

Chemical Safety Data Sheet SD-56

PROPERTIES AND ESSENTIAL INFORMATION

FOR

SAFE HANDLING AND USE

OF

VINYL CHLORIDE

ADOPTED 1954

Chemicals in any form can be safely stored, handled or used if the physical, chemical and hazardous properties are fully understood and the necessary precautions, including the use of proper safeguards and personal protective equipment, are observed.



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CHEMICAL SAFETY DATA SHEET

VINYL CHLORIDE

SUMMARY

Vinyl chloride is a highly volatile extremely **FLAMMABLE** compressed gas which is ordinarily handled in liquefied form under pressure. It has a mild anesthetic action in concentrations above 500 ppm. and its vapors are irritating to the eyes.

Precautions necessary in handling the material are detailed in the body of the Safety Data Sheet. Key points to consider for safe handling include:

1. Keep away from heat, sparks and open flame.
2. Provide adequate ventilation.
3. Ground equipment and containers before discharging to reduce danger of ignition from static sparks.
4. In discharging do not heat containers above 50°C. (122°F.). No heat should be applied to tank cars.
5. All equipment should be of steel and have a designed working pressure of at least 100-150 psi.
6. In the event of accidental leaks, spills or whenever excessive vapor concentrations may be encountered only personnel equipped with approved respiratory protection should be permitted in the contaminated area.
7. Chemical safety goggles should be worn when discharging containers or tank cars or whenever there is a danger of the liquid or saturated vapor coming in contact with the eyes.
8. Waste disposal should be away from any source of ignition. Dilute phenolic residues before discharging to sewer.

In case of fire use carbon dioxide or dry chemical extinguishing equipment. In the event of contact with the liquid remove contaminated clothing immediately. For eyes flush immediately with large quantities of water for at least 15 minutes while medical attention is being sought.

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Chemical Safety Data Sheet

VINYL CHLORIDE

Adopted February, 1954

1. NAME

Chemical Names: Vinyl Chloride
Chloroethylene
Chloroethene
Common Name: Vinyl Chloride
Formula: CH_2CHCl

2. PROPERTIES

2.1 Grade:

Technical with inhibitor. (Purity of sample 99.42%)

2.2 Important Physical and Chemical Properties:*

Boiling Point.....	—13.8°C. (+7°F.)
Color.....	Colorless or water white
Corrosivity.....	Noncorrosive at normal atmospheric temperatures when dry (moisture free). In contact with water at elevated temperatures vinyl chloride accelerates corrosion of iron or steel.
Explosive Limits (Percent by Volume in Air).....	Lower 4%; Upper 22%
Flash Point.....	—78°C. (—108.4°F.), Open-Cup
Hygroscopicity.....	No
Critical Pressure.....	52.7 Atmospheres
Critical Temperature.....	158.4°C. (317°F.)
Deliquescence.....	No
Ignition Temperature. Autogenous.....	472.22°C. (882°F.) (Vapors above —60°F.)
Light Sensitivity.....	Not a factor in handling inhibited vinyl chloride
Melting Point.....	—153.71°C. (—245°F.)
(Freezing Point)	
Molecular Weight.....	62.50
Odor.....	Sweet smelling gas
Physical State.....	Gas at ordinary temperature and pressure. Liquid under pressure in cylinders or pressure vessels at room temperature.
Reactivity.....	Polymerizes readily in presence of air, sunlight, oxygen or heat. This behavior is due to the presence of a double bond. Otherwise vinyl chloride is quite stable.
Specific Gravity.....	.9121 @ 20°/20°C. (Water = 1.00)
Vapor Density.....	2.15 (Air = 1.00)
Vapor Pressure.....	2580 mm. of mercury 20°C. (68°F.)

*Many of the data recorded under this paragraph were determined in the research laboratory of one of the large producers of vinyl chloride and are based on a technical grade material having a purity of 99.42%. Materials from other sources may vary in accordance with the nature of the impurities or the character of the inhibitor present.

2.3 Hazardous Properties

2.3.1 HEALTH HAZARDS (See 8. Health Hazards and Their Control)

Aside from the risk of fire and explosion, vinyl chloride presents no other very serious problem in general handling. The presently accepted upper limit of safety as a health hazard is 500 ppm.

2.3.2 FIRE HAZARD

Vinyl chloride vapors form flammable mixtures with air at all temperatures above -78°C . (-108.4°F .)

3. USUAL SHIPPING CONTAINERS

3.1 Type and Size

3.1.1 Approved ICC cylinders and tank cars designed to carry liquid gases under pressure and equipped with safety relief devices.

3.1.2 All parts of valve and safety devices in contact with contents of containers must be of metal or other material suitably treated if necessary, which will not cause formation of any acetylides. A good practice is to dismantle

all valves for inspection before each loading. Approved cylinders include ICC-4B300, ICC-4BA300, ICC-3A300, and ICC-3AA300. *Cylinders with brazed seams are not permitted.*

3.1.3 Some types of tank cars are ICC-106A-500, ICC-106A500X, ICC-105A300 and ICC-105A300W. Maximum permitted filling density is 84% for cylinders and for Class ICC-106A cars and for Class ICC-105A cars 87%.

3.1.4 Filling density is defined as the percent ratio of the weight of chemical in the tank to the weight of water that the tank or cylinder will hold.

3.1.5 ICC Regulations require that vinyl chloride must be inhibited for the purpose of transportation (See 6.2.3).

3.2 Label or Identification

3.2.1 Each container of vinyl chloride (including tank cars) should carry an identifying label or stencil.

3.2.2 The Manufacturing Chemists' Association recommends the following in addition to, or in combination with, any label warnings or other statements required by statutes, regulations, or ordinances:

VINYL CHLORIDE

DANGER! EXTREMELY FLAMMABLE

Keep away from heat, sparks, and open flame.

Keep container closed.

Use with adequate ventilation.

Avoid prolonged breathing of vapor.

3.2.3 Each shipping container must bear the ICC red label for **FLAMMABLE** compressed gases.

3.2.4 Tank cars and railroad cars carrying one or more containers of vinyl chloride must bear the ICC **DANGEROUS** placard.

3.3 Disposal and Return Precautions

3.3.1 Small containers (ICC-4B300 and ICC-4BA300, without brazed seams, ICC-3A300, ICC-3AA300) should be drained free of liquid vinyl chloride and the valves closed tightly before they are returned to the supplier. No air should be permitted to enter the container (See 4.3).

3.3.2 In addition, the following precautions must be taken:

3.3.2.1 Return of Small Containers

The cylinder valve protection cap or outlet cap must be securely replaced. The lower portion of the ICC shipping tag, if attached to the cylinder, must be removed. In other cases, applicable to ICC Regulations, compliance is essential. Bill of lading should give the cylinder identification number (which appears on the shoulder of cylinder) for each cylinder shipped, show name of consignee and indicate that the cylinders are empty (See 3.3.5).

Full or partly emptied cylinders should not be returned without permission of the supplier. Such cylinders must be shipped as full cylinders and correspondingly labeled and tagged (See 3.2). All empty cylinders should be returned promptly.

3.3.3 Tank cars (ICC-106A500, ICC-106A-500X, ICC-105A300, and ICC-105A300W) should be drained free of liquid vinyl chloride, the valves should be securely closed and the valve plugs replaced. No air should be permitted to enter the vessel. The inert gas used for the unloading procedures (See 4.4 Tank Cars) should be left in the vessel at a pressure not to exceed the service pressure for which the car is authorized.

3.3.4 In addition, the following precautions must be taken:

3.3.4.1 Return of Tank Cars

As soon as a tank car is completely unloaded, all valves must be made tight, the unloading connections must be removed and all closures made tight, except that heater coil inlet and outlet pipes (if any) must be left

open for drainage. Heater coils must never be used in unloading vinyl chloride. Empty tank cars should be returned as promptly as possible, in accordance with instructions received from shipper.

3.3.5 Follow ICC Regulations regarding the replacement of closures, condition and labeling of empty containers; condition of empty cars and placard requirements before returning to shipper. The ICC **DANGEROUS** placards on sides and ends of tank cars must be removed, or reversed (if in metal placard holders) by the party discharging the tank car. The empty car must be offered to the receiving carrier either without placards, or preferably with four (4) **DANGEROUS-EMPTY** placards.

4. UNLOADING AND EMPTYING

4.1 Health Hazards (See 8. Health Hazards and Their Control)

4.1.1 Aside from the risk of fire and explosion, vinyl chloride presents no other very serious problem in general handling. The presently accepted upper limit of safety as a health hazard is 500 ppm.

4.2 Fire and Explosion Hazards

4.2.1 Vinyl chloride should always be handled with full recognition of its flammability. Precautions should be taken both to keep the material enclosed and to eliminate sources of ignition. Reliance must be placed upon the elimination of all sources of ignition and on the provision of sufficient ventilation to keep escaping vapors at nonflammable levels (See 6.2).

4.3 Cylinders

4.3.1 Precautions generally applied to use of cylinders (ICC-4B300 and ICC-4BA300, without brazed seams, ICC-3A300, ICC-3A-A300) for flammable liquefied gases should be used.

4.3.2 A water bath heated to a maximum of 50°C. (122°F.) may be used to empty cylinders by means of the vapor pressure of the vinyl chloride.

4.3.3 Check valves must be installed in feed lines from the cylinder to prevent the reactants from entering the cylinder.

4.3.4 When the cylinder is empty, the valve should be securely closed. Air should not be allowed to enter the container.

4.3.5 Valve protective caps should be kept in place on cylinders except when the cylinders are connected for discharge.

4.3.6 Cylinders must not be filled except by or with the consent of the owner, and then only in accordance with the Regulations of the Interstate Commerce Commission.

4.3.7 No attempt should ever be made to mix gases or liquids in a cylinder.

4.4 Tank Cars

4.4.1 Applicable instructions for unloading tank cars containing flammable liquids are set forth in MCA Manual Sheet TC-4. (Also see ICC Regulations, Sec. 74.560 to 74.563 inclusive, for unloading tank cars.)

