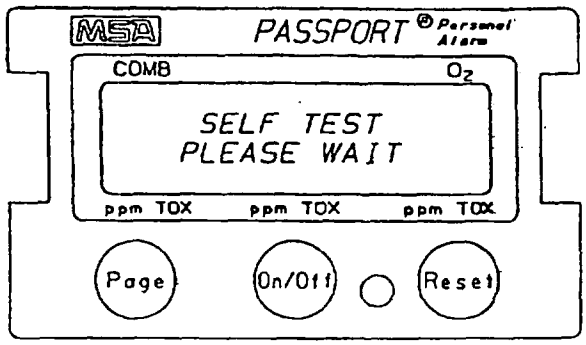

Figure 2-2.
Self Test

After tests are completed, either ERROR or OK appears on the display screen.

When **ERROR** appears:

- Alarm sounds; see the *Troubleshooting Guidelines* in the Passport Alarm Technical Manual.

When **OK** appears:

- The following display appears:

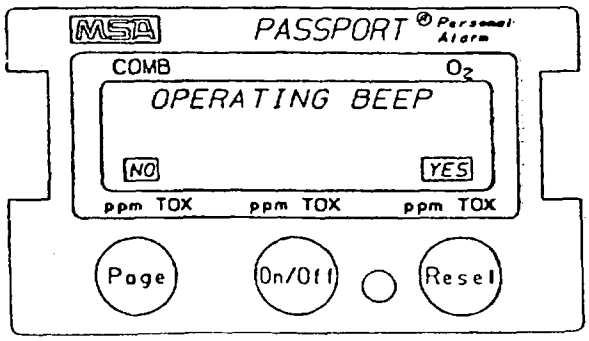

Figure 2-3.
Operating Beep - No/Yes?

If **PAGE** (NO) is pressed, or no buttons are pressed for five seconds, the display changes to **SET TIME.**

If **RESET** (YES) is pressed, the alarm beeps about every 30 seconds, indicating the Passport Alarm is turned ON. The beep does not occur if YES is not selected or the Passport Alarm is turned OFF.

The display now reads:

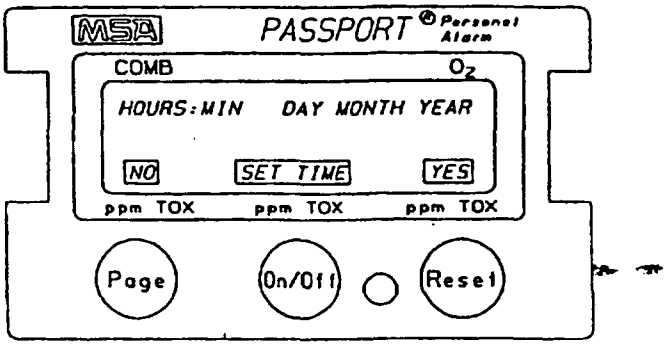

Figure 2-4.
Time and Date Set

To cancel the Time and date set, press the **PAGE** (NO) button or wait 5 seconds.

A long beep sounds and the display reads:

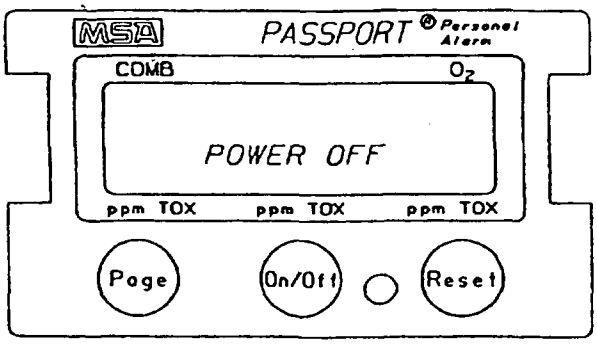

Figure 2-5.
Power OFF

To set the time, press the **RESET** (YES) button.

- The display now reads:

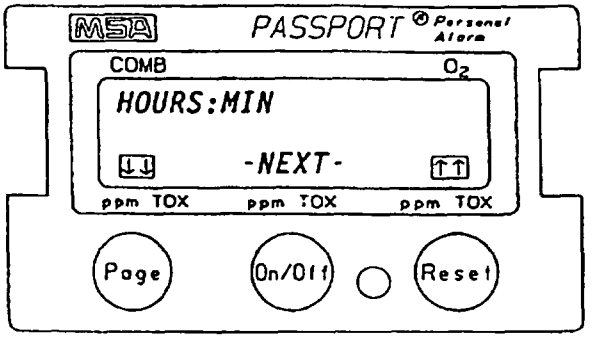

Figure 2-6.
Time Set

- The hour flashes
  - Press the **PAGE** button to lower the hours.
  - Press **RESET** to raise the hours
  - Press the **ON/OFF** button to accept the new number.
- The minutes now flash.
  - Adjust as needed.
  - Press the **ON/OFF** (NEXT) button to accept the reading.
- The display now reads:

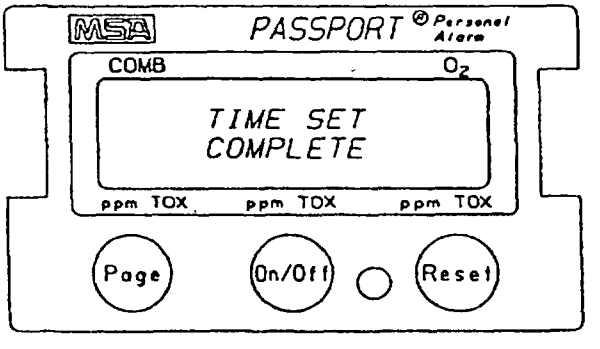

Figure 2-7.
Time Set Complete

- The display automatically displays:

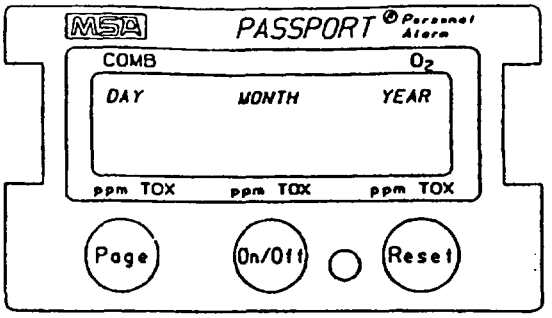

Figure 2-8.
Day, Month, Year

- The day flashes.
  - Press the **PAGE** button to lower the day.
  - Press **RESET** to raise the day.
  - Press **ON/OFF** (NEXT) to accept the reading.

- The month now flashes.
  - Adjust as needed.
  - Press **ON/OFF** (NEXT) to accept the reading.

- The year now flashes.
  - Adjust as needed.
  - Press **ON/OFF** (NEXT) to accept the reading.

- When the selected time/date values are set, the display reads:

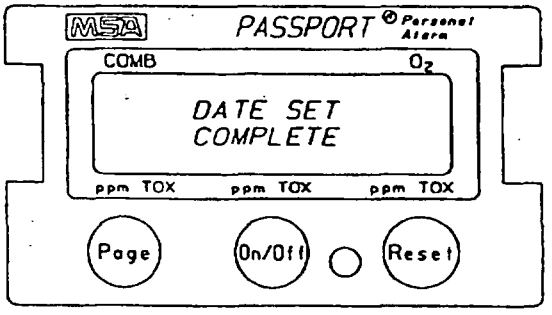

Figure 2-9.
Date Set Complete

- The Alarm sounds.

NOTE: The small battery on the main board which runs the clock has an estimated life of 5-10 years if the main battery pack is not installed, or if it is installed but completely

discharged. This clock battery has a much longer life if a charged battery pack is installed on the Passport Personal Alarm. If the clock is not holding the correct time when the battery pack is reinstalled, the clock battery is dead. Either replace the main board or send the Passport Personal Alarm to a service center to have a new battery soldered onto the main board.

- **POWER OFF** displays for a few seconds, and the instrument turns OFF.
- The Passport Alarm is ready for use after a calibration or

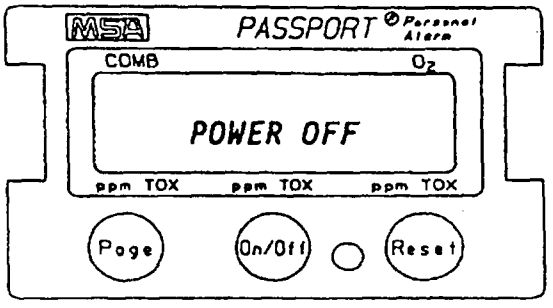

Figure 2-10.
Power OFF

response check is performed.

Turning ON the Passport Personal Alarm

Push the **ON/OFF** button.

- The display flashes and reads:
- The display backlight flashes

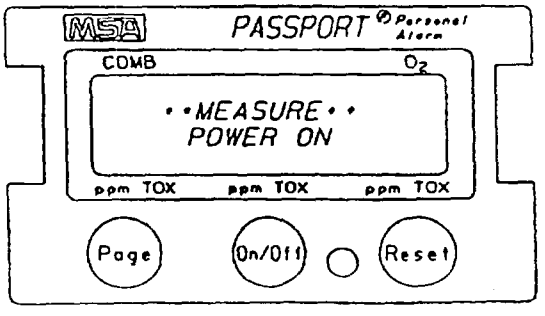

Figure 2-11.
Measure: Power ON

- The alarm lights flash
- The alarm sounds and stops
- The display reads:

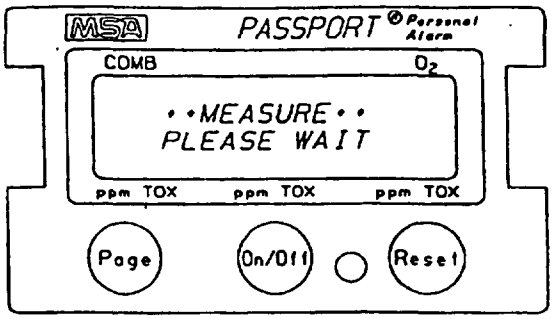

Figure 2-12.
Measure: Please wait

If the Fresh Air Setup (FAS) feature is enabled, the combustible and toxic sensors can be zeroed, and the oxygen sensor can be spanned to 20.8%. FAS must only be used in fresh air. (See *Fresh Air Setup Option* later in this Chapter for additional information.)

Using the Passport Personal Alarm

The Passport Alarm has three standard and three optional display pages. *You can move sequentially from one to the next by pressing the* ***PAGE*** *button.* You can return to the standard Exposure display page by waiting for 15 seconds or by pressing the **ON/OFF** button from another page.

The three standard display pages are:

- Exposure display (normal)
- Battery condition
- Time and date

The three optional display pages are:

- Peak readings
- Short Term Exposure Limit (STEL)
- Time Weighted Average (TWA)

If any of these optional display pages is enabled, it will appear on your instrument in the order shown above.

NOTE: The Passport Personal Alarm measures concentrations of gases no matter what display page is shown. When an

alarm condition is reached, the alarm sounds automatically. The measurements made by the Passport Alarm are NOT dependent upon a specific display page being shown.

Exposure Display

In this normal display page, numbers appear near the gas labels on the instrument's display panel:

To change from the Exposure display to the Battery Condition page, press the **PAGE** button.

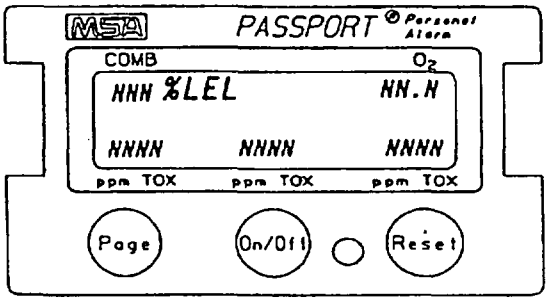

Figure 2-13.
Exposure Page

Battery Condition

The display reads:

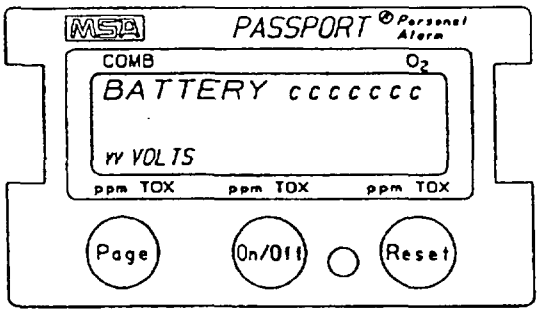

Figure 2-14.
Battery Condition

- **v.v** is the voltage from the battery
- **cccc** is one of three battery conditions that can be displayed on the Battery display page:

- **OK**: enough voltage to function properly
- **LOW**:
  - **BATT** appears in the Exposure Display Page
  - Horn sounds (Press the **RESET** button to silence it.)
  - After initial **LOW** warning, the horn sounds approximately every five minutes
  - The battery will operate the Passport Alarm for approximately 10 more minutes provided the **RESET** button is pressed after each warning.
  - The instrument will continue to operate until the power is turned OFF or the battery condition is at **BATTERY SHUTDOWN** level.
- **BATTERY SHUTDOWN:** the battery is no longer able to operate the instrument, and:
  - **BATTERY SHUTDOWN** appears in place of the Exposure Display Page. Horn sounds continuously and cannot be reset.
  - Alarm lights flash.
  - No other pages can be viewed.
  - After approximately five minutes, the instrument shuts down automatically.

⚠ WARNING

When the Battery Shutdown condition sounds, stop using the instrument. It cannot alert you of potential hazards because it does not have enough power to operate properly. You must:

1. **Leave the area immediately.**
2. **Turn OFF the instrument if it is ON.**
3. **Report to the person responsible for maintenance. Replace or recharge the battery pack.**

If you do not follow this procedure, you could be injured or killed.

⚠ WARNING

Do not use rechargeable nickel cadmium batteries in Alkaline battery packs. The Alkaline battery warning and alarm setpoints are not optimized for nickel cadmium batteries. The low battery warning and alarm could occur too quickly to be noticed. If you do use nickel cadmium batteries in the alkaline battery pack you could be injured or killed.

NOTE: The Passport unit recognizes the type of battery pack (rechargeable nickel cadmium or replaceable alkaline) is attached and automatically adjusts the low battery warning and alarm setpoints.

Time Display

Press the **PAGE** button

In the third standard display page, the time and date are displayed. The time is displayed in a 24-hour format. For example, *"Sept. 1 1992"* would read as follows at 3 p.m.:

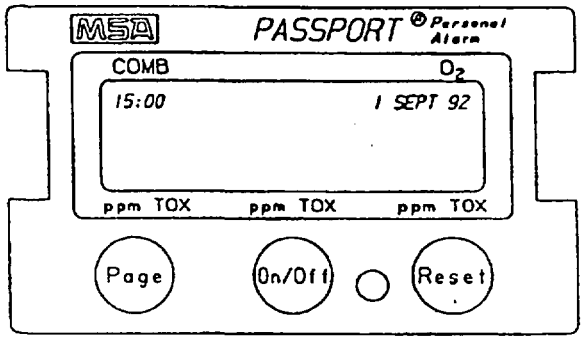

Figure 2-15.
Time Display

Calibration Check

CAUTION

The following calibration check should be performed before each day's use. This calibration check is very simple and should only take one to five minutes, depending on the number and type of gases your Passport Alarm is equipped to sense. Turn the Passport Alarm ON in clean fresh air, and verify that the readings indicate no gas present. If necessary, perform the procedure given in *Fresh Air Setup Option* later in this Chapter.

1. Attach the pump module or calibration cap to the Passport Alarm, orienting the inlet fitting to point toward the battery pack.
2. Attach the calibration adapter (P/N 636246) to the calibration cap or pump module.
3. Attach the regulator supplied with the calibration kit to the cylinder.
4. Connect the black tubing supplied with the calibration kit to the regulator.

5. Open the valve on the regulator, and connect the other end of the tubing to the inlet fitting.

The flow rate of the regulator is 0.25 lpm. Note the readings on the Passport display; they should be within the limits stated on the calibration cylinder or limits determined by your company. (If necessary, change cylinders to introduce other calibration gases.)

If the readings are not within these limits, the Passport Alarm requires recalibration. Return the instrument to your maintenance facility, or refer to the Passport Personal Alarm Technical Manual, Chapter 2, *Calibration* for detailed calibration instructions.

This calibration procedure applies to calibration gases available in cylinders. For those calibration gases only available in ampoules, refer to the Passport Personal Alarm Technical Manual, Chapter 2, *Calibration.*

Measuring Gas Concentrations

Combustible Gases (COMB)

The Passport Alarm detects combustible gases in the atmosphere. The Alarms sound when concentrations reach:

- Alarm setpoint, or
- 100% LEL (Lower Explosive Limit), or
- 5% CH_4 (Methane by volume)

When the combustible gas indication reaches the Alarm Setpoint:

- Alarm sounds
- Alarm lights flash;

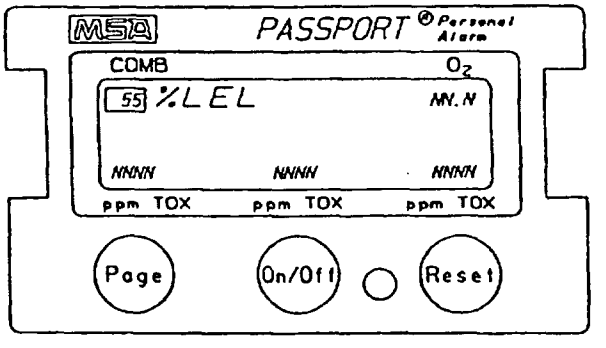

Figure 2-16.
Combustible Gas Alarm Flag

- Press the **RESET** button to silence the alarm.
- Concentration of gas flashes in the display.

When the combustible gas indication reaches 100% LEL or 5% CH_4 of the combustible gas:

- Alarm sounds;
    - This alarm *cannot* be reset with the **RESET** button.

The LockAlarm™ circuit locks the combustible gas reading and alarm if the gas reading exceeds 100% LEL or 5% methane.

- **OVER** appears on the display.

The alarm can be reset by turning off the instrument and moving to a safe, fresh-air environment.

⚠ WARNING

When the OVER alarm condition is reached, you are in a life-threatening situation; there is enough gas in the atmosphere for an explosion to occur.

You must:

1. **Leave the area immediately.**
2. **Turn OFF the instrument and do not turn it ON again until the instrument is in fresh air.**

If you do not follow this procedure, you could be seriously injured or killed.

⚠ CAUTION #1

Any Rapid up-scale reading followed by a declining or erratic reading may indicate a gas concentration beyond upper-scale limit, which may be hazardous.

⚠ CAUTION #2

High off-scale readings (indicated by "OVER") may indicate an explosive concentration. Only the combustible gas detection portion of this instrument has been assessed for performance.

Oxygen Measurements

The Passport Alarm detects the amount of oxygen in the atmosphere. There are two conditions which trigger the alarm:

- Too little oxygen (deficient)

- Too much oxygen (enriched)

At the Alarm Setpoint for either:

- Alarm sounds
- Alarm light flashes
- Concentration of gas flashes in the display

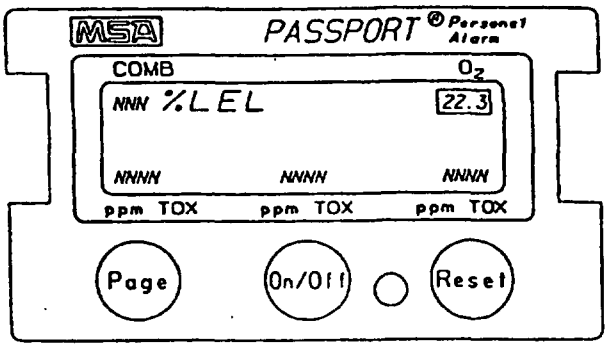

Figure 2-17.
Oxygen Alarm Flag

WARNING

When the OXYGEN alarm sounds, you may be in a life-threatening situation.

You must follow your company's work and safety procedures. If you do not follow those procedures you could be seriously injured or killed.

Toxic Gas Measurement

The Passport Alarm detects certain toxic gases in the atmosphere. Your instrument may have one, two, or three toxic sensors. Each of these sensors has a setpoint which causes an alarm if the gas level goes above that setpoint. When this happens:

- Alarm sounds
- Alarm lights flash
- Concentration of gas flashes in the display

WARNING

When the TOXIC GAS alarm sounds, you may be in a life-threatening situation.

You must follow your company's work and safety procedures. If you do not follow those procedures you could be seriously injured or killed.

Options

Optional Displays

NOTE: The following display pages appear only if enabled by internal switches; see the Passport Alarm Technical Manual for instructions.

Press the **PAGE** button to move to:

Peak Readings

This shows the highest levels of gas that the Passport Alarm recorded since it was turned ON or since the peak readings were reset.

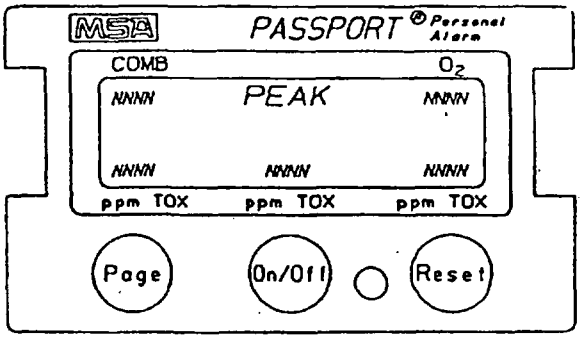

Figure 2-18.
Peak Readings

To reset the Peak Readings:

1. In Peak display, press the **RESET** button.

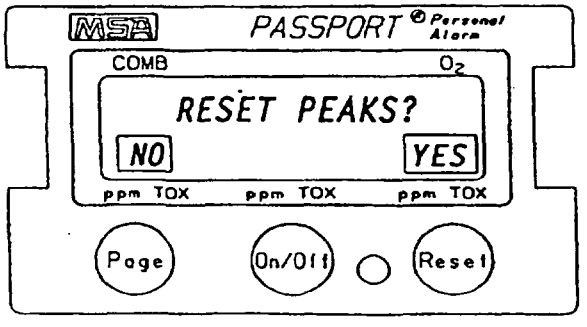

Figure 2-19.
Reset Peak Readings

2. Press the **RESET** (YES) button to reset peak readings or press the **PAGE** (NO) button or wait 15 seconds to cancel.

Press the **PAGE** button to move to:

Short Term Exposure Limit (STEL)

This shows the average exposure over a 15 minute period.

When the amount of gas detected by the Passport Alarm is greater than the STEL limit:

- On the Exposure display page, the screen displays:

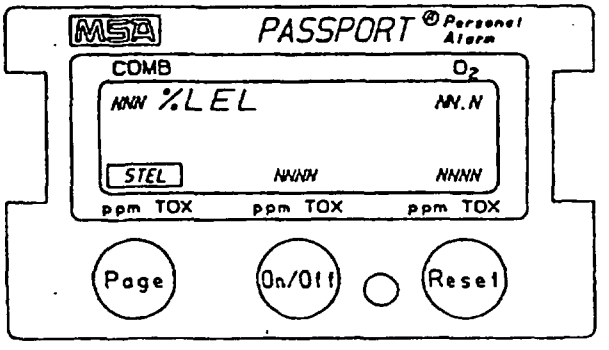

Figure 2-20.
STEL Alarm Flag

- Alarm sounds
- Alarm lights flash

To reset the alarm:

- In the STEL display, press the **RESET** button.

⚠ WARNING

When the STEL alarm sounds you may be exposed to a concentration of gas that is dangerous to your life and health.

You must follow your company's work and safety procedures. If you do not follow those procedures you could be seriously injured or killed.

Press the **PAGE** button to move to:

Time Weighted Average (TWA)

TWA is the average exposure since the TWA reading was reset. The TWA reading may be reset using the following procedure:

- Turn the Passport Alarm OFF for eight or more hours or
- Press the **PAGE** button until the TWA screen appears
    - Press the **RESET** button; the message appears on the display.

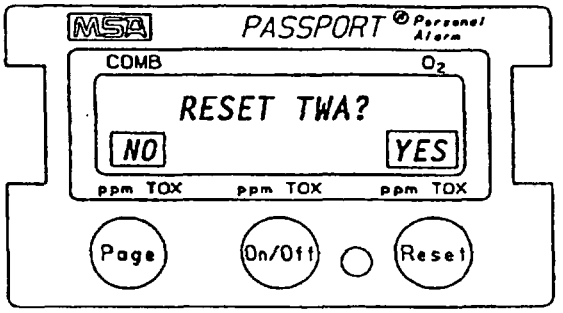

Figure 2-21.
Reset TWA Page

- Press the **RESET** (YES) button.

When the amount of gas detected by the Passport Alarm is greater than the eight-hour TWA limit:

- Alarm sounds
- Alarm lights flash
- On the Exposure display page, the screen displays the TWA alarm flag.

The TWA alarm is calculated over an eight-hour exposure. Calculation examples are as follows:

- 1-hour exposure of 50 PPM:

$$\frac{((1\ hour \times 50\ PPM) + (7\ hours \times 0\ PPM))}{8\ hours} = 6.25\ PPM$$

- 4-hour exposure of 50 PPM
  4-hour exposure of 100 PPM:

$$\frac{((4\ hours \times 50\ PPM) + (4\ hours \times 100\ PPM))}{8\ hours} = 75\ PPM$$

- 12-hour exposure of 100 PPM:

$$\frac{(12\ hours \times 100\ PPM)}{8\ hours} = 150\ PPM$$

NOTE: The accumulated reading is always divided by eight hours.

To reset the alarm:

- In the TWA display, press the **RESET** button.

WARNING

When the TWA alarm sounds you may be exposed to a concentration of gas that is dangerous to your life and health. You must follow your company's work and safety procedures. If you do not follow those procedures you could be seriously injured or killed.

You may press the **PAGE** button to move to the Exposure display.

Optional Sampling Equipment

Sampling lines and related equipment permit samples of gas to be taken from remote or inaccessible locations.

Sampling lines are 5 to 50 feet long and are made of a synthetic material specifically compounded to resist absorption of combustible and toxic vapors. Gases are drawn through the lines to the Passport Alarm by a pump.

Using the shortest possible line reduces the time the pump must run before valid samples and readings can be obtained.

Pump Module Option

When ordered, the pump module is packed separately and may be installed before using the Passport Alarm:

1. Position the pump module as shown, the inlet must point toward the battery.
2. Hand-tighten the screws until snug.

CAUTION

Do not overtighten the screws.

Removing the Pump Module

1. Loosen screws.
2. Remove pump module.

Using Sampling Equipment:

1. Turn OFF the Passport Alarm.
2. Install the Pump Module if it is not already attached (FIGURE 2-22).
3. Attach the Sampling Hose to the Pump Module as shown.

   NOTE: Do not over-tighten the thumb screws on the pump module in an effort to eliminate a leak. The thumb screws should be finger-tight only.

4. Turn ON the instrument, and verify proper operation:
   a. Plug the free end of the sampling line or probe. The pump motor shuts down and an alarm sounds. (The readings on the display may change.)

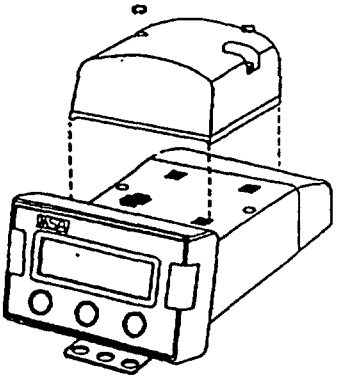

Figure 2-22. Pump Installation

WARNING

When the pump inlet/sample line/probe is blocked, the pump alarm must activate. If the alarm does not activate, check the pump/sample line/probe for leaks; once the leak is fixed, recheck the pump alarm by blocking the flow. Do not use the pump/sample line/probe unless the pump alarm activates when the flow is blocked. If the pump alarm does not activate, do not use the pump/sample line/probe since a sample may not be drawn to the sensors. Inaccurate readings may result. Injury or death may occur.

Periodically, the pump will try to restart. It cannot restart until the sampling line is opened. When the line is open the pump restarts automatically.

   b. Press the **RESET** button to reset the alarm.

CAUTION

Never let the end of the sampling line touch or go under any liquid surface. If liquid is sucked into the instrument, readings will be inaccurate and the instrument could be damaged. We recommend the use of an MSA Sample Probe (part no. 497600, 800332, 800333, or equivalent) containing a special membrane filter, permeable to gas but impermeable to water, to prevent such an occurrence.

Removing Sampling Equipment

1. Turn OFF the Passport Alarm.

2. Unscrew the connector ring on the sampling line, and remove the sampling line.

Fresh Air Set Up Option

(for automatic zero adjustment of the Passport Alarm sensors)

NOTE: The Fresh Air setup has limits. If a dangerous level of gas is present, the Passport Alarm ignores the FAS command and goes into alarm.

⚠ WARNING

Do not activate the fresh air setup unless you are certain you are in fresh, uncontaminated air; otherwise, inaccurate readings may occur. These inaccurate readings may falsely indicate that a hazardous atmosphere is safe, and injury or death could occur. If you have any doubts as to the quality of the surrounding air, do not use the fresh air setup feature.

When the display reads:

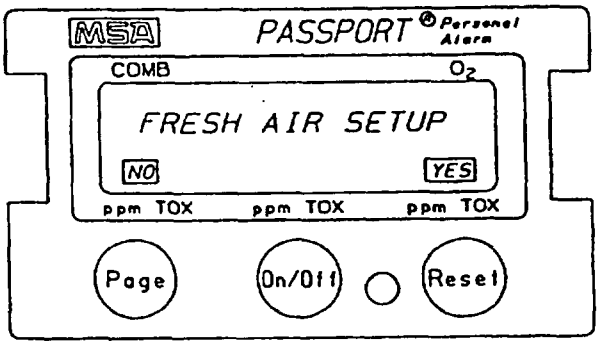

Figure 2-23.
Fresh Air Set-up

The Passport Alarm is ready for its Fresh Air Set Up.

To Proceed With Fresh Air Setup:

1. Press the **RESET** (YES) button; the display reads:

   FRESH AIR SET UP
   PLEASE WAIT

   a. When the display reads:

   FRESH AIR SET UP
   ERROR - CANCELED

   - Alarm sounds
   - Lights flash

   1) Push the **RESET** button.

2) Make certain the Passport Personal Alarm is in fresh air; move to another location, if necessary. Allow the Passport Alarm to warm up for a few minutes to allow the sensors to stabilize.

   Turn the Passport Alarm OFF and then back ON again.

3) If the Passport Alarm cancels the Fresh air Setup request again, calibration adjustments may be required. Report to the person responsible for Passport Alarm maintenance. Do not use the instrument for protection.

b. When the Fresh Air Setup is completed:

- Instrument enters the Exposure display page and displays gas readings.
- Instrument is ready for use.

To Bypass The Fresh Air Set Up:

Press the **PAGE** (NO) button, or wait five seconds.

- Display enters Exposure page.
- Display begins to show gas readings.
- The instrument is ready for use.

If the sensors drift off of zero a few minutes after being turned ON, allow the Passport Alarm to warm up for 15 minutes, then try the Fresh Air Setup again.

Turning OFF the Passport Alarm

Push the **ON/OFF** button, and hold it for five seconds. A countdown appears:

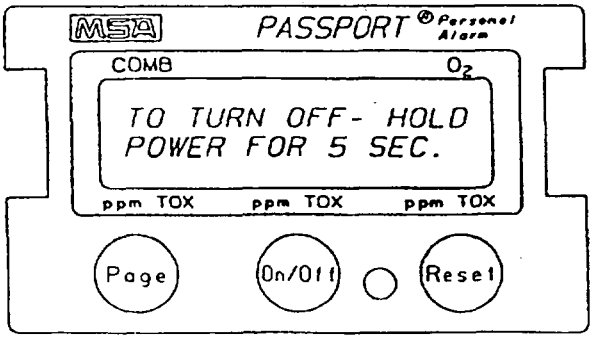

Figure 2-24.
Power Down

Battery Pack Removal

1. Turn the power OFF by pressing and holding the **ON/OFF** button for five seconds.
   - **POWER OFF** appears on the display.
2. Turn the "quarter-turn fastener" on the back of the instrument in a counterclockwise direction.
3. Slide the battery pack away from the sensor face.

Recharging Nickel-Cadmium (Ni-Cd) Battery Packs

The Passport Ni-Cd rechargeable battery packs are charged using the Omega™ battery charging system only. Look for the Omega symbol Ω on the battery pack and charger to make sure they are compatible. Use of any other charger may damage or improperly charge the batteries.

The battery pack will be fully recharged after 16 hours. The Passport unit should be turned off or the battery pack should be removed from the Passport unit during charging. Be certain that the charger is properly connected by checking to see that the charger's LED is lit.

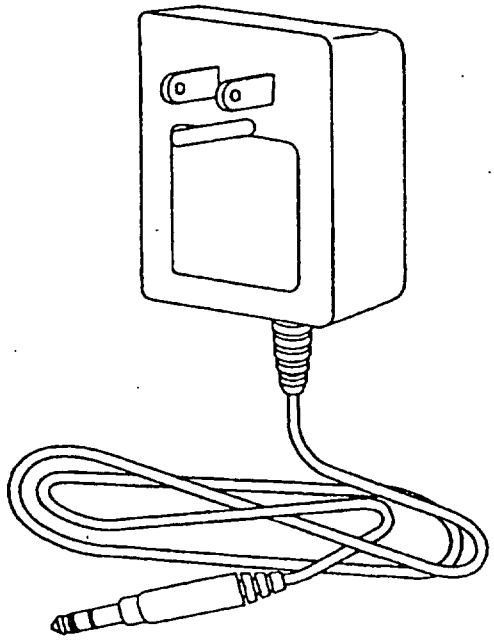

Figure 2-25.
Ni-Cd Charger (120V version shown)

No matter how long the Passport unit was run (one hour or a full shift), the battery pack can be left on charge indefinitely without causing damage - providing that the battery pack was recharged at room temperature. The Omega charger will recharge, but not over-charge, the battery pack.

The battery pack may be charged when it is connected to the Passport Alarm or when it is removed. If the battery pack is connected to the Passport Alarm:

1. Turn OFF the instrument.
2. Insert the charger plug into the jack on the battery pack.
3. Plug the charger into a matching receptacle.

The red light on the charger lights if the charger is properly connected.

BATTERY TYPE	PASSPORT OPERATING TIME (without derating/ at 20°C)	
	WITHOUT PUMP	WITH PUMP
A. NiCd Standard	10-12 hours	8-10 hours
B. NiCd Heavy Duty	20-22 hours	16-18 hours
C. "C" Alkaline	18-20 hours	16 hours

Chapter 3
General Maintenance

As with all electronic equipment, the Passport Alarm will operate only if it is cared for and maintained properly.

⚠ WARNING

Repair or alteration of the Passport Alarm beyond the scope of these instructions by anyone other than a person authorized by MSA may void all warranties and approvals. Such repairs may also endanger persons who rely on this equipment for their safety or health. When needed, use only genuine MSA replacement parts.

Cleaning and Routine Care

The case of the Passport Alarm should be cleaned periodically with a soft cloth dampened with water. If any sensor holes on the front of the instrument are blocked with dirt, they must be cleaned:

1. Remove the sensor cover plate.
2. Clean the holes in the plate with a paper clip, wire, or similar device. The holes may also be cleaned with oil-free compressed air.

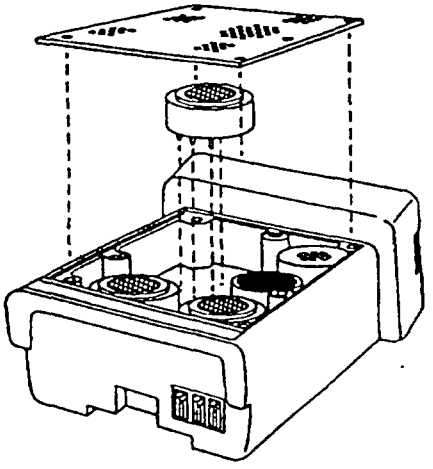

Figure 3-1.
Sensor Cover Plate

⚠ CAUTION

Do not attempt to clean the sensor cover plate while it is in place; otherwise, the sensors may be damaged. The tops of sensors are very

fragile. Do not touch or apply pressure to the tops of any sensors. If a sensor is damaged it may cause the instrument to give false readings.

The sensor cover plate contains holes for five sensors. In instruments with *less* than five sensors, some of these holes are permanently blocked with special sealing membranes. Do not puncture these membranes, or erroneous gas readings may result.

Storage

Store your Passport Alarm in a safe, dry place when it is not in use. Be sure that the storage area temperature is between 23 and 104 degrees Fahrenheit (-5 and 40 degrees Celsius).

- When the Passport Alarm is stored for more than one month, rechargeable battery packs should be periodically charged to prevent battery damage.

Storage for Models with Nitric Oxide (NO) Sensors

These models draw a small amount of power at all times (even when turned OFF) in order to maintain a voltage on toxic gas sensors and keep them ready for immediate use.

- When the Passport Alarm is stored for less than 20 days, recharge the rechargeable battery pack or replace alkaline batteries before storing.
- To store these models for more than 20 days, attach the unit to a battery charger and charge with the proper MSA charger or periodically replace alkaline batteries with fresh cells.

⚠ WARNING

After storage, always recheck the calibration of the instrument before use. During storage, sensors may drift or become inoperative and may not provide warnings of danger to the health and lives of users.

Shipment

1. Remove the battery pack before shipment. When the Passport Alarm is returned for repairs, disconnect the normally used battery pack from the unit, and include it in the container.
2. Pack the Passport Alarm in its original shipping container with suitable padding. If the original container is unavailable, ask your MSA representative for a replacement. An equivalent container may be substituted if necessary. In either case, seal the instrument in a plastic bag to protect it from moisture. Protect the Passport Alarm from the rigors of handling with sufficient padding. Damage due to improper packaging or damage in shipment is not covered by the instrument's warranty.

Chapter 4
Performance Specifications

Performance Specifications		
COMBUSTIBLE GAS	Range	0 to 100% LEL or
		0 to 5% CH_4
	Resolution	1% LEL or
		0.1% CH_4
	Reproducibility	3% LEL to 50% LEL reading
		5% LEL to full scale or
		0.2% CH_4 to 2.5% Methane
		0.3% CH_4 to full scale
	Response Time	90% of final reading in 30 seconds (normal temperature range)
OXYGEN	Range	0 to 25% O_2
	Resolution	0.1% O_2
	Reproducibility	0.3% O_2, for 2 to 25% O_2
	Response Time	90% of final reading: 30 seconds (normal temperature range)
		90% of final reading: 3 minutes (extended temperature range)
CARBON MONOXIDE (APPROPRIATE MODELS ONLY)	Range	1000 ppm CO
	Resolution	1 ppm CO
	Reproducibility	±2 ppm CO or
		10% of reading, whichever is greater
	Response Time	90% of final reading in 40 seconds (normal temperature range)
HYDROGEN SULFIDE (APPROPRIATE MODELS ONLY)	Range	50 ppm H_2S
	Resolution	1 ppm H_2S
	Reproducibility	±2 ppm H_2S or
		10% of reading, whichever is greater
	Response Time	90% of final reading in 65 seconds (normal temperature range)
NITROGEN DIOXIDE (APPROPRIATE MODELS ONLY)	Range	20 ppm NO_2
	Resolution	1 ppm NO_2
	Reproducibility	±2 ppm NO_2 or
		10% of reading, whichever is greater
	Response Time	90% of final reading in 50 seconds (normal temperature range)
NITRIC OXIDE (APPROPRIATE MODELS ONLY)	Range	100 ppm NO
	Resolution	1 ppm NO
	Reproducibility	±2 ppm NO or
		10% of reading, whichever is greater
	Response Time	90% of final reading in 120 seconds (normal temperature range)
SULFUR DIOXIDE (APPROPRIATE MODELS ONLY)	Range	20 ppm H_2S
	Resolution	1 ppm SO_2
	Reproducibility	±2 ppm SO_2 or
		10% of reading, whichever is greater
	Response Time	90% of final reading in 65 seconds (normal temperature range)
TEMPERATURE RANGE	Normal	0 to 40° C
	Extended	-10 to 40° C

Relative Responses to Combustible Gases

The following relative responses to selected combustible gases are typical of an instrument calibrated using Pentane.