4.4.2 Shipper's instructions should always be followed and all caution markings on both sides of tank and dome should be read and observed.

4.4.3 In the event of a tank car fitting failure or leak, the shipper should be telephoned or wired immediately for instructions (See 6.3).

4.4.4 Tank cars should be electrically grounded to dissipate static or induced lightning charges.

4.4.5 No heat should be applied to the tank car. An inert gas line or compressed vinyl chloride gas line should be attached to vent connection of the tank car to provide a pressure for transfer of the liquid vinyl chloride from tank car to receiving tank.

Cylinder nitrogen (inert gas) is often used as the pressuring medium in the event vinyl chloride gas is not available. Larger installations may have a suction line connected from the storage tank to a compressor which discharges compressed vinyl chloride gas to vent connection on tank car. The pressure on the car should never exceed the service pressure at which the safety valve is set to operate.

4.4.6 Some tank cars in vinyl chloride service are equipped with excess flow check valves. A too rapid opening of the discharge valves will cause the check valves to close. If this should occur, the outlet valve should be closed until the pressure is equalized and the excess flow valve opens.

4.4.7 Positive vinyl chloride or inert gas pressure should be left in car. No air should be allowed to enter car (See 3.3.3).

5. STORAGE

5.1 Hazards (See 8. Health Hazards and Their Control)

5.1.1 Aside from the risk of fire and explosion, vinyl chloride presents no other very serious problem in general handling. The presently accepted upper limit of safety as a health hazard is 500 ppm.

5.1.2 Vinyl chloride should always be handled with full recognition of its flammability. Precautions should be taken both to keep the material enclosed and to eliminate sources of ignition. If there should be any unavoidable leaks, reliance must be placed upon the elimination of all sources of ignition and on the provision of sufficient ventilation to keep escaping vapors at nonflammable levels (See 6.2).

5.1.3 CORROSION

Vinyl chloride is noncorrosive at normal atmospheric temperatures when dry (moisture free). In contact with water at elevated temperatures vinyl chloride accelerates corrosion of iron or steel.

5.1.4 VOLATILITY

Vinyl chloride is very volatile and is a gas at normal atmospheric conditions. Containers used for handling vinyl chloride at atmospheric temperature are always under pressure.

5.1.5 TEMPERATURE REQUIREMENTS

Inhibited vinyl chloride may be stored at normal atmospheric conditions in suitable pressure vessel.

Uninhibited vinyl chloride may be stored either under refrigeration or at normal atmospheric temperature in the absence of air or sunlight but only for a duration of a few days. If for longer periods, regular checks should be made for the presence of polymers.

5.2 Conditions of Storage

5.2.1 TYPE OF CONSTRUCTION

All piping (including instrument leads), storage tanks, relief devices and equipment employed to handle vinyl chloride should be of steel and designed to have a working pressure of at least 100-150 psi with a safety factor conforming to the A.S.M.E. code for unfired pressure vessels or any code applying to locale of planned storage. Shut-off valves and control

valves should be of steel or a suitable alloy not bearing copper, designed for working pressures of 150 psi or over. All-welded construction is preferred to riveted construction. It is recommended wherever possible that all liquid inlet lines enter the bottom or extend to the bottom of the vessel. This guards against the accumulation of static electricity. All equipment should be properly grounded with resistance to ground never exceeding 25 ohms. An efficient water spray system should be installed or made available. Adequate diking and drainage should be provided under tank area to confine and dispose of the liquid in case of vessel rupture. Any cylinders used to store vinyl chloride must meet ICC Specifications.

5.2.2 ISOLATION

Storage areas should be selected in accordance with local codes or authorities having jurisdiction. (Assistance may be obtained from such organizations as National Board of Fire Underwriters, Factory Insurance Association, Associated Factory Mutual Fire Insurance Companies.) For highly volatile and flammable material, storage should be located outside of buildings. Cylinders containing vinyl chloride should be stored always in a vertical position, outside of buildings, and in an isolated and well ventilated area. It is preferable to store cylinders in the open, but provision should be made to shield them from the direct rays of the sun and prevent accumulation of dirt, snow, water, or ice on valves or safety devices.

5.2.3 COMPATIBLE AND DANGEROUSLY REACTIVE MATERIALS

Tanks in vinyl chloride service should be used only for the storage of vinyl chloride (See 6.8). Before vinyl chloride is placed in a tank, the vessel should be purged with an inert gas until free of air. Vinyl chloride is generally noncorrosive at normal atmospheric temperatures when dry (moisture free). However, mild to appreciable corrosion has been noted even at ordinary temperature. This may be due to the presence of impurities. In contact with water at elevated temperatures vinyl chloride accelerates corrosion of iron or steel. Acetylene as an impurity in vinyl chloride may form an explosive compound (acetylide) when exposed to copper or possibly copper alloys.

5.2.4 VAPOR-PROOF OR EXPLOSION-PROOF REQUIREMENTS

All electrical equipment, motors, lights, and flashlights used in an area in which vinyl chloride is stored or handled should conform

to the National Electrical Code (Class I, Division II for storage; and Class I, Division I for use).

5.2.5 VENTING REQUIREMENTS

An adequate system for normal and emergency venting should be installed. All vent lines should extend to a safe area free of any source of ignition. The point of outlet should be equipped with an approved flame arrestor. Relief valves should be installed in pairs, parallel, using transflow valving to facilitate periodic testing and repairing.

5.2.6 VENTILATION

All storage areas should be provided with continuous ventilation. Pits, depressions and basements should be avoided.

5.2.7 PROTECTION FROM ELECTRICAL STORMS

Storage tanks for vinyl chloride should be protected from electrical storms and induced static electricity by grounding of all equipment.

5.2.8 PROTECTION FROM INTERNAL EXPLOSIVE MIXTURES

Storage tanks and other vessels should be maintained under positive pressure utilizing an inert gas when necessary or vapor pressure of the vinyl chloride. Vessels should be provided with bottom inlets under the liquid, or dip pipe extending from the top of the vessel to within inches of the bottom of the vessel to protect against a static discharge.

6. HANDLING

6.1 Health Hazards (See 8. Health Hazards and Their Control)

6.1.1 Aside from the risk of fire and explosion, vinyl chloride presents no other very serious problem in general handling. The presently accepted upper limit of safety as a health hazard is 500 ppm.

6.2 Fire, Explosion, and Polymerization Hazards

6.2.1 FIRE HAZARDS

Vinyl chloride should always be handled with full recognition of its volatility and its flammability. In general, precautions should be taken both to keep the material enclosed and to eliminate all sources of ignition. In small

laboratory operations, where vinyl chloride vapors may escape, reliance must be placed upon the elimination of sources of ignition and the provision of sufficient ventilation to keep escaping vapors at non-flammable levels. Vinyl chloride vapors can form flammable mixtures with air at all temperatures above -78°C . (-108.4°F).

Fires involving large quantities of liquid are difficult to extinguish since vinyl chloride is not miscible with water and is lighter than water (will float on top of water). Most small fires can be extinguished with carbon dioxide or dry chemical agents if properly applied. Adequate fire extinguishing equipment of carbon dioxide or dry chemical type, fixed and portable, should be provided. Water spray is also satisfactory for extinguishing fires. Diking and drainage should be provided for confining and disposing of the liquid in case of tank rupture or spills. Precautions should be taken to guard against vinyl chloride entering general sewer system (See 6.3).

In event of a fire no unauthorized person should be permitted to enter an unventilated area until the space has been thoroughly sprayed with water to remove gases such as hydrogen chloride, phosgene, carbon monoxide, etc. generated from the fire.

6.2.2 EXPLOSION HAZARDS

Vinyl chloride is a gas at normal atmospheric temperature and pressure. The gas will burn very readily in proper mixtures of air or oxygen. The explosive limits are: lower 4.0%, upper 22.0% by volume in air. An explosion hazard can exist when drawing samples or venting to the atmosphere. Open flames, local hot spots, friction, any spark producing equipment, and static electricity are to be avoided when handling this material.

6.2.3 POLYMERIZATION HAZARDS

Vinyl chloride does not form peroxides by autoxidation as readily as many other monomers. Aside from polymerization, vinyl chloride is chemically quite stable (See 2.2 Reactivity). Vinyl chloride can be satisfactorily stored without an inhibitor for short periods if it is kept in steel tanks under refrigeration or at normal atmospheric temperature in the absence of air and sunlight. For shipping purposes inhibitors are employed. Inhibitors, like phenol, when present have hazards of their own, being very toxic (See 7.5).

6.3 Spills and Leakage

6.3.1 Frequent inspections of equipment and vessels containing vinyl chloride should be made to detect or prevent leaks.

6.3.2 If spills or leaks occur, all sources of ignition if required to be present in the area and adjacent areas must be shut off immediately. Only necessary and properly protected personnel should remain in the area (See 6.5).

6.3.3 Spills, unless very large, usually evaporate rather rapidly and do little damage, but ample ventilation should be provided to prevent the formation of toxic and explosive mixtures. Spills should be guarded and controlled immediately. All openings in sewer system should be trapped for segregation and extinguishment. All sources of ignition should be removed (See 6.2.1).

6.3.4 If possible, increased forced ventilation should be provided. Inhalation of vapors should be avoided (See 8).

6.3.5 Leaking cylinders in any enclosure should be removed to an isolated, well-ventilated area and the contents transferred to other suitable containers (See 4.3 and 5.2.2).

6.3.6 The detection of leaks in equipment of vinyl chloride can best be accomplished by the use of a flammable gas indicator, or by inspection for the presence of vapors and frosting on the surfaces of the equipment.

6.3.7 In the event of a tank car leakage, utilize necessary personal protective equipment and make emergency repairs, if possible. The supplier should be telephoned or wired immediately for specific instructions. Guard against the fire hazard or explosion hazard (See 6.2).