COMBUSTIBLE GAS	MULTIPLY %LEL READING BY	COMBUSTIBLE GAS	MULTIPLY %LEL READING BY
Acetone	1.1	Methylcyclohexane	1.1
Acetylene	0.7	Methyl Ethyl Ketone	1.1
Acrylonitrile[1]	0.8	Methyl Tertiary Butyl Ether	1.0
Benzene	1.1	Mineral Spirits	1.1
Butane	1.0	iso-Octane	1.1
1,3 Butadiene	0.9	n-Pentane	1.0
n-Butanol	1.8	Propane	0.8
Carbon Disulfide[1]	2.2	Propylene	0.8
Cyclohexane	1.1	Styrene[2]	1.9
2,2 Dimethylbutane	1.2	Tetrahydrofuran	0.9
2,3 Dimethylpentane	1.2	Toluene	1.1
Ethane	0.7	Vinyl Acetate	0.9
Ethyl Acetate	1.2	VM&P Naptha	1.6
Ethyl Alcohol	0.8	O-Xylene	1.2
Ethylene	0.7		
Formaldehyde[2]	0.5		
Gasoline (unleaded)	1.3		
Heptane	1.1		
Hydrogen	0.6		
n-Hexane	1.3		
Isobutane	0.9		
Isobutyl Acetate	1.5		
Isopropyl Alcohol	1.1		
Methane	0.5		
Methanol	0.6		
Methyl Isobutyl ketone	1.1		

Response Notes:
1. The compounds may reduce the sensitivity of the combustible gas sensor by poisoning or inhibiting the catalytic action.
2. These compounds may reduce the sensitivity of the combustible gas sensor by polymerizing on the catalytic surface.
3. For an instrument calibrated on Pentane, multiply the displayed %LEL value by the conversion factor above to get the true %LEL.
4. These conversion factors should be used only if the combustible gas is known.
5. These conversion factors are typical for a Passport Portable Alarm. Individual units may vary by ± 25% from these values.

Interference Gases Cross Sensitivity

SAMPLE	PASSPORT RESPONSE
Carbon Monoxide Sensors	
1000 ppm Toluene/Air	1
0.58% Benzene/Air	1
1.6% Acetone/Air	2
100 ppm Isobutylene/Air	1
0.8% Hydrogen/Air	1000
0.75% Pentane/Air	1
3.9% CO_2/N_2	1
7.5 ppm Chlorine/Air	0
50 ppm HCl/Air	0
10 ppm HCN/Air	0
50 ppm NO/Air	0
5 ppm NO_2/air	0
10 ppm SO_2/Air	-2
These responses are typical over the entire -10°C to 40°C temperature range.	
Hydrogen Sulfide Sensors	
1000 ppm Toluene/Air	0
0.58% Benzene/Air	0
1.6% Acetone/Air	0
100 ppm Isobutylene/Air	0
0.8% Hydrogen/Air	-4
0.75% Pentane/Air	0
3.9% CO_2/N_2	0
1.49% Ethanol/Air	2
7.5 ppm Chlorine/Air	0
50 ppm HCl/Air	0
10 ppm HCN/Air	0
50 ppm NO/Air	-1
5 ppm NO_2/Air	0
10 ppm SO_2/Air	1
These responses are typical over the entire -10°C to 40°C temperature range.	

SAMPLE	PASSPORT RESPONSE
Nitric Oxide Sensors	
10 ppm Hydrogen Sulfide	2
60 ppm Carbon Monoxide	0
10 ppm Chlorine	0
10 ppm Hydrogen Cyanide	0
10 ppm Nitrogen Dioxide	0
10 ppm Sulfur Dioxide	0
These responses are typical over the entire -10°C to 40°C temperature range.	
Nitric Dioxide Sensors	
10 ppm Hydrogen Sulfide	-12
100 ppm Carbon Monoxide	0
5 ppm Chlorine	4
50 ppm Hydrogen Chloride	-1
10 ppm Hydrogen Cyanide	-2
50 ppm Nitrogen Dioxide	3
10 ppm Sulfur Dioxide	0
These responses are typical over the entire -10°C to 40°C temperature range.	
Sulfur Dioxide Sensors	
10 ppm Hydrogen Sulfide	23
100 ppm Carbon Monoxide	0
5 ppm Chlorine	0
10 ppm Hydrogen Cyanide	2
50 ppm Nitrogen Dioxide	-7
10 ppm Sulfur Dioxide	10
These responses are typical over the entire -10°C to 40°C temperature range.	
NOTES: These conversion factors are typical for a Passport Personal Alarm. Individual units may vary by ±25% from these values.	

Chapter 5
Parts List

Table 5-1. Parts List	
PART	PART NO.
Pump Module	497430
Calibration Cap	497367
Battery Pack, Standard Ni-Cd Rechargeable	496990
Probe - 1 ft.	800332
Probe - 3 ft.	800333
Sampling Line - 5 ft.	497332
Sampling Line - 10 ft.	497333
Sampling Line - 15 ft.	497334
Sampling Line - 25 ft.	497335
Replacement Filter, Probe	801582
Charger, Omega 120 VAC	494716
Charger, Omega 220 VAC	495965
Charger, Omega 110/220 VAC, Five Unit	801759
Charger, Omega 12 volt	800525
Calibration Kit Model RP with 0.25 lpm Regulator	477149
Calibration Gas - LEL pentane simulant / 15% O_2	478192
Calibration Gas - LEL pentane simulant / 15% O_2; 60 ppm CO	478191
Calibration Gas - 10 ppm H_2S	467898
Calibration Gas - LEL pentane simulant / 15% O_2; 60 ppm CO and 10 ppm H_2S	804770
Calibration Gas - LEL pentane simulant / 15% O_2; 10 ppm H_2S	804769
Quick-connect Calibration Adapter	636246
Calibration Kit; Ampoule Type	471735
HCN Ampoule	471747
SO_2 Ampoule	485461
NO_2 Ampoule	485462
NO Ampoule	493663

Passport® Personal Alarm

Technical Manual

⚠ WARNING

THIS MANUAL MUST BE CAREFULLY READ BY ALL INDIVIDUALS WHO HAVE OR WILL HAVE THE RESPONSIBILITY FOR USING OR SERVICING THE PRODUCT. Like any piece of complex equipment, the PASSPORT PERSONAL ALARM will perform as designed only if it is used and serviced in accordance with the manufacturer's instructions. OTHERWISE IT COULD FAIL TO PERFORM AS DESIGNED AND PERSONS WHO RELY ON THIS PRODUCT FOR THEIR SAFETY COULD SUSTAIN SEVERE PERSONAL INJURY OR DEATH.

The warranties made by Mine Safety Appliances Company with respect to the product are voided if the product is not used and serviced in accordance with the instructions in this manual. Please protect yourself and others by following them. We encourage our customers to write or call regarding this equipment prior to use or for any additional information relative to use or repairs.

⚠ CAUTION

For safety reasons, this equipment must be operated by qualified personnel only. Read and understand the instruction manual completely before operating.

In the U.S., to contact your nearest stocking location, dial toll-free 1-800-MSA-2222. To contact MSA International, dial 1-412-967-3000 or 1-800-MSA-7777.

This manual pertains to instruments with Serial Number prefix "C".

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Manufactured by
MSA INSTRUMENT DIVISION
P.O. Box 427, Pittsburgh, Pennsylvania 15230

(L) Rev 3 803919

Important

The Passport Personal Alarm has three keypad versions:

- Two U.S. versions -
  - original model
  - current production model
- International version (shipped outside U.S.).

The three versions are *functionally identical* and are differentiated by the keypad pushbuttons on the Passport Alarm front panel.

The U.S. versions use English words on the pushbutton descriptions, while the International version uses internationally-recognized symbols (or icons).

Illustrations in this manual are representative of the U.S. current production version (FIGURE 2). Refer to FIGURE 1 for the U.S. original version and FIGURE 3 for the International equivalents to the front panel pushbuttons.

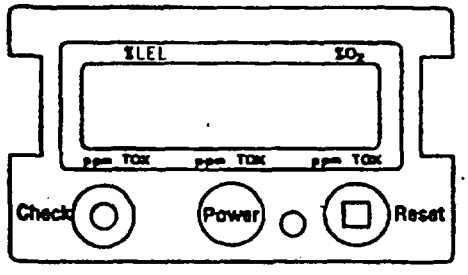

Figure 1. U.S. Version - Original

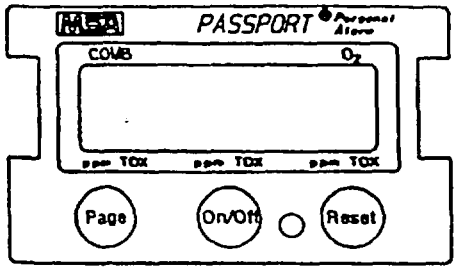

Figure 2. U.S. Version - Current Production

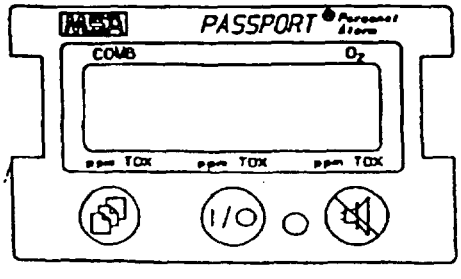

Figure 3. International Version

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Chapter 1
Set-up

To ensure that the Passport Personal Alarm operates accurately, the user must refer to this Technical Manual to:

- Set the appropriate Internal Switch Settings
- Set the appropriate Alarm Levels
- Properly Calibrate the instrument
- Perform any necessary Troubleshooting and resulting maintenance procedures

Internal Switches

Passport Alarm operating parameters are controlled and adjusted by a set of switches located inside the unit. To access the switches, the instrument must be partially disassembled (FIGURE 1-1).

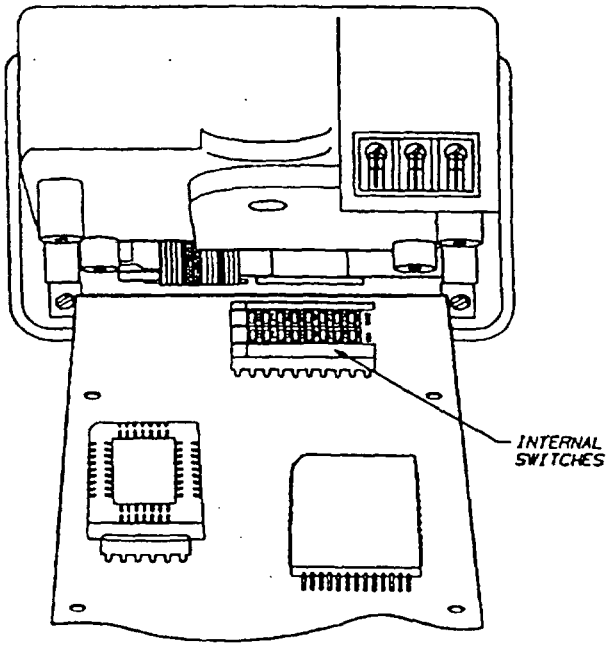

Figure 1-1.
Internal Switch

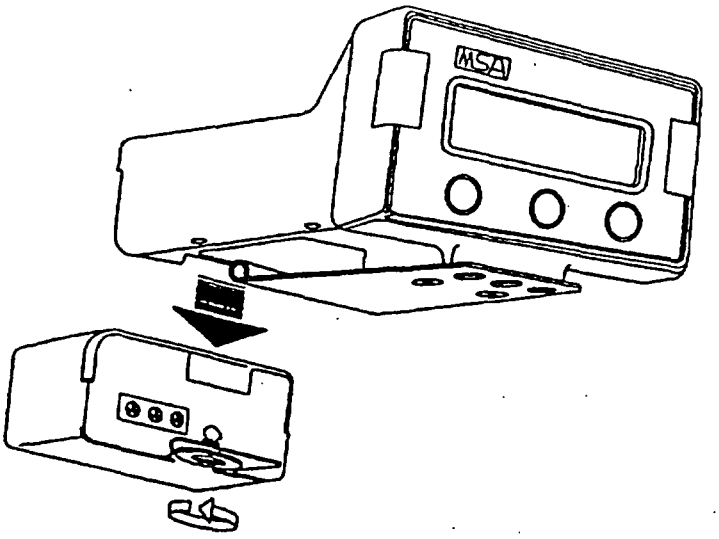

Figure 1-2.
Battery Pack Removal

1. Remove the battery pack (FIGURE 1-2).
2. Remove the sensor cover and sensors (FIGURE 1-3).
3. While holding the body of the instrument in place, remove the #1 "hold-down" screw (FIGURE 1-4).
4. Remove the rear case #2 "hold-down" screw (FIGURE 1-4).
5. Hold the display module by its sides, and slide out the internal chassis halfway.
6. Unplug the earphone connector from the chassis.

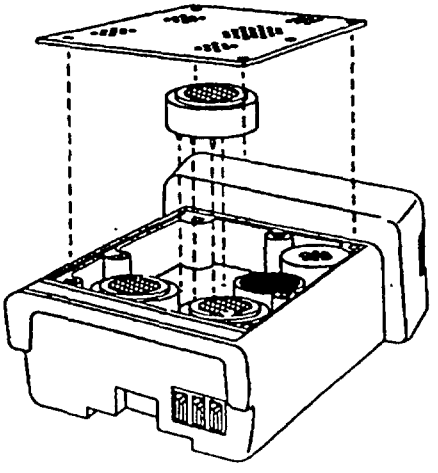

Figure 1-3.
Sensor Cover Plate

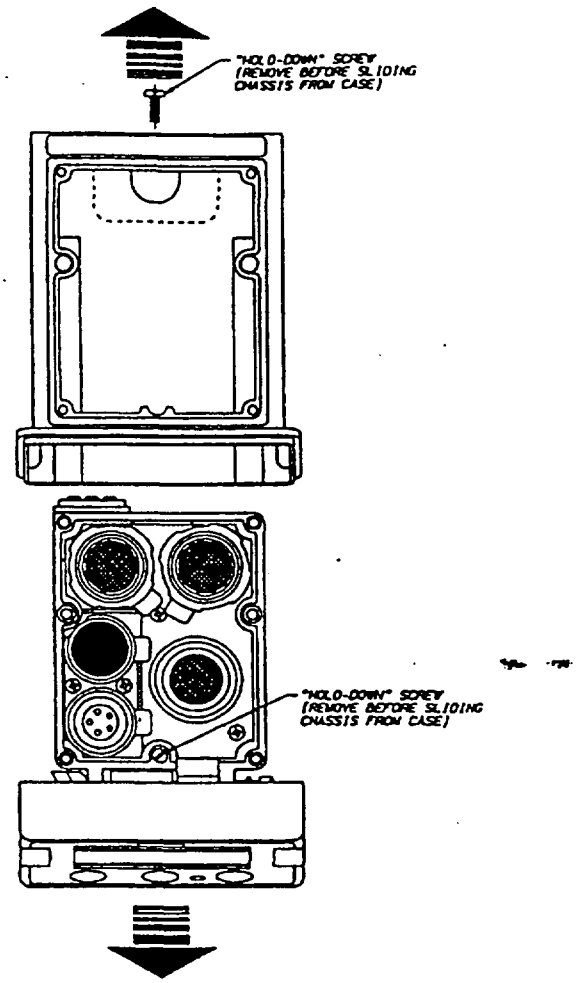

Figure 1-4.
Removing Chassis (sensors shown for reference)

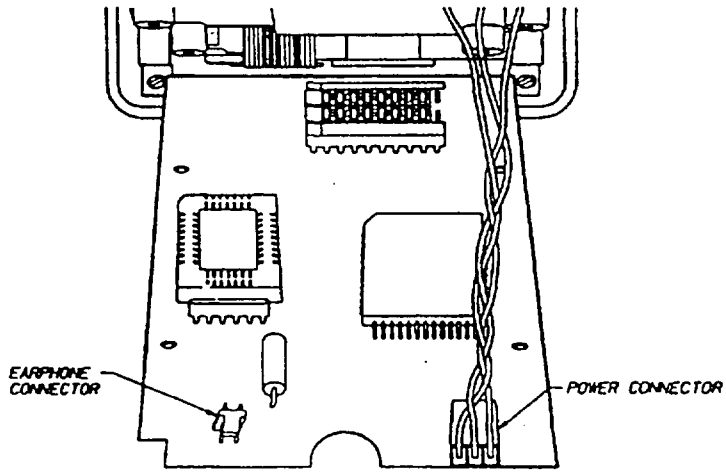

Figure 1-5.
Internal Connectors on the Main Electronics Board

7. Slide the chassis out completely.
8. Turn the chassis over with the sensor well facing down and the circuit board face up.
9. Remove the four mounting screws from the main electronics board.
10. Lift the main electronics board to a 45-degree angle, and unplug the power connect J6.
11. Lift the main electronics board until it is almost perpendicular with the chassis, and locate the two rows of switches, "A" and "B."

Switch Settings

Table 1-1 shows switch settings for normal operation.

Setting Alarm Levels

To change the instrument alarm setpoints:

1. Turn OFF the instrument.
2. Remove the battery pack.
3. Locate the internal switches as previously described.
4. Set switch A-1 to OFF. Refer to TABLE 1-2.
5. Reassemble the instrument.
6. Replace the battery pack.

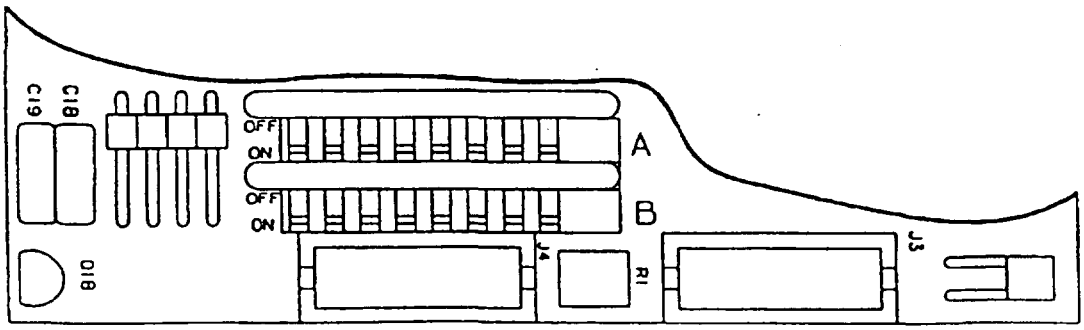

Figure 1-6.
Internal Switches

Table 1-1.
Internal Switch Settings for Normal Operation

SWITCH "A":

1 - ON: MEASURE (normal) operation, Passport Alarm will monitor for alarm conditions

2 - Combustible Display
ON: %CH_4 (Methane)
OFF: %LEL (Lower Explosive Limit)

SENSOR	SWITCH "A"	ENABLE	DISABLE
Combustible Gas	3	ON	OFF
Oxygen	4	ON	OFF
Toxic Gas #1	5	ON	OFF
Toxic Gas #2	6	ON	OFF
Toxic Gas #3	7	ON	OFF
---	8	---	---
FUNCTION	**SWITCH "B"**	**ENABLE**	**DISABLE**
Fresh Air Setup	1	ON	OFF
TWA Display/Alarm	2	ON	OFF
STEL Display/Alarm	3	ON	OFF
Peak Readings	4	ON	OFF
---	5	---	---
---	6	---	---
---	7	---	---
Factory Use Only	8	OFF	OFF

WARNING

The Passport Personal Alarm does not provide any protection while the alarm levels are being set. To enable the alarms to function, the internal switches must be set for normal operation and the instrument turned ON.

Current alarm setpoints are displayed when the instrument is turned on. Only the setpoints for gas sensors selected by corresponding internal switches can be changed. Alarm points can be set in the following order:

- Combustible Gas
    - High Alarm

Table 1-2.
Internal Switch Settings for Changing Alarm Setpoints

SWITCH "A":			
1 - OFF: SET ALARMS, Passport Alarm will NOT monitor for alarm conditions			
2 - NO CHANGE			
SENSOR	**SWITCH "A"**	**ENABLE**	**DISABLE**
Combustible Gas	3	ON	OFF
Oxygen	4	ON	OFF
Toxic Gas #1	5	ON	OFF
Toxic Gas #2	6	ON	OFF
Toxic Gas #3	7	ON	OFF
---	8	---	---
FUNCTION	**SWITCH "B"**	**ENABLE**	**DISABLE**
---	1	---	---
TWA	2	ON	OFF
STEL	3	ON	OFF
---	4	---	---
---	5	---	---
---	6	---	---
---	7	---	---
---	8	---	---

- Oxygen
  - Low Alarm
  - High Alarm
- Toxic Gas #1
  - High Alarm
  - Time Weighted Average (TWA)
  - Short Term Exposure Limit (STEL)
- Toxic Gas #2
  - High Alarm
  - Time Weighted Average (TWA)
  - Short Term Exposure Limit (STEL)
- Toxic Gas #3
  - High Alarm

- Time Weighted Average (TWA)
- Short Term Exposure Limit (STEL)

The first setpoint to be changed will be highlighted as shown in FIGURE 1-7.

WARNING

Improper adjustment of alarm setpoints may cause the instrument to fail to alarm in a hazardous atmosphere. Serious personal injury or death could result.

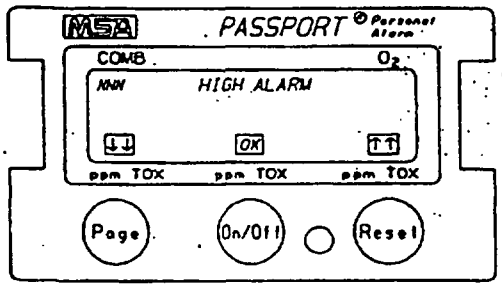

Figure 1-7.
Combustible Alarm Setpoint Display

To lower the setpoint:

- Push the **PAGE** (DOWN) button.

To raise the setpoint:

- Push the **RESET** (UP) button.

Holding either button causes the setpoint to change continuously.

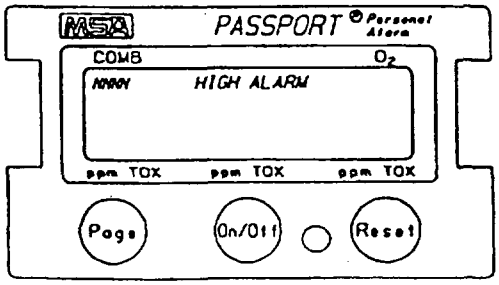

Figure 1-8.
Accepted Setpoint Display

To accept the setpoint:

- Push the **ON/OFF** (OK) button; the new setpoint is stored in memory. The Passport Alarm moves automatically to the next setpoint.

When all selected alarm setpoints are set, a long beep sounds and

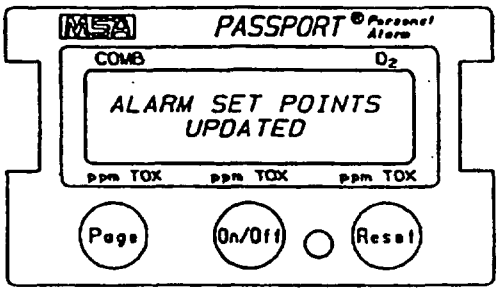

Figure 1-9.
Alarm Setpoints Updated

the display reads:

Another long beep sounds, and the Passport Alarm turns OFF automatically.

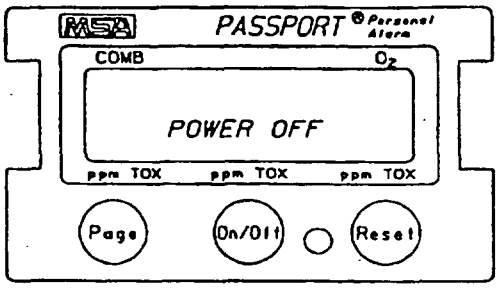

Figure 1-10.
Power OFF

Reset internal switch A-1 to ON. Refer to TABLE 1-1

Chapter 2
Calibration

CAUTION

Before each days usage, sensitivity must be tested on a known concentration of calibration gas equivalent to 25 to 60% of full scale concentration. Accuracy must be within -0 to +20% of actual. Accuracy may be corrected by specific adjustment procedure.

Optional Fresh Air Setup

The Passport Personal Alarm can be set to allow the user to automatically zero the measurement systems and calibrate the oxygen system when the unit is turned ON.

Activating the Fresh Air Setup Option

1. Locate the internal switches as previously described.
2. Turn switch B-1 to the ON position.
3. Reassemble the unit.
4. Replace the battery pack.

When this feature is activated and the instrument is turned ON, the Passport Alarm completes its self-tests and asks if a Fresh Air Setup is desired.

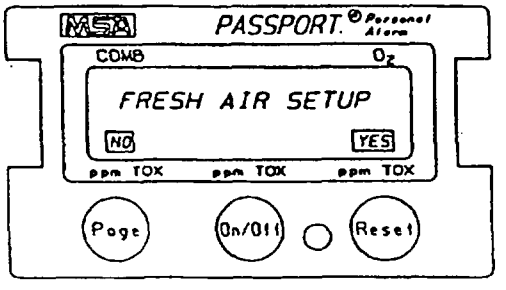

Figure 2-1.
Fresh Air Setup?

To Cancel Fresh Air Setup

- If the **PAGE** (NO) button is pressed or if no button is pressed within five seconds, the instrument does not perform a Fresh Air Setup. Instead, it goes on to operate in the normal measure mode and displays the Exposure page.

To Perform Fresh Air Setup

Press the **RESET** (YES) button within five seconds.

- The Passport Alarm begins to perform a Fresh Air Setup.
- Oxygen is set at 20.8 percent.
- All other gases are set at zero.

NOTE: If the Fresh Air Setup feature is activated and an error message is displayed, press the RESET button to exit the Fresh Air Setup and enter the Measure mode. This may occur if the original readings were outside of the limits for the Fresh Air Setup feature. This is to protect the user from zeroing out potentially hazardous gases. Expose the instrument to known fresh air and recalibrate.

⚠ WARNING

The Fresh Air Setup must only be used in fresh air; do not use it in atmospheres that are rich or deficient in oxygen, or that include combustible or toxic gases.

If you do, the Passport Alarm's calibration will be incorrect and its readings will be false. False readings will endanger the lives of those users whose safety depends on the instrument.

Do not use the Fresh Air Setup as a substitute for regular calibration checks.

Persons responsible for the use of the Passport Alarm must determine whether or not the Fresh Air Setup option should be used. The user's abilities, training, and normal work practices must be considered when making this decision.

Calibration Adjustment

Passport Alarm calibration can be adjusted easily by using gases of known mixtures and concentrations. Check the calibration each day before using your Passport Alarm.

Preparing to Calibrate

Before starting, be certain that the instrument is in normal fresh air, free of combustible or toxic gases. To prepare to calibrate:

1. Turn OFF the Passport Alarm.
2. Allow the instrument to stabilize for several minutes in fresh air at the temperature and air pressure of intended use.

⚠ WARNING

The Passport Personal Alarm does not provide any protection while the calibration is being adjusted. To enable the alarm function, the internal switches must be set for normal operation and the instrument must be turned ON.

Calibration Procedures

1. Install the pump module (if used) as shown:

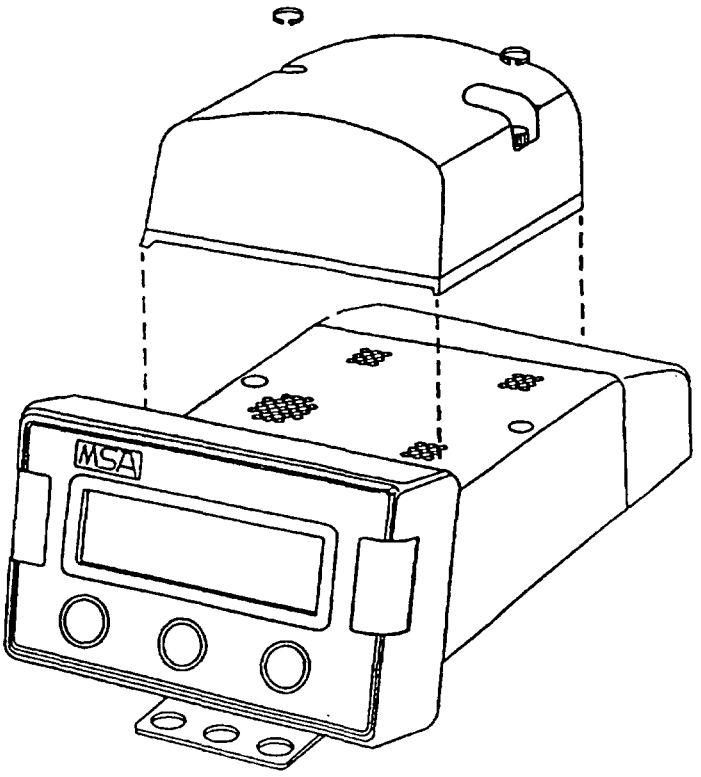

Figure 2-2.
Calibration Cap or Pump Module Installation

2. Push and hold the **PAGE** button and the **RESET** button, and then press the **ON/OFF** button. The instrument turns ON. The display is:

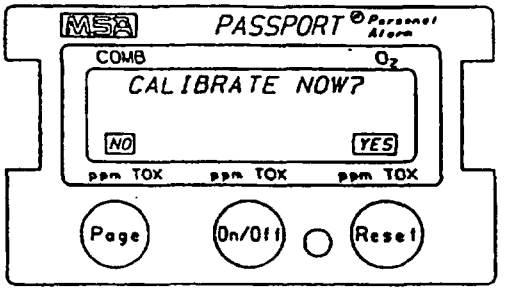

Figure 2-3.
Calibration - No/Yes?

To Cancel Calibration:

Press the **PAGE** (NO) button or wait five seconds.

- The Passport Alarm begins warming up and enters the Exposure display page.

To Continue Calibration:

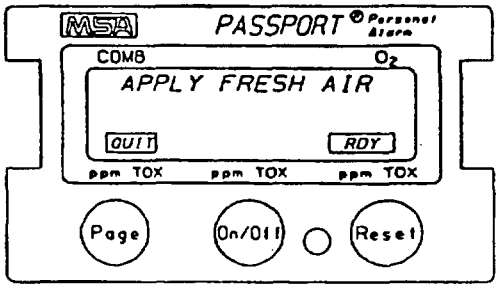

Figure 2-4.
Apply Fresh Air

3. Press the **RESET** (YES) button.
   - Display prompts you for Fresh Air.

NOTE: At this point, allow the instrument to warm up for approximately one minute

To cancel:

Press the **PAGE** (QUIT) button.

- Instrument beeps and automatically shuts OFF.

To proceed:

4. Press the **RESET** (READY) button.

5. Wait approximately 15 seconds for the Passport Alarm to complete the fresh air adjustments.
   - During this time, the display appears:

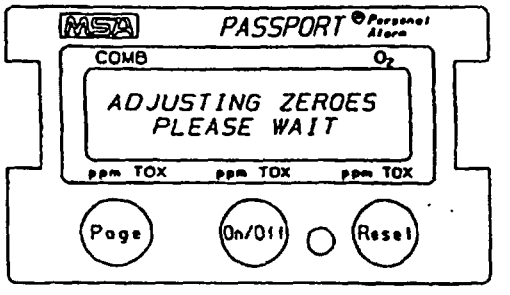

Figure 2-5.
Adjusting Zeroes

After the fresh air adjustments are made, the Passport Alarm is ready to complete calibration.

- The display appears:

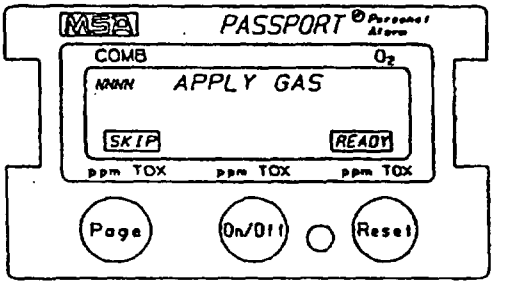

Figure 2-6.
Combustible Gas Calibration Display

Attach the calibration cap if the pump module is not being used.

The user can calibrate the gas sensors in the following order:

- Combustible Gas
- Oxygen
- Toxic Gas #1
- Toxic Gas #2
- Toxic Gas #3

Only those gas sensors turned on by the corresponding internal switches are displayed and can be calibrated.

Press the **PAGE** (SKIP) button to skip calibration for any gases you do *not* want to change.

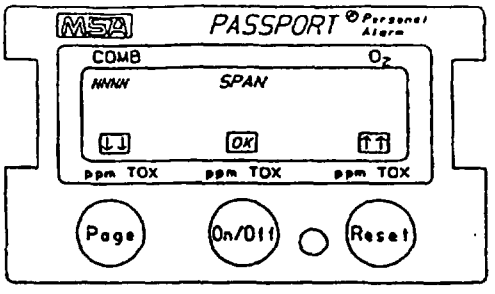

Figure 2-7.
Combustible Gas Span Adjustment

Oxygen and Toxic Gas Sensor Calibration

After the combustible gas calibration is completed, press the **ON/OFF** (OK) button. The Passport Alarm automatically moves to the oxygen and then toxic gas calibrations. Each toxic gas calibration can be completed in the same way as the combustible gas calibration. It may be necessary to change gas samples to provide the proper gas.

NOTE: The zero adjustment calibrates the oxygen sensor to 20.8%. Verify the oxygen reading is within the limits stated on the oxygen calibration cylinder.

Do not adjust the oxygen reading to the cylinder value, as slight variations may occur.

6. *Using the Bagger™ Pump (Optional)*
The following is an outline only. For specific instructions, refer to the Bagger Bag-Filling Pump Instruction Manual (P/N 472118).

   a. Assemble the calibration kit as shown in FIGURE 2-8.

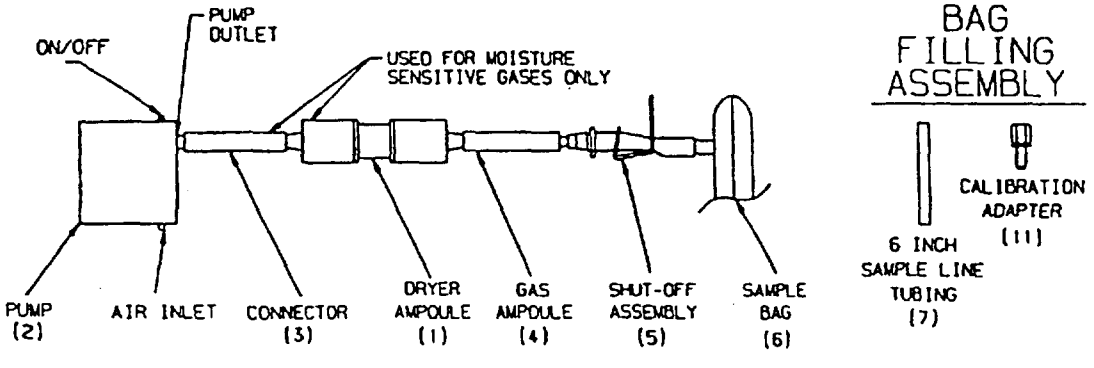

Figure 2-8.
Calibration Kit

b. Open the Shut-off Assembly clamp (FIGURE 2-8, Item 5).

c. Press and hold the **ON/OFF** button on the Calibration Kit Pump.

d. Crush the Gas Ampoule (Item 4).

- The Bag (Item 6) begins to fill.

e. When the Calibration Kit Pump stops, release the **ON/OFF** button.

- The Calibration Kit Pump stops automatically when FULL, and the sample concentration is correct.

f. Close the shut-off assembly clamp.

g. Disconnect the filled and clamped-shut Sample Bag from the Gas Ampoule.

h. Attach the six-inch Sample Line (Item 7) to the Passport Alarm Pump Module inlet.

i. Attach the other end of the Sample Line to the Shut-off Assembly on the sample bag.

- The Passport Pump stops and does not restart until the Shut-off Clamp is opened or an end of the sample line is opened.

j. Open the Shut-off Clamp (Item 5).

Using the Gas Tank (Optional)

a. Attach a 0.25 lpm (liters-per-minute) Flow Controller to the gas tank.

b. Attach a 6-inch Sample Line by screwing the connector adapter to the Passport Alarm Pump Module inlet.

c. Attach the other end of the Sample Line to the 0.25 lpm Flow Controller.

- The Passport Alarm Pump stops and does not restart until the gas tank nozzle is opened or an end of the sample line is opened.

d. Turn the knob on the gas tank in a counterclockwise direction.

- The Passport Alarm Pump Module automatically restarts.

7. Press the **RESET** (READY) button.

8. Wait for the readings to stabilize.

NOTE: During calibration, the display reading may appear more unstable than normal. The display's digital filtering has been disabled to provide the most rapid reading possible.

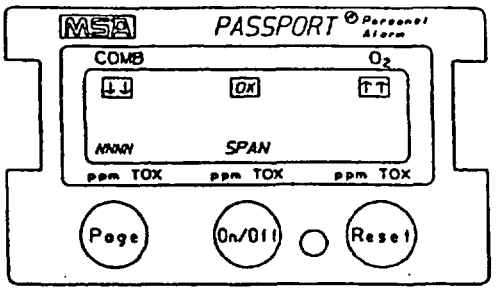

Figure 2-9.
Toxic Gas #1 Calibration Adjustment

9. After the display stabilizes, adjust the display reading to agree with the known amount of calibration gas.
   a. Push the **PAGE** (DOWN) button to lower the reading.
   b. Push the **RESET** (UP) button to raise the reading.
      - Holding either button causes the reading to change continuously.
10. Push the **ON/OFF** (OK) button to accept the reading.
    - The new reading is stored in memory, and the Passport Alarm automatically moves to the next reading.
11. Change the gas sample as needed:

    With the Bagger Pump:

    a. Disconnect the Sample Line from the Passport Alarm Pump Inlet.
    b. Exhaust the remaining sample safely. It is recommended that fresh air be pumped into the sample bag and emptied before reuse or storage.
    c. Properly dispose of the used gas ampoule.
    d. Assemble the kit with the new gas ampoule.

    With a Gas Tank:

    a. Turn OFF the gas by turning the knob on the gas tank counterclockwise.
    b. Disconnect the Sample Line from the Passport Alarm Pump inlet.
    c. Disconnect the 0.25 lpm Flow Controller from the gas tank.
    d. Assemble the kit with the new gas tank.