6.3.8 Clothing contaminated with vinyl chloride should be removed immediately and the body washed thoroughly to remove any material which may have penetrated to the skin. Clothing should be washed before reuse. If necessary shoes should be replaced with new ones. Disposal of the contaminated shoes is recommended if the spilled vinyl chloride contained a toxic inhibitor, like phenol.

6.4 Employee Education and Training

6.4.1 Safety in handling vinyl chloride and other hazardous chemicals depends upon the effectiveness of employee education, training, and the safety instructions incorporated into job instruction manuals.

6.4.2 The education and training of employees to work safely and to use the personal protective equipment or other safeguards provided for them is a responsibility of supervision.

6.4.3 Employee education and training should emphasize the need of handling vinyl chloride according to the methods outlined in this data sheet.

6.4.4 Before being placed on the job, new or transferred employees should be thoroughly instructed and questioned in respect to the proper handling of vinyl chloride. Employees on the job should be reinstructed periodically.

6.4.5 Each employee should know the location, purpose, use and maintenance of personal protective equipment and be thoroughly trained in when and how to use the equipment (See 6.5).

6.4.6 Each employee should know the location of safety showers, eye baths, bubbler drinking fountains, faucets or fire extinguishing equipment.

6.4.7 Only reliable, properly trained employees should be given the responsibility of operating valves which control the flow of vinyl chloride to and from storage tanks, tank cars, and cylinders, or drawing samples and venting to the atmosphere.

6.4.8 Employees should be trained to report to the proper authority all suspected leaks or equipment failures and any signs of illness of personnel.

6.4.9 Each employee should know what to do in case of an emergency, in rendering first aid measures, and should realize the necessity for prompt administration of artificial resuscitation when overcome by vinyl chloride vapors (See 8.4.2.1).

6.5 Personal Protective Equipment

6.5.1 AVAILABILITY AND USE

Personal protective equipment is not an adequate substitute for good, safe, working conditions, adequate ventilation, and intelligent conduct on the part of employees working with vinyl chloride. Such equipment may protect the individual wearing it while others in the area may be exposed to danger. The correct usage of personal protective equipment requires the education of the worker in the proper employment of the equipment available to him (See 6.4). Under conditions which are sufficiently hazardous to require protective equip-

ment, the use of it should be supervised. In all cases, the type of protective equipment selected should depend upon the nature and degree of the hazards existing.

The following personal protective equipment should always be used for the purposes mentioned and as specified in Section 8. Health Hazards and Their Control, and in other sections of this data sheet:

6.5.2 EYE PROTECTION

6.5.2.1 *Chemical Safety Goggles:* cup-type or rubber-framed goggles, equipped with approved impact resistant glass or plastic lenses, should be worn whenever there is danger of the vinyl chloride (in liquid or saturated vapor form) coming in contact with eyes. Goggles should be carefully fitted by adjusting the nose piece and head band to ensure maximum protection and comfort.

6.5.2.2 *Spectacle-type Safety Goggles:* metal or plastic rim safety spectacles with perforated side shields which can be obtained with prescription safety lenses or suitable all plastic safety goggles may be used where continuous eye protection is desirable. These types, however, should not be used where complete eye protection against chemicals is needed.

6.5.2.3 *Face Shields:* plastic shields (full length, eight inch minimum) with forehead protection may be worn in lieu of, or in addition to, chemical safety goggles where complete face protection is desirable. Chemical safety goggles should always be worn as added protection where there is danger of vinyl chloride striking the eyes from underneath or around the sides of the face shield.

6.5.2.4 Each employee should know the location of safety showers, eye baths, and bubbler drinking fountains for flushing the eyes.

6.5.3 RESPIRATORY PROTECTION

Respiratory protective equipment must be carefully maintained, inspected, cleaned, and sterilized at regular intervals, and always before use by another person. Personnel wearing such equipment must be carefully instructed as to its operation and limitations.

6.5.3.1 Air or Oxygen Supplied Masks

6.5.3.1.1 Air or oxygen supplied masks, equipped with full face pieces and approved by the U. S. Bureau of Mines for this purpose, should be used under the following conditions,

and the manufacturer's instructions must be carefully followed:

(a) In emergencies, when the vapor concentration is not definitely known.

(b) When the harmful vapor concentration is over 2 per cent by volume.

(c) When the oxygen content of the air may be less than 16 per cent by volume.

(d) When the exposure period is to be over 30 minutes duration.

(e) In tank and equipment cleaning and repair work under conditions outlined in (a), (b), (c) and (d).

6.5.3.1.2 *Types Generally Available Include:*

(a) *Air-Line Masks* supplied by plant compressed air are suitable for use only where conditions will permit safe escape in case of failure of the compressed air supply. Such masks should be used only in conjunction with a suitable reducing or demand-type valve, excess pressure relief valve, and filter. The compressed air should be checked frequently to make certain that harmful gases from the decomposition of the lubricating oil used in the compressor, or impure air supply, are not present.

(b) *Positive Pressure Hose Masks* supplied by externally lubricated blowers are usually preferred to the air-line type. Since these masks also depend on a remote air supply, they should be used only where conditions will permit safe escape in the event of air supply failure. Care must be taken to locate the blower air source in an area which is free of air contaminants.

(c) *Self-contained Breathing Apparatus* which permits the wearer to carry a supply of oxygen or air compressed in the cylinder, and the self-generating type which produces oxygen chemically, allow for greater mobility. The length of time a self-contained breathing apparatus provides protection varies according to the amount of air or oxygen supply carried. In tank work, where small manholes are encountered, a self-contained breathing apparatus is usually unsuitable because of its bulk.

6.5.3.2 *Industrial Canister Type Gas Masks* equipped with full face pieces and approved by the U. S. Bureau of Mines, fitted with the proper canister for absorbing vinyl chloride vapor (or gas), will afford protection against concentrations not exceeding 2 per cent by

volume when used in accordance with the manufacturer's instructions. The oxygen content of the air must be not less than 16 per cent by volume. The masks should be used for relatively short exposure periods only, i.e., less than 30 minutes. They may not be suitable for use in an emergency since, at that time, the actual vapor concentration is unknown and it may be very high. The wearer must be warned to leave the contaminated area immediately on detecting the odor of vinyl chloride. This is an indication that the mask is not functioning properly or that the vapor concentration is too high.

NOTE: Where carbon monoxide may be encountered in addition to vinyl chloride, the mask should be equipped with an "All Purpose Canister" and a "Timing Device" as approved by the U. S. Bureau of Mines.

6.5.3.3 *Chemical Cartridge Respirators* approved by the U. S. Bureau of Mines may be used to avoid inhaling disagreeable but harmless concentrations of vinyl chloride vapor. These respirators, however, are not recommended for protection where toxic quantities of an air contaminator may be encountered.

6.5.4 *HEAD PROTECTION*

6.5.4.1 Safety or "hard" hats will provide protection against accidental liquid leaks, falling tools, and other objects.

6.5.4.2 Brimmed felt hats may be substituted for a safety hat where danger of falling objects is remote.

6.5.5 *FOOT PROTECTION*

High leather or synthetic rubber safety shoes with built-in steel toe caps are recommended where there is danger of heavy objects falling on workman's foot. Liquid vinyl chloride penetrates leather, and shoes wet with vinyl chloride should be replaced.

6.5.6 *BODY, SKIN AND HAND PROTECTION*

6.5.6.1 Any work gloves, clothing or wearing apparel which becomes contaminated with vinyl chloride should be removed immediately, and the body should be thoroughly washed. All contaminated work gloves, clothing or wearing apparel should be thoroughly washed, and dried before reuse. For care of contaminated shoes see 6.5.5.

6.5.6.2 When cleaning, inspecting, or repairing tanks, safety equipment such as safety

belts, rescue harness, lifeline, clothing and gas masks should be worn as required by the specific nature of the work and the hazards involved.

6.5.6.3 Frequent inspections and necessary repairs should be made to all personal protective equipment so that it is always ready to give proper protection to the wearer.

6.5.6.4 Facilities for personal cleanliness should be provided and time allowed for thorough washing before lunch and at the end of the work day.

6.6 Engineering Controls

6.6.1 Selection of a site or location for apparatus or equipment to ship, handle, store or manufacture vinyl chloride should be made by the direction of chemical engineers or mechanical engineers fully aware of the hazards encountered in dealing with vinyl chloride (See 5.2.2).

6.6.2 Processes should be designed so that the operating personnel will not be exposed to direct contact with vinyl chloride or its vapor. The technical problems of designing equipment, providing adequate ventilation, and formulating operational procedures which promise maximum security and economy, can be handled best by engineers or other competent personnel. The manufacturers of vinyl chloride, and of the equipment in which it is to be used, are always prepared to help with these problems (See 5.2.1).

6.6.3 In the handling of vinyl chloride or operation of any type of vinyl chloride system, all valves, pipe lines, vents, safety devices, etc., should be so located that they can be readily inspected and repaired. They should always be in proper order and condition before the operation is started. All handling and storage equipment should be located away from any source of sparks, flames, heated surfaces and all sources of ignition which might cause fires or explosions. All charging and discharging pipes should enter through, or extend to, the bottom of all containers to minimize vaporization of the liquid and possible generation of static electricity.

6.6.4 It is essential for safety that equipment will be used and maintained as recommended by the manufacturer and that a periodic test schedule of the equipment, including safety devices, should be followed. All vent lines should extend outdoors to an area free of any source of ignition for discharge.

6.6.5 All electrical installations should conform with the National Electrical Code. All equipment should be properly grounded to prevent accumulation of static.

6.7 Ventilation

6.7.1 If the workroom or operating area is separate from vinyl chloride storage or processing equipment, general ventilation is adequate. For emergencies, however, the area should be provided with mechanical exhaust ventilation to maintain concentrations below flammable limits.

6.7.2 In the processing or storage area, if outside location is impracticable, special emergency equipment for ventilation is necessary under abnormal conditions, such as leaks or spills.

6.7.3 Six or more changes of air per hour are considered adequate for buildings housing storage or processing equipment for flammable liquids, vapors, or gases under pressure.