    When all the selected calibrations are set, a long beep sounds and the display reads:

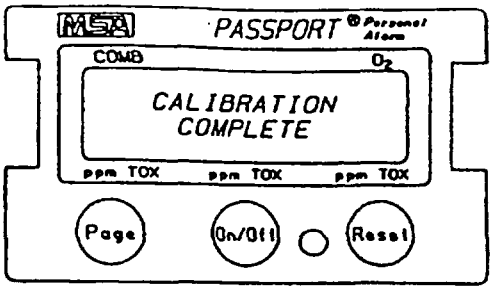

Figure 2-10.
Calibration Update

The following display appears:

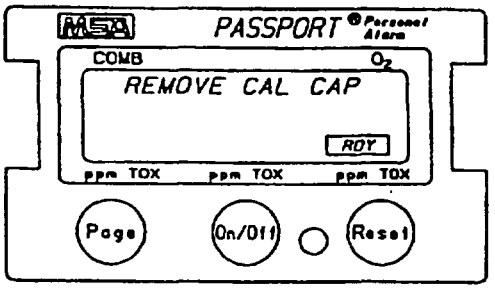

Figure 2-11.
Remove Cal Cap

Remove the calibration cap or the calibration gas from the pump module. Press the **RESET** button.

The Display now reads:

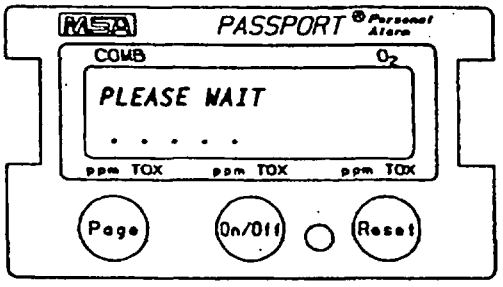

Figure 2-12.
Please Wait

and allows the calibration gases to clear from the sensors (about 30 seconds).

A long beep sounds and the Passport Alarm turns OFF automatically:

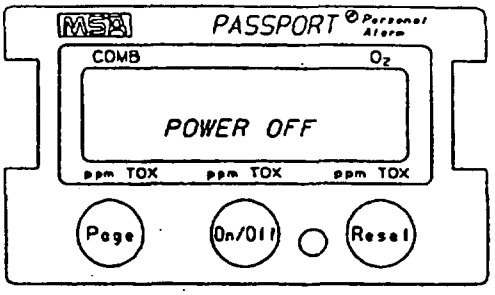

Figure 2-13.
Power OFF

Combustible Gas Display

The units of measurement for the combustible gas display may be changed by the user. The display may indicate either %LEL (% of Lower Explosive Limit) or %CH_4 (Methane by volume). The display is controlled by an internal switch.

Activating %LEL Display

1. Locate the internal switches as previously described.
2. Turn switch A-2 to the OFF position.
3. Reassemble the unit.
4. Replace the battery pack.

Activating %CH_4 Display

1. Locate the internal switches as previously described.
2. Turn switch A-2 to the ON position.
3. Reassemble the unit.
4. Replace the battery pack.

WARNING

Changing the switch requires instrument recalibration and alarm setpoint verification. Failure to do so can result in inaccurate readings.

Chapter 3
Troubleshooting and Maintenance

Troubleshooting

The Passport Personal Alarm will operate reliably for years when cared for and maintained properly. If the instrument becomes inoperative, follow the Troubleshooting Guidelines in TABLE 3-1. These represent the most likely causes of a problem. You may return inoperative instruments to MSA for repair.

MSA Instrument Division
Service Department
Walden Road
Mars, PA 16046
1-800-MSA-INST

To contact MSA International, please call:

1-412-967-3000 or 1-800-MSA-7777

When an inoperative component is located by using the guidelines, it may be replaced by using one of the following procedures:

Table 3-1. Troubleshooting Guidelines

PROBLEM	REPLACE			
	BATTERY PACK*	DISPLAY MODULE	SENSOR	MAIN ELECTRONICS MODULE
Does not turn ON	√			√
Does not complete Self-Tests				√
Display segments missing or stuck		√		
"ERROR" message after battery installation				√
"ERROR" message during use				√
Battery pack does not hold charge	√			
Combustible sensor does not calibrate			√	
Oxygen sensor does not calibrate			√	
Toxic sensor does not calibrate			√	
Clock not holding time.				√
*Recharge or replace the cells before replacing battery pack.				
In all of the above cases and for any other problems, you may return the Passport Personal Alarm to MSA for repairs.				

Repair Procedures

Battery Pack Replacement

Remove the Battery Pack

1. Turn the "quarter-turn fastener" on the back of the instrument in a counterclockwise direction.

   NOTE: Do not remove any other screws from the Ni-Cd battery pack.

2. Slide the battery pack away from the sensor face.

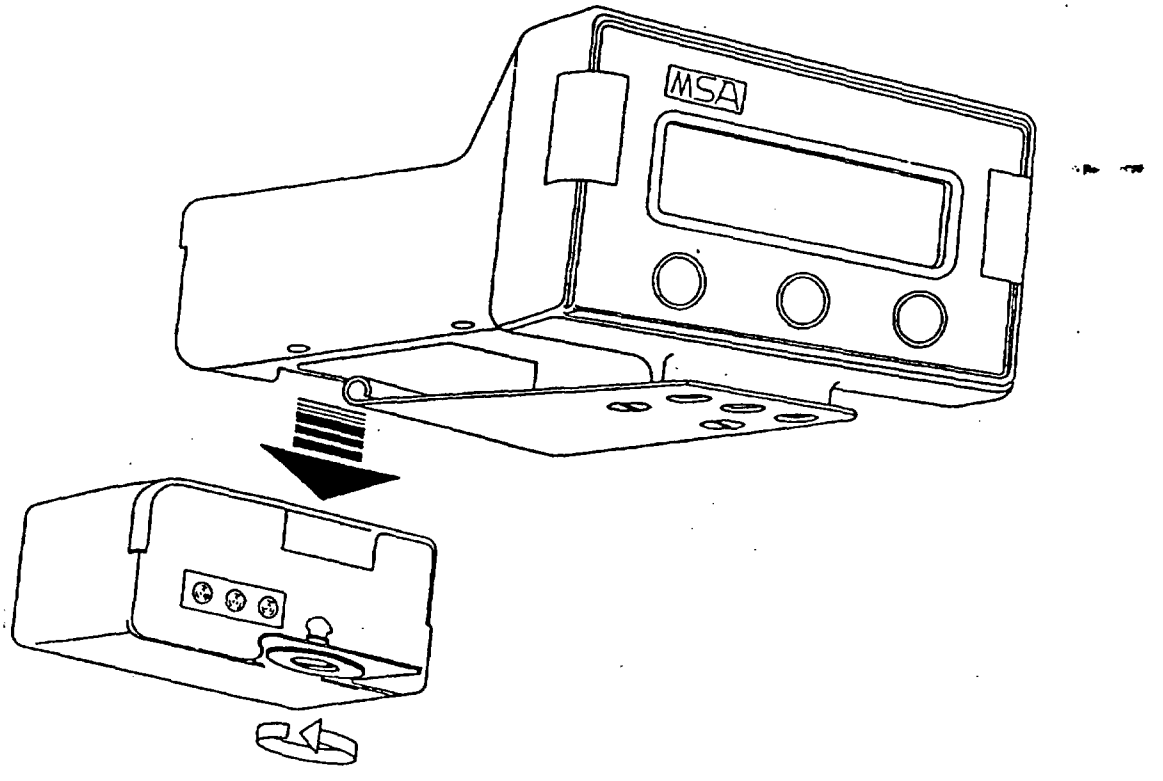

Figure 3-1.
Battery Pack Removal

Replace the Battery Pack

3. Examine the sliding battery contacts for damage.
4. Slide the battery pack toward the sensor face.
5. Turn the "quarter-turn fastener" on the back of the instrument in a clockwise direction.

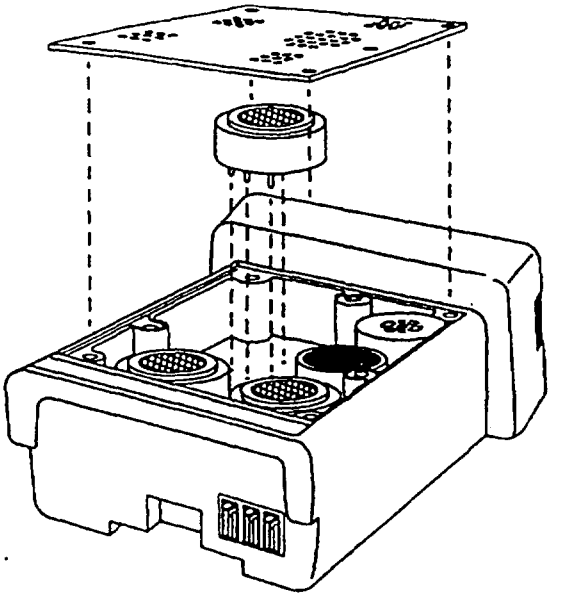

Figure 3-2.
Sensor Replacement

Sensor Replacement

1. Turn OFF the power, and remove the battery pack.
2. Remove the Pump Module or Calibration Cap, if installed.
3. Remove the sensor cover plate.
4. Unplug, remove, and properly dispose of the desired sensor.
5. If the replacement sensor is equipped with a shorting wire attached to its pins, remove the wire before inserting the replacement sensor.
6. Replace the sensor gasket
7. Align the sensor cover plate with the sensors, and be certain that it completely covers the sensors.
8. Recalibrate the instrument before using.

Main Electronics Board Replacement

⚠ CAUTION

Before handling the PC boards, ensure you are properly grounded; otherwise, static charges from your body could damage the electronics. Such damage is not covered by the warranty. Grounding straps and kits are available from electronics suppliers such as Radio Shack.

1. Turn the power OFF, and remove the battery pack.
2. Remove the Pump Module or Calibration Cap, if installed.
3. Remove the sensor cover screws.

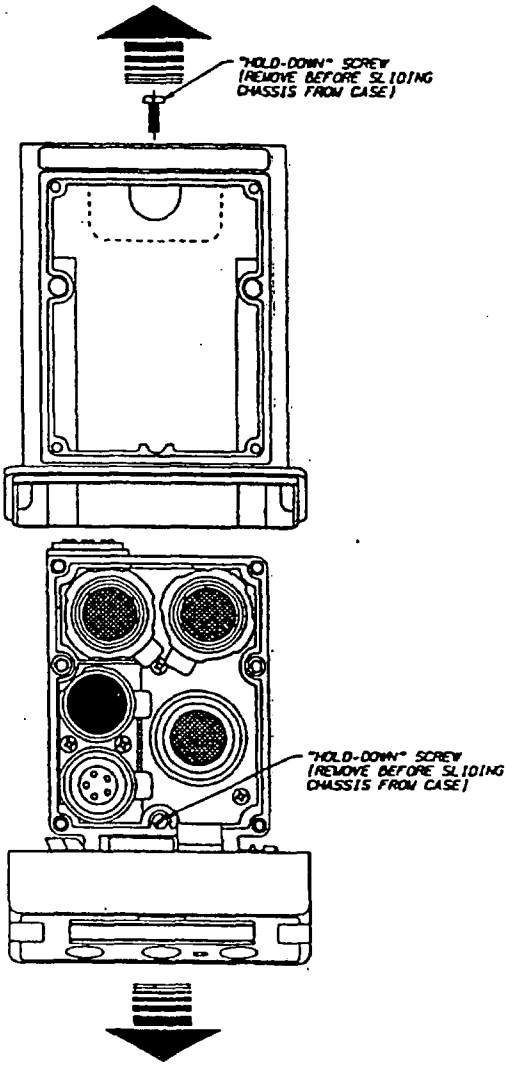

Figure 3-3.
Chassis and Sensor Removal

4. Remove the sensor cover plate.
5. Remove the "hold-down" screws.
6. Remove the sensors.
7. Slide the chassis out halfway.
8. Disconnect the ear-phone connector.

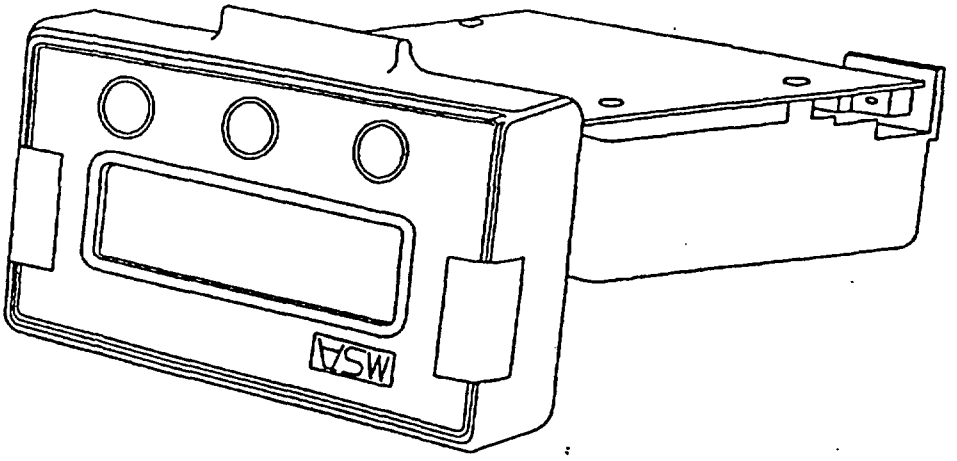

Figure 3-4.
Location of Mounting Screws

9. Completely slide out the chassis.
10. Remove the four main electronics board mounting screws.

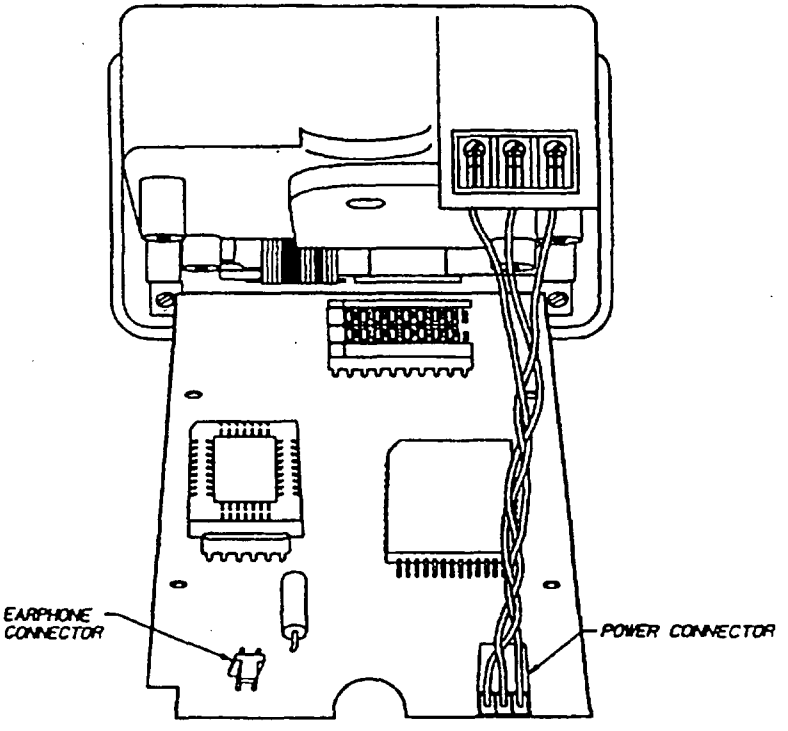

Figure 3-5.
Power Connector Removal

11. Turn the instrument over, and lift up the main board to a 45-degree angle; disconnect the power connector.
12. Lift up the board to about 90 degrees, and remove:
    - display connector
    - sensor connector
    - keypad connector
13. Remove the board.
14. Set the switches on the new main electronics board to the same positions as those set on the old Main Electronics Board.
15. Insert the new main electronics board.
16. Connect the
    - keypad connector
    - display connector
    - sensor connector

    to the new board.
17. Connect the power connector.
18. Fasten the four module-board mounting screws.
19. Slide the chassis half-way into the case.
20. Connect the ear-phone connector.
21. Slide the chassis completely into the case.
22. Install the "hold-down" screws.
23. Install the sensor cover plate, aligning the holes over the sensors.
24. Completely recalibrate the Passport Alarm.
25. Verify the alarm setpoints; adjust them if necessary.

Display Module Replacement

1. Turn the power off, and remove the battery pack.
2. Remove the Pump Module or the Calibration Cap, if installed.
3. Remove the sensor cover screws.
4. Remove the sensor cover plate.
5. Remove the "hold-down" screws.
6. Slide the chassis out halfway.
7. Disconnect the ear-phone connector.
8. Completely slide out the chassis

9. Turn the instrument over, and remove the four mounting screws.

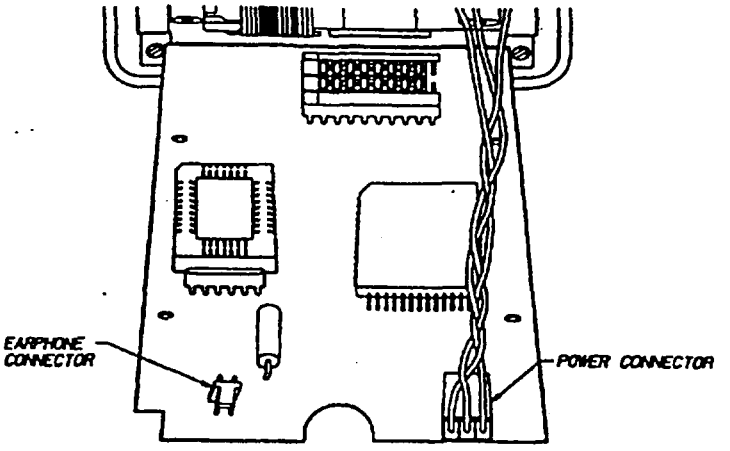

Figure 3-6.
Power Connector Removal

10. Lift up the main electronics board to a 45-degree angle, and disconnect the power connector.
11. Lift up the main electronics board to about 90 degrees. Remove:
    - display connector
    - sensor connector
    - keypad connector
12. Remove the two screws holding the display to the chassis.

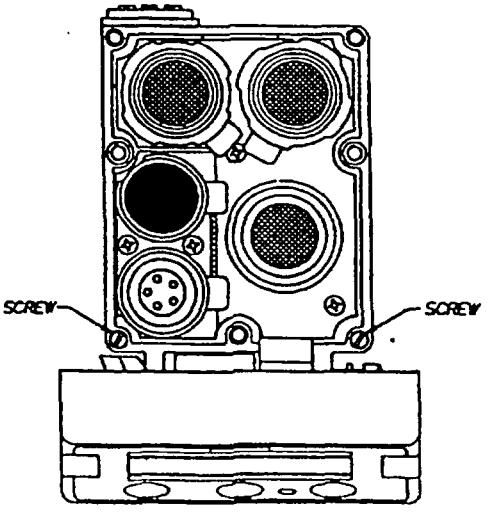

Figure 3-7.
Display-to-Chassis Mounting Screws

a. Remove the four screws holding the display module to the face piece.

13. Remove the display module.
14. Install the new display module.
15. Fasten the display mounting screws.
16. Connect the
    - keypad connector
    - display connector
    - sensor connector

    to the main electronics module.
17. Connect the power connector.
18. Replace the four module mounting screws.
19. Slide the chassis half-way into the case.
20. Connect the ear-phone connector.
21. Slide the chassis completely into the case.
22. Replace the "hold-down" screws.
23. Replace the sensor cover plate, aligning the holes over the sensors.
24. Complete recalibration of the Passport Alarm is recommended as a performance check.

Sensor Board Replacement

1. Turn the power OFF, and remove the battery pack.
2. Remove the Pump Module or Calibration Cap, if installed.
3. Remove the sensor cover screws.
4. Remove the sensor cover plate.
5. Remove the "hold-down" screws.
6. Slide the chassis out halfway.
7. Disconnect the ear-phone connector.
8. Completely slide out the main electronics board
9. Remove the four main electronics-board mounting screws.
10. Turn the instrument over, and lift up the main board to a 45-degree angle; disconnect the power connector.
11. Lift up the board to about 90 degrees, and remove:
    - display connector

- sensor connector
- keypad connector

12. Remove the board.
13. Remove all sensors.
14. Remove the four mounting screws.
15. Remove the Sensor Board from the chassis, and replace it with a new Sensor Board, reinstalling the screws and sensors, from 13 and 14 above.
16. Connect the
    - keypad connector
    - display connector
    - sensor connector

    to the main electronics module.
17. Connect the power connector.
18. Replace the four module mounting screws.
19. Slide the chassis half-way into the case.
20. Connect the ear-phone connector.
21. Slide the chassis completely into the case.
22. Replace the "hold-down" screws.
23. Replace the sensor cover plate, aligning the holes over the sensors.
24. Calibrate the Passport Personal Alarm.

Chapter 4
Parts List

Table 4-1. Parts List

PART	PART NO.
Pump Module	497430
Calibration Cap	497367
Battery Pack, Standard Ni-Cd Rechargeable	496990
Probe - 1 ft.	800332
Probe - 3 ft.	800333
Sampling Line - 5 ft.	497332
Sampling Line - 10 ft.	497333
Sampling Line - 15 ft.	497334
Sampling Line - 25 ft.	497335
Replacement Filter, Probe	801582
Charger, Omega 120 VAC	494716
Charger, Omega 220 VAC	495965
Charger, Omega 110/220 VAC, Five Unit	801759
Charger, Omega 12 volt	800525
Calibration Kit Model RP with 0.25 lpm Regulator	477149
Calibration Gas - LEL pentane simulant / 15% O_2	478192
Calibration Gas - LEL pentane simulant / 15% O_2; 60 ppm CO	478191
Calibration Gas - 10 ppm H_2S	467898
Calibration Gas - LEL pentane simulant / 15% O_2; 60 ppm CO and 10 ppm H_2S	804770
Calibration Gas - LEL pentane simulant / 15% O_2; 10 ppm H_2S	804769
Quick-connect Calibration Adapter	636246
Calibration Kit; Ampoule Type	471735
HCN Ampoule	471747
SO_2 Ampoule	485461
NO_2 Ampoule	485462
NO Ampoule	493663
Main Electronics Board	802470
Display Module	804029
Sensor Board	806397
Combustible Gas Sensor	478537
O_2 Sensor	480566
CO Sensor	636240
H_2S Sensor	636241

Instruction Manual

MIE personal DataRAM Aerosol Monitor (Part Number: PDR)

HAZCO

1-800-332-0435

MIE, Inc.
7 Oak Park
Bedford, MA 01730
U.S.A.
Telephone: 617-275-1919
Fax: 617-275-2121

INTRINSIC SAFETY NOTICE

Please be informed that the intrinsic safety approval process for the *personal*DataRAM (MIE model *p*DR-1000) has not been completed as of the date of this shipment, and therefore the appropriate approval seal has not been affixed on the back panel of this instrument.

As soon as the intrinsic safety certification is received at MIE, you will receive a notification to that effect as well as the approval seal.

Although MIE regrets this certification delay, the inherently safe design of the *personal*DataRAM is not in question, and the user should feel free to operate this instrument within the environments listed on its back panel, provided that the operating stipulations on that panel are adhered to.

*personal*DataRAM

INSTRUCTION MANUAL

August 1996

MIE, INC.
1 Federal Street, #2
Billerica, Massachusetts 01821-3500
(508) 663-7900 Fax (508) 663-4890

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ONE YEAR LIMITED WARRANTY

MIE warrants to the original Purchaser that the apparatus to be delivered hereunder will be of the kind designated or specified and free of defects in workmanship or material. MIE makes no other express warranty, and disclaims any implied warranty of merchantability or fitness for purpose.

If the apparatus fails to conform to the above warranty, and notice is received by MIE from Purchaser within one year from the date of shipment, MIE will, at its option, either repair the defective part or parts or make available a repaired or replacement part. This warranty extends to all parts and labor involved in the required repair to the extent that said repair was not caused by negligence in operation of the apparatus by the Purchaser. MIE will perform the repair at its plant with all shipping and insurance costs paid by the Purchaser or, upon mutual consent of the parties, at a site designated by the Purchaser except, in the latter circumstances, the Purchaser will be responsible to reimburse MIE for all costs associated with travel, per diem and travel time of those MIE individual(s) deemed appropriate to effectuate the repair.

Repair or replacement of the apparatus in the manner and for the time period specified above, is the Purchaser's exclusive remedy and will satisfy all liabilities of MIE to Purchaser arising out of the supply or use of the apparatus, whether based on contract, warranty, negligence or otherwise. In no event will MIE be liable for any incidental or consequential loss or damage resulting from any failure of the apparatus to conform to the contract of sale.

1.0 GENERAL DESCRIPTION

The MIE *personal*DataRAM (for Personal Data-logging Real-time Aerosol Monitor), model *p*DR-1000, is a technologically advanced instrument designed to measure the concentration of airborne particulate matter (liquid or solid), providing direct and continuous readout as well as electronic recording of the information.

The *personal*DataRAM is the result of many years of field experience acquired with thousands of units of its well known predecessor, the MIE MINIRAM, and embodies many technological advances made possible by the latest electronic hardware and software. The *personal*DataRAM is also a worthy miniaturized companion to the MIE DataRAM, a recognized paragon of portable aerosol monitors.

The *personal*DataRAM is a high sensitivity nephelometric (i.e. photometric) monitor whose light scattering sensing configuration has been optimized for the measurement of the respirable fraction of airborne dust, smoke, fumes and mists in industrial and other indoor environments.

The *personal*DataRAM is an ultra-compact, rugged and totally self-contained instrument designed for hand-held, belt-worn, as well as unattended operation. It is powered either by its internal replaceable battery, or by an optional attachable rechargeable battery pack, or by an AC supply (included as standard accessory).

The *personal*DataRAM samples the air passively (i.e. without a pump); air accesses freely the sensing chamber by convection, diffusion, and adventitious air motion.

Zeroing is accomplished by means of a hand-inflatable "zero air" pouch provided with each monitor. In addition, the instrument automatically checks agreement with its original factory calibration by checking its optical background during the zeroing sequence.

The *personal*DataRAM covers a wide measurement range: from 0.001 mg/m^3 (1 µg/m^3) to 400 mg/m^3, a 400,000-fold span, corresponding to very clean air up to extremely high particle levels.

In addition to the auto-ranging real-time concentration readout, the *personal*DataRAM offers the user a wide range of information by scrolling its two-line LCD screen, such as run start time and date, time averaged concentration, elapsed run time, maximum and STEL values with times of occurrence, etc.

Operating parameters selected and diagnostic information displays are also available. Furthermore, the *personal*DataRAM features complete, large capacity

internal data logging capabilities with retrieval through an externally connected computer. The stored information (up to 10,000 data points) includes average concentration values, maximum and STEL values with time information as well as tag numbers.

Selectable alarm levels with built-in audible signal and switched output, and a RS-232 communications port are all part of this versatile instrument.

A custom software package is provided with the *personal*DataRAM to program operating/logging parameters (e.g. logging period, alarm level, concentration display averaging time, etc.) as well as to down-load stored data to a PC or laptop. Standard spreadsheet packages (e.g. Microsoft Excel™, Lotus 1-2-3™, etc.) can be used for tabulation and archiving of the collected data.

The *personal*DataRAM is intrinsically safe for use in hazardous environments of Class 1, Division 1, Groups A, B, C, & D.

2.0 SPECIFICATIONS

- Concentration measurement range (auto-ranging)[1]: 0.001 to 400 mg/m^3
- Scattering coefficient range: 1.5×10^{-6} to 0.6 m^{-1} (approx.) @ λ =880 nm
- Precision/repeatability (2-sigma)[2]:
  ± 10 $\mu g/m^3$ for 1-second averaging
  ± 1.5 $\mu g/m^3$ for 60-second averaging
- Accuracy[1]: ± 5% of reading ± precision
- Resolution: 0.1% of reading or 0.001 mg/m^3, whichever is larger
- Particle size range of maximum response: 0.1 to 10 µm
- Concentration display updating interval: 1 second
- Concentration display averaging time[3]: 1 to 60 seconds
- Alarm level adjustment range[3]: selectable over entire measurement range
- Alarm averaging time[3]: real-time (1 to 60 seconds), or STEL (15 minutes)
- Datalogging averaging periods[3]: 1 second to 4 hours
- Total number of data points in memory: 10,000
- Number of data tags: 10 (1,000 data points per tag)
- Logged data:
  - Each data point: average concentration, time/date, and data point number
  - Run summary: overall average and maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date of occurrence, averaging (logging) period, calibration factor, and tag number.
- Elapsed time range: 30 days max.
- Time keeping and data retention: › 10 years
- Readout display: LCD 16 characters (4 mm height) x 2 lines

- Serial interface: RS-232, 4,800 baud
- Computer requirements: IBM-PC compatible, 286 or higher, MS-DOS 3.1 or higher, ≥ 1 MB memory, hard disk drive, 3.5" or 5.25" floppy, VGA or higher resolution monitor
- Internal battery: 9V alkaline, 15-hour run time (typ.)
- Current consumption: 22 to 35 mA (in Run Mode); 15 to 25 mA (in Ready Mode)
- AC source: universal voltage adapter (included) 100-250 V~, 50-60 Hz (CE marked)
- Optional battery pack: rechargeable NiMH, 48-hour run time (typ.)
- Operating environment: -10° to 50° C (14° to 122° F), 10 to 95% RH, non condensing
- Storage environment: -20° to 70° C (-4° to 158° F)
- Dimensions (max. external): 153 mm (6.0 in) H x 92 mm (3.6 in) W x 63 mm (2.5 in) D
- Weight: 0.5 kg (18 oz)

---

[1]Referred to gravimetric calibration with SAE Fine (ISO Fine) test dust (mmd = 2 to 3 µm, σ_g = 2.5, as aerosolized)
[2]At constant temperature
[3]User selectable

3.0 USER GUIDELINES

3.1 Handling Instructions

The *personal*DataRAM is a sophisticated optical/electronic instrument and should be handled accordingly. Although the *personal*DataRAM is very rugged, it should not be subjected to excessive shock, vibration, temperature or humidity. As a practical guideline, the *personal*DataRAM should be handled with the same care as a portable CD player.

If the *personal*DataRAM has been exposed to low temperatures (e.g. in the trunk of a car during winter) for more than a few minutes, care should be taken to allow the instrument to return near room temperature before operating it indoors. This is advisable because water vapor may condense on the interior surfaces of the *personal*DataRAM causing temporary malfunction or erroneous readings. Once the instrument warms up to near room temperature, such condensation will have evaporated. If the *personal*DataRAM becomes wet (e.g. due to exposure to water sprays, rain, etc.), allow the unit to dry before operating.

Whenever the *personal*DataRAM is shipped care should be taken in placing it in its carrying case and repackaging it with the original cardboard box with the factory provided padding.

3.2 Safety Instructions

- *Read and understand all instructions in this manual.*
- *Do not attempt to disassemble the instrument. If maintenance is required, return unit to the factory for qualified service.*
- *The personal*DataRAM *should be operated only from the type of power sources described in this manual.*
- *When replacing the internal 9-V battery, follow the instructions provided on the back panel of the unit.*
- *Shut off personal*DataRAM *and any external devices (e.g., PC) before connecting or disconnecting them.*
- *Shut off personal*DataRAM *before replacing the internal battery, or when plugging in or disconnecting the AC power supply or the optional rechargeable battery pack.*

3.3 Positioning and Handling During Operation

The *personal*DataRAM can be operated in any position or orientation.

Exposure to high intensity fluctuating light of the interior of the sensing chamber, through the front and back slotted air openings (see Section 5.5), should be

avoided. Such large light intensity transients may cause erroneous readings. Direct access of sunlight to the sensing chamber should be prevented.

Typical modes of instrument support/handling include:

- Hand-held. Do not obstruct or cover the sensing chamber opening slots on front and back of unit.
- Belt attached. Use belt clip kit provided as standard accessory. The unit can be worn on a waist belt, or with the optional shoulder belt (model *pDR-SS)* for breathing zone monitoring.
- Table top operation. The *personal*DataRAM can be placed on a table either in an upright position (i.e. resting on its lower protective bumper), or on its back (i.e. resting on the rear edges of its two protective bumpers).
- Tripod mounted. The unit can be attached to any standard tripod using the threaded opening on the bottom of the *personal*DataRAM.

3.4 Air Sampling Guidelines

The *personal*DataRAM is designed primarily for intramural use, i.e. for indoor air quality, in-plant, or mining environment monitoring. Extramural use (i.e. ambient monitoring) is possible, especially for personal monitoring. General ambient monitoring applications, however, are performed preferentially using active sampling instruments such as the MIE DataRAM with an appropriate inlet configuration, in order to ensure representative particle sampling under conditions of variable wind speed and direction.

For typical area monitoring applications, the *personal*DataRAM should be placed and operated centrally within the area to be monitored, away from localized air currents due to fans, blowers, ventilation intakes/exhausts, etc. This is to ensure representative sampling within the area to be assessed.

3.5 Environmental Conditions

The *personal*DataRAM is designed to be reasonably dust and splash resistant, however, it is not weatherproof. To operate the unit outdoors provisions should be made to protect it from environmental extremes outside its specified range, and from any exposure to precipitation.

The *personal*DataRAM is certified for compliance with the electromagnetic radiation limits for a Class A digital device, pursuant to part 15 of the FCC Rules. The unit also complies and is marked with the CE (European Community) approval for both immunity to electromagnetic radiation and absence of excessive emission interference.

4.0 ACCESSORIES

4.1 Standard Accessories

The *personal*DataRAM is provided to the user with the following standard accessories:

- Soft-shell carrying case (MIE model *p*DR-CC-1)
- Digital communications cable (MIE model *p*DR-DCC)
- Communications software disk (MIE model *p*DR-COM)
- Z-Pouch zeroing kit (MIE model *p*DR-ZP)
- Belt clip kit (MIE model *p*DR-CA)
- AC power supply (and charger for optional MIE model *p*DR-BP) (MIE model *p*DR-AC)
- Instruction manual

4.2 Optional Accessories

The following optional accessories are available from MIE for use with the *personal*DataRAM:

- Rechargeable battery module (MIE model *p*DR-BP)
- Active sampling adapter kit (MIE model *p*DR-FA)
- Shoulder strap (MIE model *p*DR-SS)
- Remote alarm unit (MIE model *p*DR-RA)
- Soft shell carrying case for 3 *p*DR-1000's (MIE model *p*DR-CC-3)

5.0 INSTRUMENT LAYOUT

The user should become familiar with the location and function of all externally accessible controls, connectors and other features of the *personal*DataRAM. Refer to Figures 1, 2 and 3.

All user related functions are externally accessible. All repair and maintenance should be performed by qualified MIE personnel. Please contact the factory if any problem should arise. Do not attempt to disassemble the *personal*DataRAM, except as described in Section 11.0 (Maintenance), and 12.3 (Span Check).

5.1 Front Panel

Refer to Figure 1 for location of controls and display.

The front panel contains the four touch switches (keys) and the LCD screen required for the operation of the *personal*DataRAM.

The four touch switches provide tactile ("popping") feedback when properly actuated.

The ON/OFF key serves only to turn on the unit (while it is in the off state), and to turn it off (when it is operating).

The EXIT and ENTER keys serve to execute specific commands that may be indicated on the screen, and the NEXT key generally serves to scroll the displayed information, e.g. to review the operating parameters that have been programmed, display maximum/STEL values, diagnostic values, etc.

If an incorrect command is keyed (e.g. ENTER when the *personal*DataRAM displays real-time concentration) a beep is heard to alert the user.

The two-line, 16-character per line LCD indicates either measured values of concentration (instantaneous and time averaged on the same screen), elapsed run time, maximum and STEL (short term excursion limit) values, operating and logging parameters, diagnostics, or other messages.

The acoustic alarm transducer is located directly behind the center of the MIE arrow logo on the front panel.

5.2 Bottom Base

Refer to Figure 2. The base of the *personal*DataRAM contains the following: a) internal battery compartment cover, b) external DC power input receptacle, and