6.7.4 Buildings of substantial construction should have at least one square foot of door, window, or nonrigid roof area for each 35 cubic feet of volume to prevent serious structural damage in the event of explosion within the building.

6.7.5 The most important consideration in ventilation is to ensure an adequate air flow away from the work area.

6.7.6 All ventilating systems should be inspected periodically and maintained in a safe and efficient working condition.

6.7.7 Under abnormal conditions, such as when leaks or spills occur, all available ventilation should be used.

6.8 Tank and Equipment Cleaning and Repairs

6.8.1 The hazardous nature of tank or vessel inspections, cleaning, and repairs requires that the foreman and crew be selected, trained, and drilled carefully. They should be fully familiar with the hazards and safeguards necessary for the safe performance of the work. Use only spark-resistant tools.

6.8.2 Wherever possible, vessels should be cleaned from the outside, using cleanout manholes or openings provided for this purpose.

6.8.3 First consideration in vessel entry work requires the vessel be properly isolated

from any process equipment, pipe lines, or apparatus. These process lines, pipe lines, and apparatus should be disconnected, preferably by removing a complete small section and providing a blank flange on the open end to protect against human error and unsuspected leaks. Valves and plug cocks in the process lines, pipe lines, or apparatus should not be relied upon to prevent leakage into vessel being cleaned.

6.8.4 Electrical switches should be locked in the "OFF" position and tagged with a warning that they are not to be opened. Where possible, the fuses should be pulled. Drive belts should be removed and all other precautions taken to ensure against the accidental starting of agitating equipment or other moving parts inside the vessel or adjacent to the entrance.

6.8.5 Before entering a tank, it should be empty, purged, and tested for flammable residues. Caution should be exercised in checking for trapped vapors in any semi-solid or solid residues. In purging a vessel, an inert gas (carbon dioxide or nitrogen) is recommended. The inert gas must be displaced before allowing entry into a vessel. When air is used for purging a vessel, there is a period when an explosive mixture is present (mixture contains by volume between 4-22% gas). For this reason it is best to avoid the use of air in removing flammable vapors.

6.8.6 Warning signs should be placed indicating nature of hazard present during preparation of vessel for entry or repair.

6.8.7 Before entering a vessel and during the course of the work, tests should be made by a qualified person to determine that no further purging or washing is necessary, that no oxygen deficiency exists, and that no harmful gas or vapor is present.

6.8.8 Special ventilation and a continuous fresh air purging of vessel is recommended during the entire time men are cleaning, inspecting, or repairing vessel.

6.8.9 Proper personal protective equipment such as a safety belt, rescue harness, lifeline, or mask as required should be worn by anyone entering a vessel after preparation for inspection, and/or repairs (See 6.5).

6.8.10 An attendant should be stationed outside the vessel in such a position as to keep workmen within the vessel under constant observation. He should serve as the lifeline tender and be ready at all times to summon help or other required aid. He should never abandon the lifeline while workmen are in the vessel.

6.8.11 A self-contained breathing apparatus or an air-supplied mask should be located immediately adjacent to vessel repair area for any emergency situation during vessel entry work. In addition a lifeline and safety harness should be on hand.

6.8.12 The portable electric lights and power tools should be in good condition, grounded and approved by competent persons for use in exposures of this nature.

6.8.13 Before reuse, the vessel should be purged free of air by using an inert gas such as carbon dioxide or nitrogen.

6.9 Repackaging

6.9.1 Only clean, ICC Specification cylinders or tank cars should be used (See 3.1).

6.9.2 Adequate ventilation should be provided and all sources of ignition removed from transfer area.

6.9.3 Proper personal protective equipment should be used (See 6.5). Transferring vinyl chloride from cylinders by the use of an uncontrolled heating method is not recommended because it is unsafe, wasteful, and time consuming. Temperatures of over 50°C. (122°F.) should not be applied to any part of a cylinder containing compressed gas. Excessive heating weakens the structural characteristics of the metal and may seriously damage the cylinder. Low melting safety devices may reach the fusing point by the application of excessive heat to a cylinder. Never apply direct flame to a cylinder. A definite fire hazard is created. For recommended practice to transfer contents of a cylinder see 4.3.

6.9.4 For recommended practice to transfer contents of tank car see 4.4.

6.9.5 The appropriate labels should be applied to the filled cylinders or tank cars (See 3.2).

7. WASTE DISPOSAL

7.1 All Federal, State, and local regulations regarding health and pollution should be observed. Disposal of waste material, however, depends to a great extent upon surroundings and weather conditions.

7.2 When it becomes necessary to dispose of vinyl chloride as such, it is preferable to do so as a vapor, venting to an area free of any source of ignition (See 5.2.5 and 5.2.6).

7.3 When a waste disposal problem arises as a result of a major spill or equipment rupture, only properly protected and qualified personnel should remain in the area (See 6.3 and 6.5).

7.4 Waste mixtures containing vinyl chloride should not be allowed to enter drains or sewers as serious explosion in such systems may result (See 6.3).

7.5 Removal of inhibitor, such as phenol in form of sodium phenolate, should be done by dilution to approximately 1% solution (See SD-4, Part 7. Waste Disposal).

8. HEALTH HAZARDS AND THEIR CONTROL

8.1 Hazards

8.1.1 GENERAL

Aside from the risk of fire or explosion, vinyl chloride presents no other very serious problem in general handling. The presently accepted maximum allowable concentration is 500 ppm.

8.1.2 SYSTEMIC EFFECTS

In concentrations well above 500 ppm, vinyl chloride acts as a mild general anesthetic.

8.1.3 LOCAL EFFECTS

In contact with the skin vinyl chloride is irritating. Prolonged contact will result in refrigeration and freezing.

8.2 Prevention and Control

Vinyl chloride is not a serious industrial hazard provided precautions are taken to avoid leaks or spills which might provide a fire or explosion hazard. Where serious leaks or spills do occur, the workmen present in the area should be evacuated, and persons returning to the area to repair or clean up equipment should be provided with appropriate gas masks, self-contained oxygen units, or air supplied hoods.

8.2.1 EMPLOYEE EDUCATION (See 6.4 Employee Education and Training)

Employees working in areas where vinyl chloride is handled or stored should be thoroughly and repeatedly warned of the anesthetic properties of vinyl chloride gas and instructed as to what to do if anesthetic effects are detected in themselves or in others (See 8.4.2.1).

Emphasis in training should be placed on:

1. *The use of artificial respiration in cases where breathing has stopped because of deep anesthesia.*
2. *The necessity of immediate removal of contaminated clothing and shoes in case of liquid spills.*
3. *Repeated washing of the eyes with copious amounts of water in case of liquid splashes.*

8.2.2 VENTILATION

Work areas where vinyl chloride is handled or stored should be provided with adequate ventilation. The concentration of vinyl chloride should be kept below the upper safe limit of 500 ppm. at all times.

8.3 Personal Protective Equipment

8.3.1 No personal protective equipment is an adequate substitute for safe working conditions and intelligent conduct on the part of employees who work with vinyl chloride. Furthermore, the correct usage of personal protective equipment requires education of the worker in the proper employment of the materials available to him. ~~Under conditions which are sufficiently hazardous to require personal protective equipment, the use of it should be supervised.~~

8.3.2 Employees who may be subjected to severe exposure to vinyl chloride, as in tank and equipment cleaning and repairs, in decontaminating extensive areas after large spillage, or in cases of failure of piping or equipment, should be provided, when indicated, with proper eye, respiratory, skin, and mucous membrane protection as follows:

- (a) Suitable gas tight safety goggles.
- (b) Rescue harness and life line for those entering tank or enclosed storage space (See 6.7).
- (c) Hose masks with hose inlet in a vapor-free atmosphere, air line masks with proper reducing valve and filter, suitable for use only where conditions will permit safe escape in case of failure of the compressed air supply, or self-contained breathing equipment with stored oxygen or air (such equipment allows greater mobility but usually requires more highly trained men).

8.3.3 Facilities for washing eyes and skin with large quantities of water should be readily available (See 6.5.2.4).

8.4 First Aid and Medical Care

8.4.1 GENERAL PRINCIPLES

8.4.1.1 As in exposure to any odorless or mildly scented anesthetic gas, a recognition of the presenting symptoms and signs in oneself and in others is very important. The anesthetic properties of vinyl chloride are mild in degree and slow in developing. Detection of symptoms except in very high concentrations permits ample warning and sufficient time for escape from the environment provided the warning is heeded and escape is possible.

8.4.1.2 As in any skin contact with irritating or harmful materials, speed in removing the contaminant from the skin is of primary importance. Vinyl chloride is very volatile and simple exposure to air will usually effect adequate removal. Clothing, shoes, bandages, or other articles by which vinyl chloride might be held in contact with the skin should be immediately removed to decrease the freezing effect.

8.4.2 SPECIFIC ACTIONS

8.4.2.1 Inhalation

Continued exposure to atmospheres containing vinyl chloride in concentrations of 1000 ppm. or over will slowly produce evidences of mild anesthesia: (1) a sensation of drowsiness and inability to concentrate, (2) a blurring of vision—at first readily cleared by conscious effort—later controlled only with difficulty or not at all, (3) staggering gait, (4) sensation of numbness or tingling in feet or hands or both.

These symptoms may be readily detected by the employee himself if he has been alerted to the possibility of their arising from over-exposure to vinyl chloride. They may also be noted in fellow employees. When such symptoms arise, they are definite warning of a hazardous exposure to vinyl chloride, and all personnel should be immediately evacuated from the area until the leak or spill has been located and corrected and until complete recovery from all symptoms has occurred.

Because of the mildness and slow development of symptoms, it is very unlikely

that any workman will be overcome to the point where he will require help in escaping the environment or medical care following exposure. Any person with evidence of intoxication from vinyl chloride should be put at rest, either seated or lying, in an uncontaminated atmosphere.

If trapped in an area of high concentration where escape is impossible, deep anesthesia can result. If such an exposure has occurred, the patient should be placed in bed, preferably with the head slightly lowered and with no pillows. If respirations have ceased, artificial respiration will be required. In any case, medical attention should be obtained immediately.