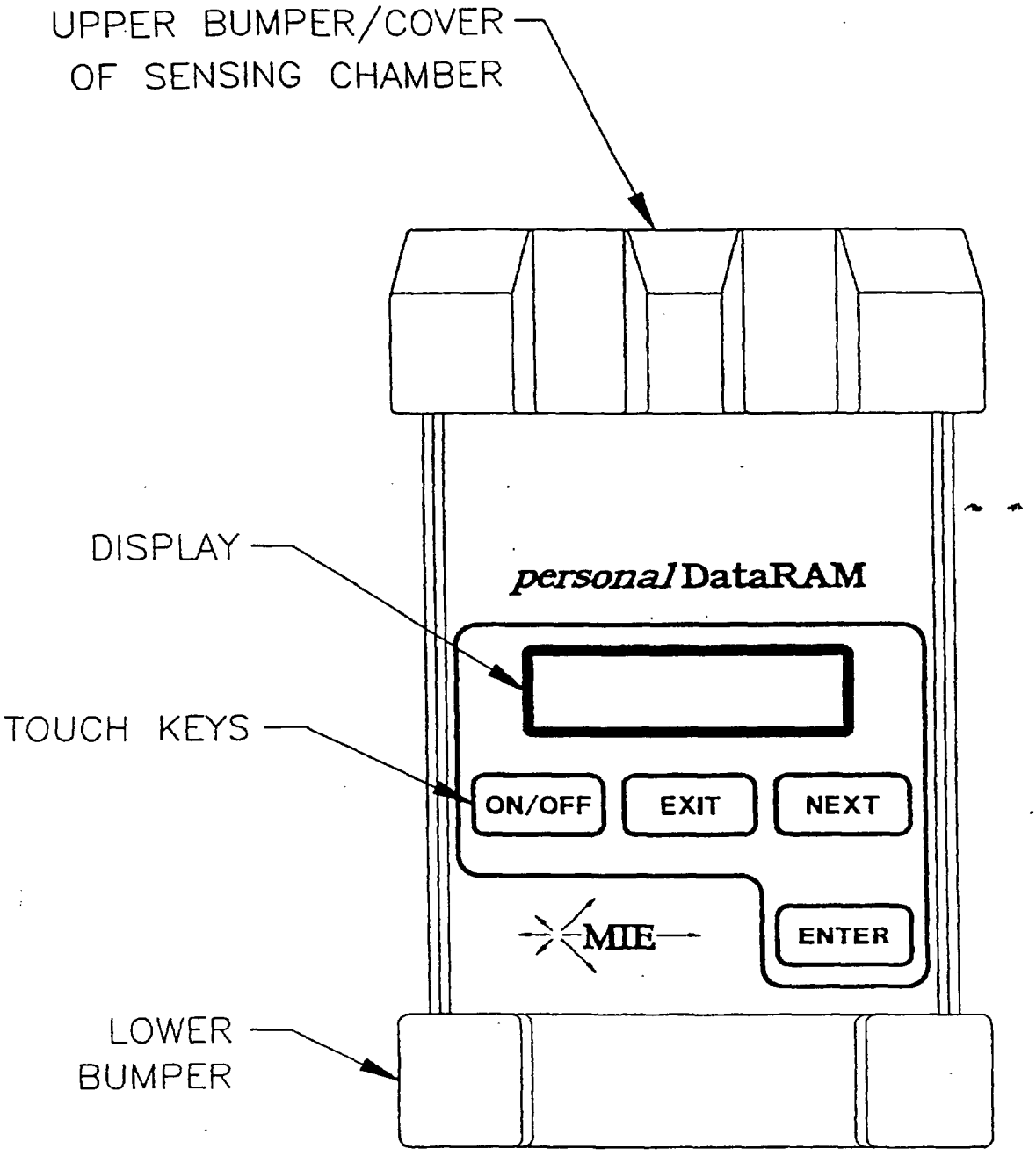

Figure 1 - FRONT PANEL

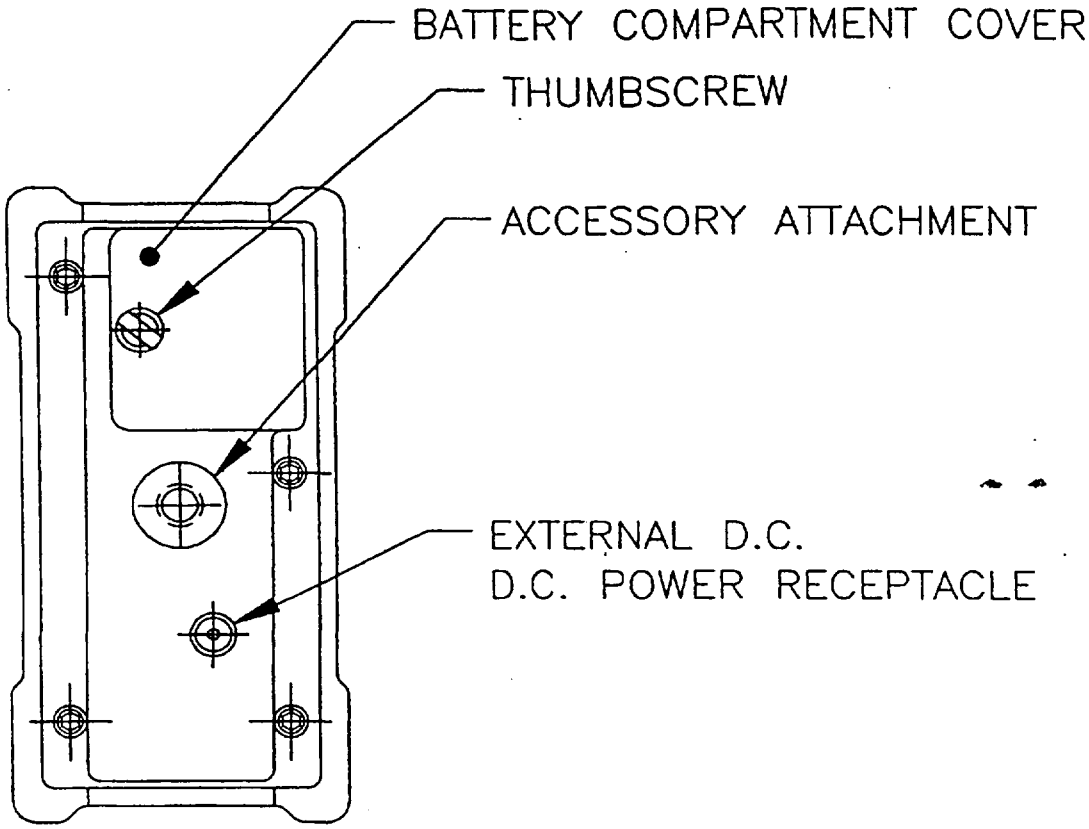

Figure 2 - BOTTOM BASE

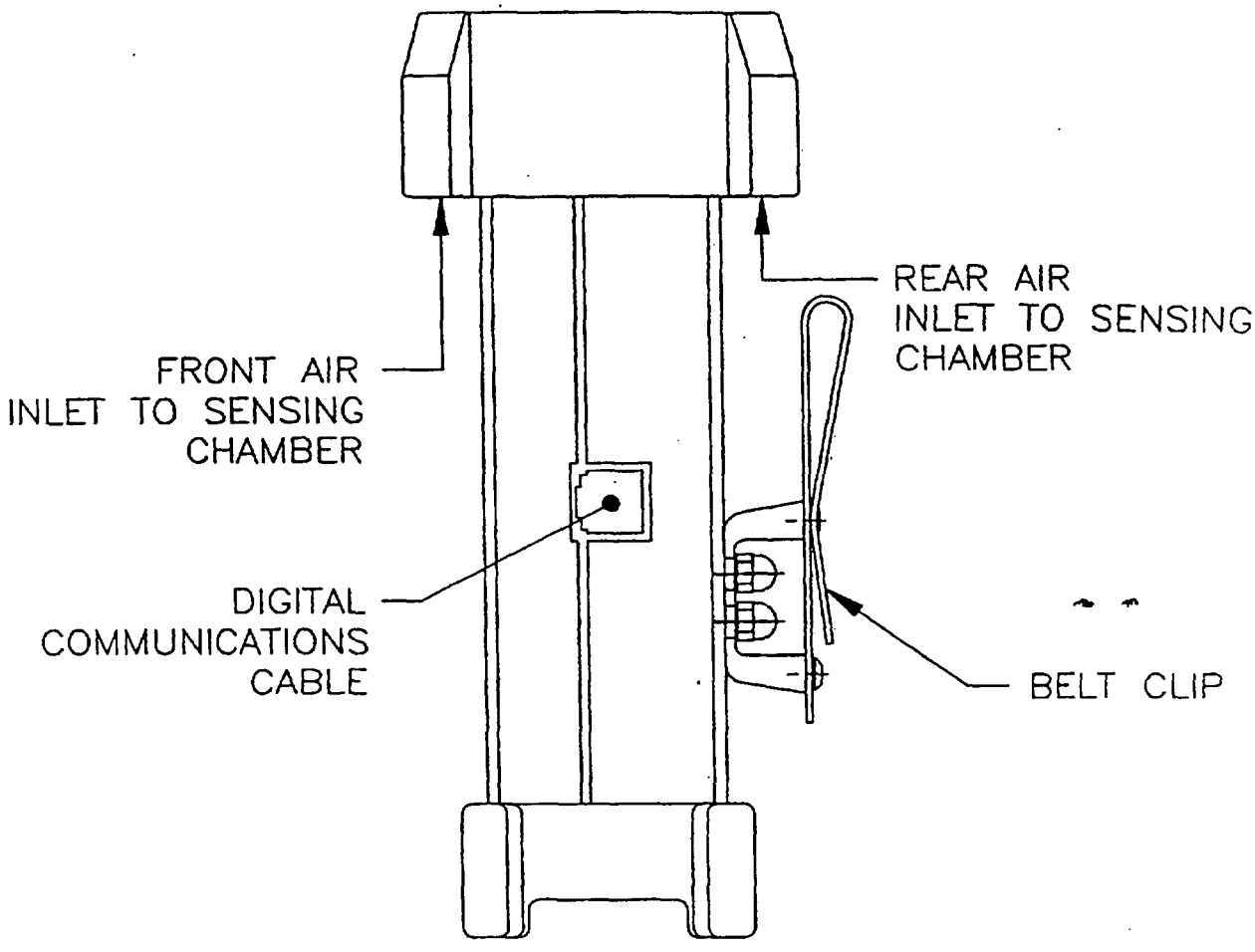

Figure 3 - RIGHT SIDE PANEL
(SHOWN WITH BELT CLIP ATTACHED)

c) threaded opening for the attachment of optional battery pack, tripod, or other mounting/support hardware.
Only the internal battery compartment cover should be opened by the user, for removal and replacement of the on-board 9-V battery. Removal of the base plate could result in voiding of instrument warranty.

5.3 Right Side Panel

Refer to Figure 3. The right side panel (as viewed from front panel) contains the digital (RS-232) communications 4-pin connector. This connector also provides the alarm output control for a remote/auxilliary alarm signal. The digital communications cable provided as standard accessory is to be inserted into this receptacle for interconnection to a computer (for data downloading or to reprogram parameters).

5.4 Back Panel and Belt Clip

The back panel consists of a label with important user information on safety procedures and certifications, model and serial numbers, etc.

The back panel is provided with mounting hardware for the attachment of the belt clip kit (see Figure 3 for mounting configuration of the belt clip).

5.5 Sensing Chamber

Referring to Figures 1 and 3, the upper section of the *personal*DataRAM contains the optical sensing chamber. This chamber is the only internal section that the user should access for maintenance purposes (see Section 11.2).

Air enters the sensing chamber through the two slot shaped inlets (one on the front and other on the back) under the upper protective bumper. During instrument operation those two openings should remain unobstructed in order to ensure free access of the surrounding air. When the *personal*DataRAM is used as personal monitor, i.e. clipped to a person's belt, the rear air inlet opening may be partially obstructed, but care should be exercised in ensuring that the front air inlet remains free of any obstructions.

6.0 PREPARATION FOR OPERATION

6.1 Battery Installation

When shipped from the factory, the *personal*DataRAM will arrive without its replaceable 9V battery installed. Two fresh alkaline batteries are factory packed separately in the carrying case, one of which should be installed in the *personal*DataRAM when preparing it for operation.

NOTE: Whenever the *personal*DataRAM is to be left unused for an extended time (i.e. longer than a month), the 9V battery should be removed from the unit.

Neither the program, time/date keeping, nor stored data will be lost by removing the battery.

To install the battery proceed as follows:

- Place the *personal*DataRAM upside down, resting on the upper bumper.
- Loosen thumbscrew that secures the battery compartment cover (see Figure 2), and remove that cover.
- Observe battery polarity and the back panel battery orientation pattern (the negative battery terminal is the one closer to the side of the instrument).
- Insert the battery by sliding it in until it bottoms out and is approximately flush with the bottom surface of the instrument.
- Place battery compartment cover over battery and, while pushing down the cover firmly (taking care that the cover seats flush on the bottom surface of the *personal*DataRAM), tighten thumbscrew.

6.2 Battery Replacement

Normally, only alkaline type 9V batteries (type 1604A, or equivalent) should be used with the *personal*DataRAM.

NOTE: The intrinsic safety approval (as marked on the backpanel) applies only when using an alkaline 9V battery. Use of any other type of battery voids that approval while such battery is in place.

Only fresh batteries should be used in order to ensure the maximum operating time. The *personal*DataRAM shuts itself off whenever the battery voltage falls below 6 volts (while retaining all programming and data). A fresh 9V alkaline battery, at room temperature, should provide a minimum of 12 hours of continuous operation (please note that not all manufacturers produce batteries of equal capacity). Intermittent operation should extend the total running time because of partial battery recovery effects.

The approximate remaining battery capacity is indicated by the *personal*DataRAM

(see Section 8.2) in increments of 20%, starting from 99% (i.e., 80%, 60%, 40% and 20%). If the remaining battery capacity is 40% or less, immediate restarting after shut off is automatically inhibited to prevent incomplete runs. If, nevertheless, a new run is to be initiated with low remaining battery capacity, do not shut off the *personal*DataRAM at the end of the previous run (i.e., remain in the Ready Mode, see section 7.0).

When significantly extended operating times are required (beyond the typical 15 hours), the use of either lithium or zinc-air batteries can be considered. The use of such alternative battery types can provide about 2.5 to 3 times longer operation than alkaline batteries. Use of non-alkaline batteries, however, voids the intrinsic safety classification of the *personal*DataRAM.

6.3 AC Power Supply

A universal line voltage AC to DC power supply (MIE model *p*DR-AC) is provided as standard accessory with the *personal*DataRAM. This power supply can be used with any line with a voltage between 100 and 240 VAC (50 to 60 Hz). When using that power supply, its output plug should be inserted into the external DC receptacle at the base of the *personal*DataRAM (see Figure 2). Insertion of that connector automatically disables the internal 9V battery of the instrument. Removal of the *p*DR-AC plug from the instrument automatically re-connects the internal 9V battery.

NOTE: Before plugging in or unplugging the external power supply, the *personal*DataRAM must be shut off.

While the external power supply remains connected to the *personal*DataRAM the intrinsic safety classification of the instrument is voided.

6.4 Rechargeable Battery Module

A rechargeable battery pack (MIE model *p*DR-BP) is available as an optional accessory. This unit attaches directly to the base of the *personal*DataRAM.

The *p*DR-BP contains a sealed nickel-metal-hydride battery which provides up to 48 hours of continuous operation between successive charges.

To attach the *p*DR-BP to the *personal*DataRAM, the instrument should be shut off. Carefully plug the *p*DR-BP into the external DC receptacle on the *personal*DataRAM. Rotate the large thumbscrew at the opposite end of the *p*DR-BP tightening it firmly. The *p*DR-BP can be recharged by means of the AC power supply of the *personal*DataRAM.

Detailed instructions for the use of the rechargeable battery module are furnished with that accessory.

The use of the *p*DR-BP voids intrinsic safety classification.

6.5 Zeroing the *personal*DataRAM

One of the most important steps to be performed by the user before initiating a measurement run with the *personal*DataRAM is to zero the instrument in a particle-free environment. This is required to ensure maximum accuracy of concentration measurements, especially at low levels, i.e. below about 100 $\mu g/m^3$.

During the 2-minute pre-run automatic zeroing sequence (see Section 8.1), the *personal*DataRAM registers its own optical background, stores that level in its memory, and then subtracts that background from all measured concentration values, until the zero is updated again by the user.

A particle-free environment for zeroing the *personal*DataRAM can be any of the following:

- A clean room
- A clean bench
- Any duct or area directly downstream of a HEPA filter
- The *personal*DataRAM Z-Pouch (standard accessory)
- The MINIRAM Z-Bag

In some cases, a very clean, well air conditioned office may offer a sufficiently low particle concentration environment for zeroing (i.e. $\leq 5\ \mu g/m^3$), as determined by another monitor (e.g. a MIE DataRAM).

To zero the *personal*DataRAM by means of its Z-Pouch, proceed as follows:

- Wipe the outside surfaces of the *personal*DataRAM to remove as much dust from those surfaces as possible before placing the instrument inside the Z-Pouch.
- In a reasonably clean area, open the zipper of the Z-Pouch and place the *personal*DataRAM inside it. Close the zipper shut.
- Open the small nipple on the Z-Pouch, and insert the fitting of the hand-pump/in-line filter unit into the nipple.
- Start pumping the hand-pump until the Z-Pouch begins to bulge slightly, and proceed with the steps in Section 8.1, pressing the keys of the instrument through the wall of the Z-Pouch. Then, continue pumping.
- After completing the zeroing (step 2. of Section 8.1) procedure, open the Z-Pouch zipper and remove the *personal*DataRAM. Close the zipper and flatten the Z-Pouch while plugging its nipple, in order to prevent dust contamination of the interior of the Z-Pouch.

7.0 OPERATING MODES

The *personal*DataRAM has several different operating modes which will be described in what follows. The specific commands and displays within each of these operating modes will be explained in detail in Section 8.0.

7.1 Start-Up Mode

The *personal*DataRAM enters the Start-Up Mode as soon as the instrument is switched on. The user then has the choice to:
a) Wait before proceeding;
b) Zero the instrument and check its readiness; or
c) Proceed directly to the Ready Mode.

7.2 Ready Mode

Once the *personal*DataRAM is in the Ready Mode, the user is presented with the following alternatives:
a) Start a run immediately, or after any of the subsequent steps;
b) Review (by scrolling the display) all operating parameters, status and diagnostic data;
c) Activate or deactivate the logging function; activate, select (instantaneous or STEL), or deactivate alarm;
d) Program parameters or output logged data through a computer.

7.3 Run Mode

When a measurement run has been initiated the user has the following display choices:
a) Instantaneous and time-averaged concentrations (both on the same screen);
b) Elapsed run time, and run start time and date (both on the same screen);
c) Maximum displayed concentration from run start, and time/date at which current maximum occurred;
d) Short term excursion limit (STEL) from run start, and time/date at which current STEL occurred;
e) Remaining battery charge, and (if logging function is enabled) remaining free memory.

The user can command the termination of the run at any time returning it to the Ready Mode. To download logged data into a PC, the *personal*DataRAM must be in the Ready Mode. No changes in the program parameters or operating conditions can be made while in the Run Mode.

The *personal*DataRAM can be shut off from any of the three operating modes. If shut off while in the Run Mode, the instrument will save all stored data.

8.0 OPERATION

8.1 Start-Up

	KEY	DISPLAY	NOTES
1.	**ON/OFF**	START ZERO:ENTER GO TO RUN: NEXT	Before starting a run place *personal*DataRAM inside Z-Pouch, pump air into it and key **ENTER** while pumping. Alternatively, key **NEXT** to go to RUN/READY mode. If **ENTER** is keyed:
2.	**ENTER**	ZEROING V1.00	Keep pumping slowly while ZEROING is displayed for 2 minutes, followed by one of the following screens:
		CALIBRATION: OK	or,
		BACKGROUND HIGH	or,
		MALFUNCTION	If CALIBRATION: OK, then go to to step 3. If one of the other two screens is displayed, consult Section 11.0 of this Manual.
3.	**NEXT**	START RUN: ENTER READY: NEXT	To start a measurement run key **ENTER** (Section 8.3, step 1). To set up for a run and scroll logging/ operating parameters, key **NEXT** (see Section 8.2).
4.	**ON/OFF**	TURN OFF PDR? Y:ENTER N:NEXT	Keying **ON/OFF** while the *personal*DataRAM is operating will elicit this message to prevent accidental shut off. To confirm shut down, key **ENTER**. To continue operation, key **NEXT**.

8.2 Setting Up For A Run

	KEY	DISPLAY	NOTES
1.	NEXT	LOGGING OFF	This screen indicates the logging status. To enable the logging function, key ENTER. Toggling of the on/off logging status can be done by keying ENTER.
2.	ENTER	LOG INTRVL 600s TAG #: 4	This example assumes that a 10-min log period had been selected previously through the PC (see Section 9.0), and that the next unused tag is #4.
3.	NEXT	ALARM: OFF	This screen indicates the alarm status. Keying ENTER repeatedly toggles through the 3 alarm modes:
4.	ENTER	ALARM: INSTANT LEVEL:1.50 mg/m3	This enables the alarm based on the real-time concentration. The level (e.g. 1.50 mg/m3) must be set on the PC.
5.	ENTER	ALARM: STEL LEVEL:0.50 mg/m3	This enables the alarm based on the 15-min STEL value. The level (e.g. 0.50 mg/m3) must be set on the PC.
6.	NEXT	CAL FACTOR: 1.00 DIS AVG TIME 10s	This screen displays the calibration factor and the display averaging time. Both values can be edited via PC.
7.	NEXT	BATTERY LEFT 80% TAGS LEFT: 6	This screen displays the remaining battery charge (in 20% steps), and the remaining number of free tags.

8.	**NEXT**	CONNECT TO PC	When this screen has been selected, the operating parameters can be edited and/or the logged data can be downloaded via the PC (see Section 9.0). If **NEXT** is keyed again, the screen returns to RUN/READY:
9.	**NEXT**	START RUN: ENTER READY: NEXT	The *personal*DataRAM is now ready to run following the procedure in section 8.3.

8.3 Measurement Run Procedure

	KEY	DISPLAY	NOTES
1.	**ENTER**	LOGGING OFF	or, if logging was enabled:
		LOG INTRVL 600s TAG #: 4	Logging status will be displayed for 3 seconds.
		CONC*0.047 mg/m3 TWA 0.039 mg/m3	After 3 seconds, the concentration screen appears (values shown here are examples). CONC is the real-time and TWA is the time-averaged concentration. The * appears only if logging has been enabled.
2.	**EXIT**	TERMINATE RUN? Y:ENTER N:NEXT	To terminate the current run and return to the Ready Mode, key **ENTER**. To continue the run, key **NEXT**.
3.	**NEXT**	CONC*0.047 mg/m3 TWA 0.039 mg/m3	Keying **NEXT** successively scrolls the display to show various run values (elapsed run time, maximum, STEL, etc.). Keying **EXIT** from any of those screens returns to the concentration display.
4.	**NEXT**	ET 06:12:49 ST 08:18:26MAY15	This screen shows the elapsed run time (ET) and the run start time/date (ST).