8.4.2.2 Contact with Skin

Liquid vinyl chloride is a primary irritant to intact skin. If sufficient quantities remain long enough in contact with the skin, the rapid evaporation may result in freezing or "frost bite". Consequently, anything which tends to hold vinyl chloride in contact with the skin, such as clothing, shoes, or bandages, increases the risk of freezing.

If spills occur, all contaminated clothing should be removed immediately and the contaminated area washed copiously in running water. If mild irritation has occurred, no further treatment may be required. If inflammation is severe, loose dressings of petroleum jelly should be applied and the patient placed in the care of a physician.

If freezing has occurred, the area should be loosely covered with a clean, preferably sterile, gauze or towel and placed in the care of a physician.

8.4.2.3 Contact with Eyes

Vinyl chloride which has gotten into the eyes should be washed out immediately with copious amounts of flowing water. Water at room temperature will produce less pain than very cold water, but in an emergency a drinking fountain is a satisfactory source of water. The washing should continue for at least 15 minutes. If injury is apparent in the tissues of the eye after 15 minutes of irrigation, the washing should be continued for another 15 minutes. In all cases except of very minor irritation, the patient should be placed in the care of an ophthalmologist immediately.

The medical information in this publication has been supplied by the Medical Advisory Committee of the Manufacturing Chemists' Association, Inc.

MONOCHEN, INC.

SUPERVISORS' SAFETY MANUAL

April 18, 1962



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April 18, 1962

MONOCHEM INC.

SUPERVISORS' SAFETY MANUAL

Safety is everybody's business. To this end, management will actively and vigorously support a continuous program to promote the health, safety, and welfare of all employees.

Since the responsibility for making this program effective rests squarely upon the shoulders of the supervisors, you will be provided with every reasonable and practicable assistance that can be made available. This manual represents one such aid to be used as a supervisory tool. Other supervisory aids are discussed in the manual itself.

The material in the manual was developed by the pooled efforts of all levels of line supervision. It represents the consolidated thinking of the group that has direct responsibilities for accident prevention. It provides the basis upon which a continuously successful safety program must be built.

This manual is not presented to you as a finished product but as a "starting point," which is subject to more or less constant revision. You are not only requested to submit suggested changes in the manual, you are expected to.

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Your suggested changes should be channeled through your Department Head to the Safety Supervisor who will present them for consideration.

The proper use of this manual should greatly assist you in fulfilling your safety responsibilities.



J. V. LYNN

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I. INTRODUCTION

The material in this part of the manual covers the objectives of the safety and health program, its general content, and establishes responsibility.

1. OBJECTIVES

Obviously, the most compelling reason for our safety and health program is the welfare of our employees. However, an effective program also will contribute much to the Company in increased production and lowered cost of operation. The objective of our safety and health program, then, is not merely to save something; it is to add something. In addition to preventing human suffering, damage to property, and costly interruptions and delays, important objectives of our safety and health program are high morale, loyalty and efficiency in the entire working team. Safety, health, morale, loyalty and efficiency go hand-in-hand.

2. CONTENT OF SAFETY AND HEALTH PROGRAM

It is the policy of the Company to take every reasonable and practicable action to effectively control the material and machinery hazards on the working scene and to provide the best possible training in safety and health for its personnel. In pursuing this policy, our safety and health program will include, but not be limited to, the following items designed

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to help make it easier for supervisors to perform their jobs efficiently:

A. FIRE PROTECTION

A comprehensive fire protection and prevention program will be carried out under the direction of the Safety Supervisor.

(1) Fire Fighting Equipment

Adequate fire fighting equipment will be provided and maintained in good condition.

(2) Fire Fighting Crews

Well-trained fire fighting crews will be on duty at all times.

B. TRAINING

(1) Employee Safety Meetings

Definitely scheduled and well-planned and prepared safety meetings will be arranged so that each group meets at least once each month, or more often if deemed necessary. These regularly scheduled meetings are not intended as a substitute for necessary on-the-job safety meetings that should be held frequently by supervisors in connection with normal job-planning.

(2) Supervisors' Meetings

Safety training for supervisors will be an important

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part of the regularly scheduled supervisory development meetings to be held periodically. Special safety meetings of all supervisory personnel may be called by management at intervals as recommended by the Safety Supervisor.

(3) Fire Protection Training

A comprehensive fire prevention and fire-fighting training program will be carried out under the direction of the Safety Supervisor. Persons designated to serve as members of a fire crew will be recommended by the Safety Supervisor and authorized by the immediate supervisor.

(4) First-Aid Training

First aid training will be provided to the extent that sufficient personnel with thorough first-aid training will be available on each shift.

C. ENGINEERING FOR SAFETY

Constant emphasis will be placed on safety provisions in the design of plant equipment and facilities as a basic part of the safety program.

D. MEDICAL AND HYGIENE

A complete physical examination is part of the pre-employment procedure and no person is employed unless he meets the minimum physical standards.

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(1) Periodic Physical Examination

Periodic physical examinations may be required of any employee or group of employees.

(2) Special Physical Examination

Special physical examinations may be required at any time considered necessary by the Company.

(3) Periodic Sanitary Inspections

Periodic inspections will be made to insure sanitary conditions within the Company.

E. REFERENCE MATERIALS

(1) Posters, etc.

Posters, publications, and other safety reminders will be used to help maintain a constant interest in safety.

(2) Safety Manuals

Each employee and each supervisor will be provided with a copy of an Employee Safety Manual and a Supervisors' Safety Manual, respectively, at the time of his initial indoctrination.

(3) Library of Reference Material

The Safety Supervisor will maintain for the use of Supervisors an up-to-date library of reference materials on safety, health, and sanitation subjects.

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F. PARTICIPATION IN SAFETY ORGANIZATIONS

The Company will subscribe to the activities of appropriate groups working to promote industrial safety.

G. PROTECTIVE EQUIPMENT

Company-owned protective equipment will be provided in any instance that such equipment is required by the Company. It is important that approved equipment be used for the purpose intended.

H. RULES AND REGULATIONS

Appropriate safety rules and regulations and suggested safe working practices have been established and are included as a part of this manual. These are designed for the reference and observance of all personnel. It would be impossible to cover all aspects of the broad subject of safety by written rules; therefore, the rules and suggestions included in the following portions of the manual are not intended as a substitute for sound judgment and proper job planning. They are intended to provide the supervisor with a reference that will help him fulfill his safety obligations to his employees, to himself, and to the Company. From time to time additional rules will be posted.

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I. RECORDS

Safety records will be kept to provide a basis of comparison between different sections of the plant and between our plant and outside industrial establishments.

The basic method for comparison is the following:

$$\text{Frequency rate} = \frac{\text{Number of lost time accidents} \times 1,000,000}{\text{manhours worked}}$$

$$\text{Severity rate} = \frac{\text{Number of days lost} \times 1,000,000}{\text{manhours worked}}$$

3. THE SAFETY STAFF

The Safety Section has been established to provide assistance and service to all levels of supervision in carrying out a continuously effective safety and hygiene program.

4. PROCEDURES

Detailed procedures in regard to safety, health and sanitation matters will be issued as necessary in accordance with the Company's established method of publishing procedural information.

5. SUPERVISOR'S GENERAL RESPONSIBILITIES

A safe working organization is the FIRST demand the Company makes of its supervision. The responsibility for accident prevention rests first and foremost on the supervisory group which is defined for safety purposes, to include anyone directing people or work, regardless of job classification. This

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can be no other way for the reason that safety must be so closely meshed with the human and material aspects of every job operation. Since practically all accidents are caused either by unsafe acts or unsafe conditions, the supervisors' accident prevention responsibilities fall into three general categories:

A. PREVENTION OF UNSAFE ACTS

The responsibility to take action to prevent the commission of unsafe acts. The first job to be done in safety is one of PREVENTION rather than of correction. It is also an easier job in the long run. The job of correcting unsafe acts and correcting unsafe conditions needs to be done only when a thorough job of prevention has not been done.

B. PREVENTION OF UNSAFE CONDITIONS

The responsibility to take action to prevent the creation of unsafe conditions.

C. CORRECTION OF UNSAFE ACTS AND CONDITIONS

The responsibility to correct unsafe acts and unsafe conditions that for some reason may have escaped the preventative action.

D. EMPLOYEE PREPARATION

The supervisor is responsible for making sure that his

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employees are prepared to do every part of every job with safety. This means the employee must:

(1) Training

Be properly trained.

(2) Equipment

Be provided with the safest possible tools for work under the safest possible conditions.

6. SUPERVISOR'S BASIC RESPONSIBILITIES

The field of accident prevention involves so many different aspects, many of them intangible, that there can never be a standard approach to the problem. There are, however, certain actions to take and attitudes to be developed that are considered BASIC requirements for the supervisor who is to do his safety job effectively. Supervisors will be expected to:

A. DISPLAY A SINCERE INTEREST IN SAFETY

(1) By Example

Set safe examples.

(2) By Committee Cooperation

Cooperate with safety committees and the safety section; serve with enthusiasm on safety committees to which appointed.

(3) By Enthusiastic Safety Meetings

Conduct safety meetings with enthusiasm.

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(4) By Encouragement

Encourage employees to make safety suggestions; discuss them; consider them, follow-up.

(5) By Exchange of Ideas

Exchange safety ideas with other supervisors.

(6) By Injury Reports

Make sure that all injuries are properly reported.

B. TRAIN EMPLOYEES FOR SAFETY

(1) By Talking Safety

Talk safety to the individual in terms of his job.

(2) By Understanding and Execution of Rules

Make sure all definite rules are understood and train for their proper execution.

C. PLAN EACH PART OF EVERY JOB FOR SAFETY AND FOLLOW-UP

(1) By Considering Employee Ability

Consider the physical ability and mental aptitude of those assigned the job.

(2) By Anticipating Hazards

Consider hazards that may be encountered and see that proper safety equipment is used.