5.	**NEXT**	MAX: 0.113 mg/m3 T 10:08:44 MAY15	This screen shows the maximum concentration of current run and time/date of occurrence.
6.	**NEXT**	STEL:0.058 mg/m3 T 09:59:22 MAY15	This screen shows the 15-min STEL value of the current run and the time/date of occurrence.
7.	**NEXT**	BATTERY LEFT 80%	or, if logging was enabled,
		BATTERY LEFT 80% RUN MEM LEFT 96%	This screen shows the amount of usable charge left in the battery and, if logging has been enabled, the amount of memory left for the run (in currently used tag).
8.	**NEXT**	CONC*0.047 mg/m3 TWA 0.039 mg/m3	The last **NEXT** command returns the display to the concentration screen.
9.	**EXIT**	TERMINATE RUN? Y:ENTER N:NEXT	As indicated in step 2, to end current run, key **ENTER**, to return to the Ready Mode:
10.	**ENTER**	START RUN: ENTER READY: NEXT	This keystroke terminates the current run and returns the unit to the Ready Mode.

If during a run the currently used tag memory is filled completely (0% memory left), the run is automatically terminated and the display will indicate:

RUN TERMINATED
TAG #4 FULL MEM

8.4 Abbreviated Run Start/Stop Instructions

To power-up and start a measurement run without zeroing and setting up, proceed as follows:

- Key sequentially **ON/OFF**, **NEXT** and **ENTER**.

To terminate run and shut down, proceed as follows starting from the concentration screen (otherwise key **EXIT** first):

- Key sequentially **EXIT**, **ENTER** and **ON/OFF**.

9.0 COMMUNICATIONS WITH COMPUTER

9.1 Hardware and Software Requirements

The computer requirements to install the software provided with the *personal*DataRAM (MIE *p*DR-COM) are the following:

- IBM-PC compatible
- 286 or better processor
- Minimum operating system: Microsoft Windows 3.1™, or Windows 3.11™, or Windows 95™
- ≥ 1 MB of RAM (4 MB is preferred)
- 2 MB hard disk drive
- 3.5" or 5.25" floppy drive
- VGA or higher resolution monitor

MIE custom hardware and software (provided as standard accessories):

- Digital communications cable (MIE model *p*DR-DCC)
- Software floppy disk (3.5" or 5.25", MIE model *p*DR-COM)

9.2 Software Installation Procedure

To install the MIE provided software in the computer, proceed as follows:

1. Insert the 3.5" disk labeled "*p*DR-COM" into computer (Note: This disk may be copied onto a 5.25" diskette, if necessary).

2. For Windows 95™ users, select **Start** and then **Run**. For Windows 3.1 and 3.11 users, from Program Manager select **File** and then **Run**.

3. Type in on the **Command Line**: **a: install** (or **b: install**, as required).

4. The message "**Do you wish to install *p*DR-COM?**" will appear. Click **OK** to continue, or **Cancel**.

5. A message appears allowing the option to change the default directory: "**C:\PDRCOM**". It is advisable to leave the default directory (unless you address the hard drive by a different letter), and select **OK**.

6. After a successful installation, the message "**Installation Complete!**" will appear.

9.3 Communication Between *personal*DataRAM and Computer

To effect the communication between the *personal*DataRAM (via the *p*DR-COM software installed in the computer as described in the preceding section) and the PC proceed as follows:

1. Connect the *personal*DataRAM to one of the computer's serial ports using the *p*DR-DCC cable provided by MIE. This cable has a 9-pin female connector for the computer port. A 9-pin to 25-pin female converter is provided, as well (most "lap-top" computers use 9-pin connectors and most table top versions use 25-pin connectors).

2. Key **ON** the *personal*DataRAM and then key **NEXT** repeatedly until CONNECT TO PC is displayed on the *personal*DataRAM.

3. On the computer, double click on the ***p*DR-COM** icon. A four-tabbed notebook display should appear. Click on the **Com Port Select** and select the port to which the *p*DR-DCC cable has been connected.

4. From the four-tabbed notebook displayed on the computer screen select the tab with the desired option. The options are:

- **Main**: This page allows the user to input the *personal*DataRAM serial number (or any other desired label).

- **Logged data**: This page allows the user to download, tabulate, print data, or transfer to a CSV file the data stored in the *personal*DataRAM. This page also serves to display real-time numerical data when the computer is connected to the *personal*DataRAM in the Run Mode.

- **Graph data**: This page enables the downloading and graphing of stored data to the computer screen and to a printer. In the Run Mode, this page displays the real-time data in graphic format.

- **Configure pDR**: This screen allows the user to edit the operating/logging parameters. Click on the item to be edited and select or type in the new value. To review the parameter values currently programmed into the *personal*DataRAM, click on **Get configuration**. After editing the parameters, click on **Set configuration** to input the new values into the *personal*DataRAM program.

Most operations within *p*DR-COM are self-evidently labeled, including fly-over dialog boxes. In addition, instructions may be found in the On-line Help files by selecting **Help** and then **Contents**.

The following operating/logging parameters of the *personal*DataRAM are selected (edited) via the computer:

- Current date (month and day of the month)
- Current time (hour, minute and second)
- Display averaging time (1 to 60 seconds, in 1s increments)
- Calibration factor (0.01 to 9.99, in 0.01 increments)
- Logging interval (1 to 14,400 seconds, in 1s increments)
- Alarm level (1 to 409,599 $\mu g/m^3$, in 1 $\mu g/m^3$ increments)
- Alarm mode (Off, Instantaneous, or STEL)(can also be selected directly through *personal*DataRAM keyboard, see Section 8.2)

In addition, the user can input an identification for the instrument (e.g. serial number), or multi-character label (up to 20 characters).

10.0 ALARM

10.1 Alarm Description and Operation

The *personal*DataRAM alarm function is provided both as an audible signal as well as a electrical output. The audible alarm consists of a series of beeps (0.5 seconds on - 0.5 seconds off) generated by an on-board piezo-transducer. The electrical output, available at the digital communications port, consists of a series of low power on-off voltage pulses which can be used to trigger/activate other equipment through an appropriate interface (consult with the factory).

The alarm function can be enabled/disabled by the user through the *personal*DataRAM keyboard (see Section 8.2). Setting of the alarm level must be performed on the PC (see Section 9.0).

The alarm is triggered whenever the displayed real-time concentration exceeds the preset alarm level. When the concentration falls below that level the alarm condition stops. While the alarm is on the user can stop it (i.e. silence the alarm) by pressing any key of the *personal*DataRAM. If the concentration continues to exceed the set alarm level after 10 seconds, however, the alarm restarts.

10.2 Alarm Output

A pulsed voltage output is available on the *personal*DataRAM in synchronism with the audible signal. This signal consists of 0.5-second duration, 4 KHz bursts with an amplitude of 4 V pp. An externally connected load should have an impedance of no less than 100 kilo-ohms. This alarm output signal is available at pins 1 and 4 of the digital communications port.

11.0 MAINTENANCE

11.1 General Guidelines

The *personal*DataRAM is designed to be repaired at the factory. Access to the internal components of the unit by others than authorized MIE personnel voids warranty. The exception to this rule is the occasional cleaning of the optical sensing chamber.

Unless a MALFUNCTION message is displayed, or other operational problems occur, the *personal*DataRAM should be returned to the factory once every two years for routine check out, test, cleaning and calibration check.

11.2 Cleaning of Optical Sensing Chamber

Continued exposure to airborne particles may result in gradual build-up of contamination on the interior surfaces of the sensing chamber components. This may cause an excessive rate of increase in the optical background. If this background level becomes excessive, the *personal*DataRAM will alert the user at the completion of the zeroing sequence, as indicated in Section 8.1, by the display of a BACKGROUND HIGH message. If this message is presented, the *personal*DataRAM can continue to be operated providing accurate measurements. However, it is then advisable to clean the interior of the sensing chamber at the first convenient opportunity, proceeding as follows:

- Remove the two screws on the top of the large protective bumper that covers the sensing chamber;
- Remove the large protective bumper by lifting it firmly upwards and away from the sensing chamber;
- Remove the socket-head screws on the front and back black covers that were exposed by removal of the large top bumper. Lift away the freed front and back covers of the sensing chamber; set them aside carefully and such that they can be reattached in the same position as they were previously;
- Using filtered (particle-free) pressurized air, blow the inside of sensing chamber taking great care in not marring or scratching any of the exposed surfaces.
- Reposition the two sensing chamber cover plates in the same location (front and back) as they had been originally. Insert and tighten socket head screws firmly.
- Reposition large protective bumper over sensing chamber pushing down until properly seated. Insert the two top screws holding down the bumper and tighten securely.
- Check optical background by zeroing the *personal*DataRAM as indicated in Section 8.1. If the sensing chamber cleaning was performed correctly, a CALIBRATION: OK message should be seen at the end of the zeroing period.

12.0 CALIBRATION

12.1 Factory Calibration

Each MIE *personalDataRAM* is factory calibrated against a set of reference monitors that, in turn are periodically calibrated against a gravimetric standard traceable to the National Institute of Standards and Testing (NIST).

The primary factory reference method consists of generating a dust aerosol by means of a fluidized bed generator, and injecting continuously the dust into a mixing chamber from which samples are extracted concurrently by two reference filter collectors and by two master real-time monitors (MIE DataRAMs) that are used for the routine calibration of every *personal*DataRAM.

The primary dust concentration reference value is obtained from the weight increase of the two filters due to the dust collected over a measured period of time, at a constant and known flowrate. The two master real-time monitors are then adjusted to agree with the reference mas concentration value (obtained from averaging the measurements of the two gravimetric filters) to within ±1%.

Three primary, NIST traceable, measurements are involved in the determination of the reference mass concentration: the weight increment from the dust collected on the filter, the sampling flowrate, and the sampling time. Additional conditions that must be met are: a) suspended dust concentration uniformity at all sampling inlets of the mixing chamber; b) identical sample transport configurations leading to reference and instrument under calibration; and c) essentially 100% collection efficiency of filters used for gravimetric reference for the particle size range of the test dust.

The test dust used for the MIE factory calibration of the *personal*DataRAM is SAE Fine (ISO Fine) supplied by Powder Technology, Inc. It has the following physical characteristics (as dispersed into the mixing chamber):

- Mass median aerodynamic particle diameter: 2 to 3 μm
- Geometric standard deviation of log-normal size distribution: 2.5
- Bulk density: 2.60 to 2.65 g/cm^3
- Index of refraction: 1.54

12.2 Field Gravimetric Calibration

If desired, the *personal*DataRAM can be calibrated for a particular aerosol (dust, smoke, mist, etc.) under field conditions. Typically, a personal type filter sampler is placed side-by-side to the *personal*DataRAM to be calibrated, within

the particle environment of interest. Running of both the filter sampler and the *personal*DataRAM to be calibrated should be started simultaneously.

The comparison run duration should be sufficient to collect a mass of at least 1 mg on the reference filter (in order to permit accurate weighing of the collected mass by means of an analytical balance). The time-weighted average (TWA) reading of the *personal*DataRAM can be used to estimate the required sampling time to collect the above mentioned mass on the filter. To estimate the required sampling time (ET as measured on the *personal*DataRAM) in minutes, read the TWA value (see Section 8.3), after an elapsed time (ET) of one minute or more, and apply the following relationship:

$$ET \geq 500/TWA$$

For example, if TWA = 2.5 mg/m^3, then ET ≥ 200 minutes (approximately 3 hours). If the TWA value changes significantly as the run proceeds, recalculate the required ET accordingly.

At the end of the run (after time ET has elapsed), record TWA, ET and the flow rate Q of the filter sampler. Weigh the filter on an analytical balance and obtain Δm, the mass increment due to the collected particles.

Calculate the average gravimetric concentration C, as follows:

$$C = 1000\ \Delta m/ETxQ$$

Compare the recorded value of TWA and the calculated value C, and calculate the calibration factor to be programmed into the *personal*DataRAM (see Section 9.0) as follows:

$$CAL\ FACTOR = C/TWA$$

For example, if C was found to be 3.2 mg/m^3, and TWA had been determined to be 2.5 mg/m^3, the CAL FACTOR equals 1.28. Select this value on the PC, as described in Section 9.0. This completes the gravimetric calibration of the *personal*DataRAM for a specific aerosol.

12.3 Internal Span Check

The zeroing procedure (see Section 8.1) and the resulting normal diagnostic display of "CALIBRATION: OK" (step 2) informs the user that the instrument's calibration agrees with the original factory setting. This is an internal span check that consists of an automatic comparison between the initial (factory) optical background of the *personal*DataRAM (registered in its non-volatile memory), and the current optical background sensed during the zeroing sequence.

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INSTRUCTIONS FOR THE USE OF THE RECHARGEABLE BATTERY MODULE MIE MODEL *p*DR-BP

1.0 DESCRIPTION

The MIE Rechargeable Battery Pack (MIE model *p*DR-BP) is an optional accessory for the *personal*DataRAM hand-held dust monitor/data logger. The *p*DR-BP is a modular unit for direct plug-in and rigid attachment to the *personal*DataRAM. The *p*DR-BP contains a rechargeable nickel-metal-hydride (NiMH) battery pack designed to provide d.c. power to the *personal*DataRAM allowing it to operate for an extended period of time without requiring line power, or battery replacement.

Plugging the Rechargeable Battery Pack into the *personal*DataRAM automatically disconnects the internal battery of the instrument, preventing any interference between the internal and the external power sources.

The *p*DR-BP can be recharged by means of the AC Power Supply (MIE model *p*DR-AC) provided as standard accessory with the *personal*DataRAM. The *p*DR-BP, used in combination with the *p*DR-AC, provides uninterruptible power operation, i.e. continuous operation over unlimited time, even during line power interruptions.

2.0 ATTACHMENT TO *personal*DataRAM

Before attaching the Rechargeable Battery Pack to the *personal*DataRAM, the instrument should be shut off. The same rule applies when detaching the two units.

Place the *personal*DataRAM upside down on a flat surface. Carefully insert the upper end of the *p*DR-BP and its output connector (see accompanying figure) into the bottom end of the *personal*DataRAM, aligning the connector of the *p*DR-BP with the corresponding d.c. power receptacle on the *personal*DataRAM. Ensure complete insertion and then tighten firmly the large thumbscrew on the bottom end of the *p*DR-BP (now facing upwards). Check that the *p*DR-BP is firmly attached to the *personal*DataRAM forming one solid unit.

3.0 CHARGING PROCEDURES

To charge the Rechargeable Battery Pack plug the output connector of the AC Power Supply (model *p*DR-AC) into the charger receptacle on the bottom of the *p*DR-BP (see accompanying figure). Connect the line plug of the *p*DR-BP to an a.c. line outlet. It can be used with any voltage between 100 and 250 volts a.c. (50-60 Hz).

The *p*DR-BP can be charged either separately or while attached to a *personal*DataRAM, and the latter may be switched on or off during charging.

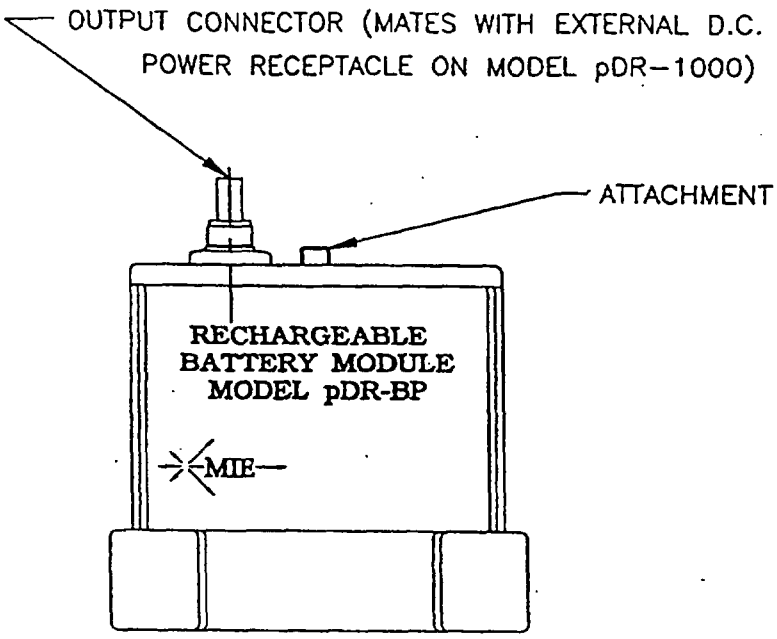
A completely discharged *p*DR-BP battery requires approximately 2 hours to be fully recharged using the *p*DR-AC charger. No overcharging or damage to the battery will occur if the charger is left connected to the *p*DR-BP for longer periods of time; however, it is advisable to disconnect the charger after full charge has been reached in order to extend the life of the rechargeable battery.

Charging of the *p*DR-BP should be completed as close to a monitoring run start time as possible to minimize self-discharge losses.

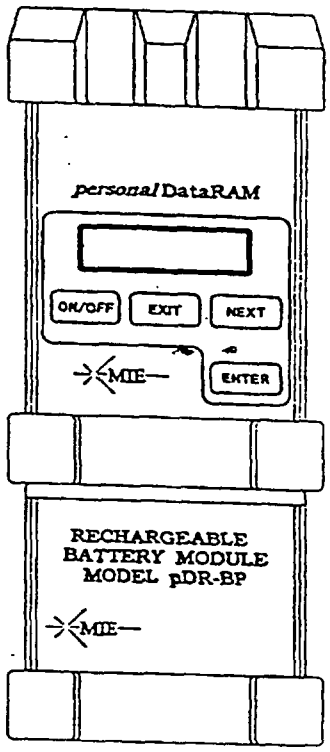
The NiMH battery used in the *p*DR-BP exhibits no memory effects, therefore it may be recharged even when only partially discharged without affecting its capacity to retain a full charge.

4.0 SPECIFICATIONS

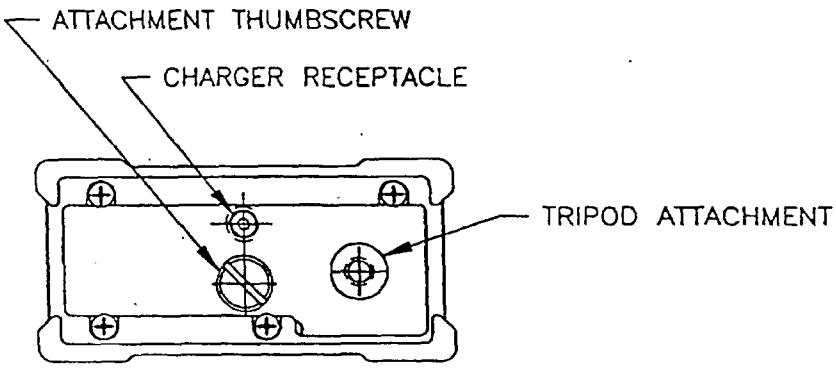
- Rated capacity @ 20 °C: 1.9 ampere-hours
- Full charging time: 2 hours
- Operating time when used to power *personal*DataRAM @ 20 °C: 50 hours (typ.)
- Life expectancy: > 500 cycles (typ.)
- Dimensions (max. external): 102 mm (4.0 in) H x 92 mm (3.6 in) W x 45 mm (1.8 in) D
- Dimensions (attached to *personal*DataRAM): 77 mm (3.0 in) H x 92 mm (3.6 in) W x 45 mm (1.8 in) D
- Weight: 0.45 kg (1 lb)



SIDE VIEW



pDR-BP ATTACHED TO pDR-1000



BOTTOM VIEW