(3) By Commendation

Commend for good performance.

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D. MAKE SAFETY INSPECTIONS A HABIT**(1) Enforce Rules**

Enforce all safety rules.

(2) Be Aware of Conditions

Constantly watch for unsafe conditions.

(3) Be Aware of Practices

Constantly watch for unsafe practices.

(4) Corrective Actions

Take corrective action immediately if work is performed by group under your supervision. If another group is involved, contact appropriate supervisor.

E. UTILIZE ALL AVAILABLE EXPERIENCE AND ASSISTANCE**(1) Analyze Injuries**

Critically analyze each injury and near injury; how could it have been prevented? What will be done to prevent similar instances?

(2) Consultation

Consult with the Safety Staff.

(3) Research

Read, think about, and discuss the safety promotion material that the Company furnishes from time to time.

7. THOUGHTS ON THE SUPERVISOR'S RESPONSIBILITY FOR SAFETY**A. ASSURANCE OF EMPLOYEE TRAINING**

When you try to teach a man anything, it isn't what

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you say that counts. The important thing is what he gets.

B. IMPROPERLY SUPERVISED MAN

An improperly supervised man is an accident going some place to happen.

C. USE SAFETY MATERIAL

The supervisor's job in safety is to take the safety out of posters and out of records and put it between the ears of his workers.

D. EMPLOYEE EMOTIONS

Practically every phase of an employee's life has a bearing on safety. Learn to recognize emotions and control them.

E. SAFETY IS EVERYBODY'S JOB

"SAFETY IS EVERYBODY'S JOB," but it is the supervisor's responsibility to get the job done.

F. ACCIDENT ANALYSIS

The prompt and accurate reporting of accidents provides the basis for a good program of accident analysis. Many lives have been saved as a direct result of accident analysis. It took some paper work to save those lives.

G. RELATIONSHIP BETWEEN SUPERVISOR AND EMPLOYEE

The supervisor has the responsibility to convey the feeling for safety to his men; this can be done effectively

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only if the entire relationship between the supervisor and his men is good.

H. EXPLANATION OF RULES

The best way to enforce rules is to explain why they are necessary.

8. FUNCTIONS OF THE SAFETY SECTION

The Safety Section has been established as management's representative for coordinating all activities in regard to safety, health, and sanitation. It functions as a planning, research, training, inspection and service group for the specific purpose of helping all supervisors fulfill their safety responsibilities efficiently. In working toward this objective, the Safety Section will:

A. PLAN SAFETY PROGRAM

Plan a continuing over-all safety program designed to generate maximum interest and participation by all personnel of the organization;

B. RESEARCH

Constantly make inquiries and tests in the search for new and better safety devices and methods;

C. GUIDANCE

Provide the necessary guidance and materials for effective training courses in safety;

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D. SAFETY INSPECTIONS

Carry out regularly scheduled and special safety inspections;

E. ACCIDENT INVESTIGATION AND ANALYSIS

Investigate and analyze all accidents and maintain accident records and statistics;

F. FIRST-AID PROGRAM

Direct the first-aid program;

G. SAFETY REPORTS TO PERSONNEL

Keep all personnel informed of results of the Company safety program through periodic reports;

H. TRAINING MATERIALS

Provide demonstrations, literature, displays, equipment, materials, and statistics;

I. COUNSEL

Counsel on safety, health, and related matters;

J. PROVIDE SAFETY ASPECTS

Assist in providing safety aspects of job training at all levels;

K. INSPECTIONS

Make field inspections;

L. FIRE PROTECTION SYSTEM

Be responsible for plant fire protection system;

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M. EMERGENCY AND DISASTER PROCEDURES

Devise and direct emergency and disaster procedures and training;

N. SANITATION

Devise sanitation schedules and procedures;

O. REFERENCE LIBRARY

Maintain a reference library on safety, health, and sanitation subjects.

9. RESPONSIBILITY OF THE SAFETY SECTION

The responsibility of the Safety Section is plant-wide. As such, this group can't be the safety experts that each individual supervisor can be in regard to his own phase of work, and therefore, the work of the Safety Section can in no way replace the supervisory responsibility for safety. With its planning and research, its training, and its other services, it is available for the use by all supervisors in the job of making our safety efforts successful.

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II. GENERAL RULES AND SUGGESTED SAFE WORK PRACTICES

The material in this part of the manual concerns EVERY member of the organization. It is set out in undetailed form for the guidance of supervisors in training employees and developing safe work habits.

1. CARDINAL RULES

The Company will operate with a minimum of iron-clad safety rules. At the present time, only seven such rules are to prevail.

A. SMOKING

Smoking will be permitted in designated areas only.

(1) Areas

The following is a list of areas where smoking will be permitted during normal operations:

(a) Administration

Administration Building excluding the explosion proof laboratory.

(b) Guard and Change House

Guard and Change House.

(c) Engineering and Maintenance Office

Engineering and Maintenance Office.

(d) Control Rooms

All area control rooms including the first and second floors of the Boiler Structure and the Maintenance Shop.

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(2) Electric Lighters

Electric lighters will be provided in these areas, therefore, matches or lighters are not permitted in the plant.

(3) Abuse of Privilege

This privilege will remain in effect only as long as it is not violated or abused.

B. EYE PROTECTION

Eye protection must be worn while inside the fenced plant area and the laboratories excluding walkways between the Engineering Building, Administration Building, and the Main Gate.

C. HARD HATS

Wear hard hats when in fenced plant area, excluding the walkways between the Engineering Building, the Administration Building and the Main Gate. Non-conducting hard hats must be worn by maintenance men when working with electrical facilities.

D. DRINKING OF INTOXICATING LIQUIDS

The drinking of intoxicating liquids is strictly forbidden within the fenced area. No person "under the influence" of alcohol will be allowed to pass through the gates of the fenced plant area.

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E. SHOES

Shoes of the canvas or sandal type will not be worn in the fenced plant area or laboratories.

F. INJURY REPORT

All injuries must be reported to first aid.

G. ENTERING TANK CARS, VESSELS, etc.

When tanks, tank cars, vessels or other enclosed areas are entered by personnel, adequate respiratory protection and suitable life belts, life lines, clothing, etc. should be used. A watch must be maintained outside the vessel continuously during occupancy.

2. RULES WHICH ARE OF PRIMARY INTEREST TO SUPERVISORS AND WHICH ARE SUPERVISORY IN NATURE**A. EXCAVATIONS**

All excavations will be adequately covered, properly guarded and illuminated, if deemed necessary, when left before the work has been completed.

B. MAKE-SHIFTS

Make-shifts of any kind are not to be used (except in case of emergency).

C. JOB CLEAN-UP

When work is completed, all left-over material, scrap, tools and equipment are to be removed to the proper places.

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D. UNSAFE CONDITIONS

Any unsafe condition which may affect the safety of men or equipment is to be reported at once. When correction is within the authority of the individual supervisor, it is to be done immediately by that supervisor.

E. ELECTRICAL EXTENSION CORDS

Electric extension cords and lights should be inspected prior to use.

F. APPROVAL

No work will be started on product lines or other production equipment before receiving the written approval of the operating supervisor or his authorized representative in charge.

G. PERSONAL INSPECTION BY SUPERVISOR

Supervisors in charge of operating equipment must make certain by personal inspection that pressure is off lines and equipment is drained where necessary, vessels and lines are blanked off where needed, valves are locked and tagged if necessary, and that it is safe to perform the work before authorizing maintenance supervisors to proceed with maintenance work. When necessary, adjacent or connected lines or equipment should be protected against their being broken.

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H. ISOLATED WORK AREAS

Arrangements are to be made to contact at regular intervals all men working alone in isolated locations by telephone or otherwise. These contacts are to be made at least twice a shift at equal intervals in addition to the contact at the beginning and the end of the shift. More frequent contacts should be made if the conditions warrant.

I. WORK COMPLETION

When work is completed all guards, hand rails, etc. must be replaced.

J. UNDERGROUND CIRCUITS

All installations requiring the placing of electric circuits or conduits underground are to be encased in concrete to which red coloring matter has been added.

K. GAS TEST

Gas test must be made before entering an open top vessel or excavation.

L. DOMESTIC WATER SYSTEM

No connections into or alterations to the domestic water system will be made without the knowledge and written approval of the Production Manager.

M. AUTHORIZED PERSONNEL

The number of employees working around or on a process

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unit must be kept to an absolute minimum when that unit is being taken out of operation or being put into operation. Operations supervisors are responsible for advising the proper maintenance supervisors when such operations are in progress.

N. CHECK OF SHOWERS AND FOUNTAINS

Emergency showers and eye fountains must be checked for correct operation once each shift by the operators on that shift.

3. SAFE WORKING PRACTICES APPLICABLE TO ALL EMPLOYEES

A. GENERAL PERSONAL PRECAUTIONS

(1) Report Injuries

All injuries, no matter how slight, must be reported immediately.

(2) Clothes Saturation

An employee getting his clothing saturated with chemicals must wash the parts of his body affected with water, change his clothing if possible, and report at once to First-aid.

(3) Approval Prior to Commencement

Before starting any work on lines or equipment, request specific instructions from the supervisor in charge of the equipment involved and obtain his written O. K.

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before proceeding with the work.

(4) Loitering

Loitering around operating units is prohibited at all times.

(5) Tool Placement

Place tools or materials on scaffolds, top of towers, platforms, or other elevations in such a manner that they will not create a tripping hazard or become dislodged and fall.

(6) Lowering Material

Before lowering material from above, the area below must be properly blocked off and guarded to prevent anyone from passing underneath.

(7) Scaffolding

All loose objects must be removed from the top of scaffolds before they are moved.

(8) Horseplay

Conduct which may be termed "fooling" or "horseplay" is strictly forbidden.

(9) Railroad Cars

Climbing over railroad cars, crawling or sitting under such cars or attempting to pass between cars that are standing close together on the same track,

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except at loading racks, is forbidden.

(10) Compressed Air

Compressed air must not be used to clean clothing or any part of the body, and the air hose must never be pointed toward anyone.

(11) Short Cuts

Do not use short cuts or make pathways through process equipment areas.

(12) Walkways

Where walkways are provided, employees should use them. When necessary to use the roads, employees are instructed to keep on the left side in order to face any approaching vehicles, unless otherwise directed by traffic signs.

(13) Standing on Lines

Employees should not stand on lines or fittings.

(14) Walking on Pipelines

Avoid walking on pipelines.

(15) Avoid Wire Lines Holding Strain

Exercise every effort to prevent anyone from walking in the vicinity of wire lines holding a strain.

(16) Suspended Loads

All men should stand clear of suspended loads.

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(17) Reporting Leaks, Defects, etc.

Employees should be on the watch for leaks, defective ladders, railings, cables and all unsafe conditions or absence of safeguards. Such defects should be reported to the appropriate supervisor or to the Safety Supervisor.

(18) Defective Equipment

Do not use defective equipment of any kind.

(19) Lifting

Use the proper method when lifting, keeping the back as nearly upright as possible and using the leg muscles. Do not attempt to lift more than can be safely handled. See that there are sufficient men for the load. Use a hoist to move large heavy objects.

(20) Ambulance

In cases of serious injuries or injuries which might be serious, even though not apparently so, call the ambulance. Give specific information as to the exact location where the ambulance should go. If possible, state the extent of the injuries. Give your name.

(21) Artificial Respiration

First-aid in emergencies is the only occasion when anyone should render aid to any injury. Even then be

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certain you know what to do. When an individual is not breathing due to drowning, electrical shock, or being overcome by fumes, start artificial respiration immediately.

(22) Avoiding Scaffolds

Every effort should be made to avoid passing under scaffolds, or other elevations from which work is being performed.

(23) Avoid Falls

Exercise care in walking and in moving about your work in order to avoid slipping, tripping or falling. Particular care should be taken while going up or down stairs.

(24) Falling Objects

Falling objects have caused many serious injuries. Handle material with care. Keep feet in the clear.

(25) Observing Safety Rules

Every employee should consider it a part of his duties to take an active part in the safety program and should insist on the observance of safe practices by fellow workers.

(26) Know Rules in All Areas

When in an area other than his normal working area, an employee will be expected to know and observe all

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rules pertaining to that area.

(27) Railroad Cars on Siding

The universal rules with respect to railroad cars on sidings should govern their spotting. The following comments are considered as standards:

- (a) All handbrakes must be set.
- (b) A blue flag must be set at least one car length toward the main track from tank cars being worked.
- (c) All cars on the siding should be chocked with an approved device.
- (d) The derails should be placed after cars are spotted.

B. CLOTHING

(1) Hard Hats

Wear hard hats when in fenced plant area, excluding Service Building and road from gate to the Service Building. Non-conducting hard hats must be worn by maintenance men when working with electrical facilities.

(2) Working With Acids, Etc.

When working on equipment in acid, caustic, or other chemical services, wear clothing covering arms, legs, and the body. Wear goggles, protective gloves, face

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shield, rubber boots and/or full protective suit if common sense dictates the use of the same.

(3) Avoid Loose Clothing

Employees must not wear neckties, dangling sleeves, or other loose clothing while operating or working close to moving machinery. Gloves should not be worn while using abrasive or buffing wheels, drill presses or other high speed rotating equipment.

(4) Attachments to Clothing

Do not tie or attach a rag to your person in such a manner that it cannot be removed with one quick movement.

(5) Gloves

Long gloves should be used in drawing hot or cold liquid samples.

(6) Clean Clothes

Do not work in oily clothing, as a flash might prove fatal. Have work clothes washed frequently.

C. ELECTRIC EQUIPMENT

(1) Authorized Personnel

Only authorized employees should be permitted to start electrically-driven equipment. In the event that it does not start or run properly, do not tamper with it.

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The Maintenance Section should be notified.

(2) Changing Fuses

In cases of emergencies, duly authorized and instructed individuals approved by the Maintenance Engineer in writing are permitted to change cartridge-type fuses up to and including 440 volts. Under all other circumstances, an electrician must be called.

(3) Grounding

All electrical equipment must be properly grounded according to the Company's General Specifications.

(4) Portable Electric Equipment

On portable electric equipment with an outside ground wire, the ground connection must be made before making the electrical connection. Work the ground clamp back and forth at the point of connection so that rust, paint, etc. will be scraped off, thus insuring a good connection. Where portable cord circuits are in excess of 50 volts, 3 wire grounded cords should be used.

(5) Approved Lights in Towers, etc.

Only approved flashlights will be used in the plant. It is preferable that only 6 volt lighting be used in towers, drums and vessels. At no time will lights

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of more than 32 volts be placed in towers, drums or vessels.

(6) Proper Use of Extension Cord

An electric extension cord should not be used if it is in bad condition. Check each cord before using it for bad insulation, broken grounds, etc. Avoid wrapping the cord around the arms or any part of the body. Avoid standing in water while using the cord.

(7) Avoid Unidentified Wires

Employees should regard all wires as live and dangerous and are warned against permitting any object being handled to come in contact with electric lines. The insulation on the wire is not guarantee that it will not cause instant death. Any wire found dangling from a pole or any other defective electrical equipment should be reported immediately to the Maintenance Section and must not be touched in the meantime.

D. FIRE PROTECTION

(1) Hazardous Work Permits

The use of burning or welding equipment, rivet heaters, forges, tar pots, portable emery wheels, gasoline torches, soldering equipment, string lights or any other such equipment, in locations inside the fence (other than shop and office) requires a HAZARDOUS WORK

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PERMIT.**(2) Cleaned and Uncleaned Portable Equipment**

All portable cleaned equipment such as steel drums, barrels, shell and tube heat exchangers, etc. which can be readily moved from place to place with the possibility of becoming confused with a like piece of equipment which has not been cleaned, is to be prominently marked as cleaned or gas free, together with the date of such preparation.

(3) Cleaning Fluids

Only approved cleaning fluids are to be used. If in doubt, ask.

(4) Fire Fighting Equipment

Fire fighting equipment should be used for fires only.

(5) Access to Equipment

Do not block access to fire fighting equipment.

(6) Electrical Fires

Water should not be used to extinguish a fire on or about an electric apparatus as it is a conductor of electricity. Use dry chemical extinguisher, CO₂ extinguisher, blankets or sand.

(7) Sewer Manholes

Avoid working close to sewer manholes whenever possible.

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Do not drag or drop material on them as such action might create a spark.

(8) Extinguishers, Blankets, etc.

All personnel should know the location of fire extinguishers, fire blankets, and safety showers in the areas in which they are working.

(9) Gasoline

Gasoline is manufactured for use only as a fuel to explode and burn. It must not be used as a cleaning fluid.

(10) Matches, etc.

Matches and lighters will not be allowed inside the fenced area except as authorized by proper HAZARDOUS WORK PERMIT.

(11) Flammable Liquids

Approved safety cans should be used for transporting and handling of flammable liquids in small quantities.

E. TOOLS, MACHINERY AND MECHANICAL EQUIPMENT

(1) Tools in Good Condition

Use only tools that are in proper working order. Turn in defective tools for repair or replacement.

(2) Light Wrenches

Light wrenches of any kind should not be struck with a maul or hammer.

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(3) Use of Open End Wrenches

The use of two open-end wrenches to secure leverage by placing one into the jaws of the other is prohibited.

(4) Files

Files should not be used without handles.

(5) Authorized Personnel

The operation of any machine except by an authorized employee is prohibited.

(6) Repair of Machinery

Do not attempt any repair on machinery while it is in motion if it is practical to shut it down. All guards must be kept in place while the machinery is in motion and not being worked on.

(7) Make-Shifts

The use of any make-shift apparatus is to be avoided. For example, drums or barrels should not be used for work-benches, supports for scaffolds, etc.

(8) Men Riding on Hoists, etc.

Men are not allowed to ride on material, hoists, crane blocks, or crane loads.

F. GOOD HOUSEKEEPING

(1) Protruding Nails

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Remove or bend down all nails wherever they may be.

Do not bend down nails by stepping on them. All nails in the heads of kegs or wooden barrels should be removed when the containers are opened.

(2) Clear Aisles

Keep all aisles, passageways, stairs, platforms, and ladders clear of all obstructions. Material should not be placed where it will offer a stumbling hazard and should be piled with due regard to safety.

(3) Oily Rags

Never allow oily waste, rags, or clothes to lie around. They should be placed in closed metal containers. Oily or chemically damaged boards should not be used to build scaffolds.

(4) Chemical Spills

Any oil or chemical spilled on stairs, platforms, walkways or any other walking areas should be cleaned up immediately or it may cause a fall.

(5) Waste Material

Waste material should not be allowed to accumulate, but should be cleaned up and hauled away.

(6) Clean Floors

Floors should be kept clean and in good repair.

(7) Continual Practice

Good Housekeeping is a continuous practice and is

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part of every job. Do not wait for a scheduled clean-up period.

G. FLAMMABLE, TOXIC, OR OTHER INJURIOUS GASES AND LIQUIDS

(1) Hazardous Work Permit

Before entering vessels or enclosed areas where chemicals have been stored or handled, proper tests for gas concentration must be made and a HAZARDOUS WORK PERMIT written.

(2) Burns By Volatile Products

If highly volatile products come in contact with the skin, wash them off at once, as they may cause severe burns. If burning occurs, report to the First-aid Room at once for treatment.

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III. HAZARDOUS WORK PERMITS

1. PURPOSE

To further insure maximum plant safety practices and procedures, no job function or action of a hazardous nature, as listed herein, will be initiated without first obtaining a Hazardous Work Permit approved by Shift Supervisor. Specific hazardous functions or operations pertaining primarily to the Production and Maintenance areas are outlined below. However, potentially hazardous operations will not necessarily be limited to Production and Maintenance areas and must be recognized in all areas and locations where employees operate.

2. RESPONSIBILITY

All Monochem and contractor personnel are responsible for compliance with safety rules and procedures listed herein. Hazardous operations will, no doubt, arise which are not specifically covered below. While such occurrences, in the absence of definite regulations, must necessarily be dealt with as special cases, the precautions listed herein should be used as a guide.

3. DEFINITIONS

A. RESTRICTED AREA

Any place within the fenced area exclusive of the warehouse, offices, shop building, fire house, garage building,

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salvage yard, and main plant roads.

B. MOTORIZED VEHICLES

Any automobile, truck, tractor, scooter, dragline, roller, lift digger, and related or similar equipment.

4. ACTIONS REQUIRING HAZARDOUS WORK PERMITS

Hazardous Work Permits will be required before any one of the following actions are taken in the restricted areas of the Plant proper or on pipelines.

A. USE OF FLAME PRODUCING DEVICES

(1) Equipment

- (a) Any type of welding equipment
- (b) Blowtorches
- (c) Stone saws
- (d) Electric or air-driven buffers and scalers
- (e) Electric or air-driven portable grinding wheels
- (f) Electric drills, hammers, and other similar tools
outside of unit Control Houses
- (g) Electric or gasoline-driven motors and equipment
- (h) Sand blasters
- (i) Heating lamps
- (j) Matches, flints or cigarette lighters
- (k) Photoflash equipment
- (l) Portable electronic devices not rated explosion
proof when used outside of unit Control Houses

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- (m) Changing light bulbs on a hot circuit outside of unit Control Houses

B. CLOSED VESSEL ENTRY

Entering a closed vessel or confined area.

C. FIVE FOOT EXCAVATION ENTRY

Entering an excavation deeper than five feet.

D. MOTORIZED VEHICLES ENTRY INTO RESTRICTED AREA

Entry of any motorized vehicle or equipment into the restricted area other than on normally used Plant roads.

E. FIRES

Burning of brush, grass, or waste on Company property, except in designated burning areas.

F. CUTTING FIRE WALLS

Cutting fire walls around storage tanks.

G. INJURIOUS LIQUIDS INTO RESTRICTED AREAS

Bringing or using toxic, flammable, or other injurious liquids or gases into the restricted area if not in sealed or safety-type containers, other than small samples routinely taken in the area.

H. CHLORINE TRANSPORT

Transporting chlorine in bulk quantities in the Process Area.

I. USE OF GAS MASK

Any work requiring a gas mask, except normal work at a

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loading rack.

J. MECHANIZED EQUIPMENT USE

Digging hole or ditch with mechanized equipment.

K. HOT TAP

Making "hot tap".

L. BURNING POTS, ETC.

Burning lead melting pots; burning baking furnace and burning tar melting pots.

M. VALVE REPACKING

Repacking valves under pressure.

5. GENERAL REQUIREMENTS

A. MOTORIZED VEHICLES & EQUIPMENT STARTUP AFTER SHUTDOWN

When motorized vehicles and equipment in restricted areas are shut down because of gas hazard, they will not be started again until the Shift Supervisor again declares the area safe.

B. MOTORIZED VEHICLES & EQUIPMENT SHUTDOWN DURING ABSENCE

Motorized vehicles and equipment in restricted area, other than diesel air compressor, will be shut down when not in use during lunch periods or in the absence of the operator from the immediate area at any time for any purpose. Approval from the Operating Shift Supervisor must be obtained by the equipment operator before resuming the work.

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C. WELDING

Hazardous Work Permits issued for welding purposes will require that a stand-by man be located at the welding location.

D. STAND-BY MAN FOR VESSEL, ETC. DURING ENTRY

A stand-by man will be located immediately outside a vessel, tower, or tank car during the time an employee is inside, and will check with the employee inside frequently and observe everyone leaving or entering the vessel.

E. GAS ANALYSIS

Before a Hazardous Work Permit is issued, a gas analysis must be made indicating that there is neither flammable gases and/or carbon monoxide in the particular location. The Operating Shift Supervisor and Maintenance Supervisor, before signing the permit, must be certain that all other possible precautions have been taken to make the job safe.

F. ON ALERT FOR DANGEROUS DEVELOPMENTS

Employees engaged in work requiring a Hazardous Work Permit must be alert at all times for unexpected dangerous developments from any source. If a dangerous condition arises, all work will be stopped at once, all flames will be shut off, all machines will be stopped, and the employees will immediately vacate the vicinity. Work will

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be resumed only when the dangerous condition has been eliminated and the area has been approved for entry by the Operating Supervisor.

6. PROCEDURES FOR OBTAINING HAZARDOUS WORK PERMITS

A. INSPECTIONS

The operating shift supervisor is primarily responsible for safety in a Production Area. When a permit is required, the Maintenance Foreman will ascertain that his personnel have made all necessary preparations. The Maintenance Foreman will then notify the operating supervisor, who will inspect the conditions. When the operating supervisor is satisfied conditions are satisfactory, he will fill out a Hazardous Work Permit.

B. PERMIT CARD

The operating supervisor then gives the Permit Card to the Maintenance Supervisor in charge of the job, who passes it to the workman involved as his authorization to begin the work covered by the Permit. The operating supervisor retains one copy of the Permit for his files.

C. SIGNING OF PERMITS

The welder or other appropriate workman will sign the Permit. Should he leave the job location before the completion of his work and be replaced by another welder or

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workman, he will deliver the Permit to the replacing welder or workman, pointing out the instructions written on the Permit. The relieving workman must sign the Permit after reading the instructions on the Permit. Operating supervisors coming on duty will sign all Hazardous Work Permits then in effect in their respective areas.

D. CHECKS BY OPERATING SUPERVISORS

The operating supervisor rechecks the area from time to time as the work progresses and consults with the maintenance supervisors involved regarding conditions which may have arisen during the course of the work.

E. RETURN PERMIT CARD

When the work is completed, the Permit Card copy is returned to the operating shift supervisor.

F. TIME VALIDITY ON PERMITS

Hazardous Work Permits will be effective for no more than one shift change of maintenance personnel. If work is not started within one hour after the Permit is issued or work is interrupted for more than one hour, the area must be rechecked for a gas hazard by the operating supervisor on the Permit.

G. DISPLAY PERMITS

A Hazardous Work Permit form must be displayed at the job.

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location. Operating supervisors will make routine checks of all work locations where work requiring Hazardous Work Permits is in progress to see that a Permit has been issued covering the job.

H. SIGNATURE VALIDITY ON PERMITS

Hazardous Work Permits are valid only when approved by the signature of the appropriate Production and Maintenance Supervisor.

I. VIOLATIONS

Violation of or failure to comply with the rules and procedures listed herein will result in disciplinary action.

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IV. DANGER TAGS

1. PURPOSE

Danger tags are attached to tools, materials or equipment to prevent their use or operation until such time as all required maintenance, installations or repairs are accomplished.

A. DANGER TAGS SIGNIFY

- (1) Its use or operation may result in serious and costly mechanical damage.
- (2) Its use or operation may result in bodily injury or fire.
- (3) Its use or operation may result in serious and costly disruption to over-all Plant operation.

2. RESPONSIBILITY

Any employee may, if deemed necessary, attach a danger tag to tools, material or equipment to prevent its use or operation by other employees. When more than one employee, or group of employees, is working on a tool, process unit or piece of equipment and each is performing a different phase of the over-all operation, each employee, or group of employees, must attach a danger tag with his own signature and date.

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3. PROCEDURES

A danger tag must be dated and signed by the employee attaching it. If a danger tag is required on more than one

shift. PERSONS ATTACHING TAGS SHOULD INFORM THEIR RELIEF
OF ANY EXISTING TAGS and have the relief sign and date
each tag. The same should apply to all relieving shifts.
There should be no tag in any given area without the signa-
ture of the man on duty. Any number of tags may be at-
tached to a valve, switch, or device to properly protect
persons involved. Operation is prohibited under any cir-
cumstances until all tags have been removed. Persons re-
moving tags are responsible for the satisfactory comple-
tion of the work they were doing for operation. This in-
cludes reinstallation of guards and making sure all per-
sons affected by the tag being removed are so informed
and warned. No work is to be done on any operable equip-
ment until operation of same is prevented by use of the
danger tag and lock.

4. TYPES OF DANGER TAGS

Two types of danger tags will be used in tagging tools, installations, process units, materials, and equipment. They are printed as follows:

A. "DANGER, DO NOT OPERATE"

To be attached to a mechanical or process unit or assembly, such as a pump valve, switch, grinding wheel or vehicle.

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B. "DANGER"

To be attached to a hand tool, vessel, or building entrance, ladder, toxic or flammable material container and other equipment or installations where not actual "operation" would be involved in its use. Before attaching this tag, the employee must write a clear and concise explanation on the reverse side of the tag as to why it is being attached, such as, "Danger - Do Not Open Door".

5. UNAUTHORIZED REMOVAL OF DANGER TAGS

A danger tag is not to be removed by anyone other than the employee who attaches it, except in such cases where the employee is absent or off duty, at which time the Maintenance Supervisor or Area Supervisor in charge of the explicit operation may remove the tag after careful and thorough investigation of the situation. Violation of this rule may result in disciplinary action.

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MONOCHEM, INC.

EMPLOYEES' SAFETY HANDBOOK

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UNIRO001697

April 18, 1962

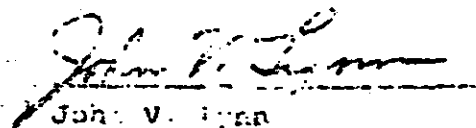
To Each Monrochem Employee:

This booklet has been prepared to guide you in the safe performance of your job. Many years of experience have shown us practices which may lead to personal injury or property damage and practices and methods which will get the job done with maximum safety of all personnel and equipment.

It is expected that you will become thoroughly familiar with all the general safety rules and with those other sections of the booklet covering jobs and methods which you encounter in the performance of the work assigned you. It is obviously impossible to formulate rules for every conceivable combination of circumstances that may occur in the day-to-day operation and maintenance of a plant. Accordingly, situations may arise from the experience of the safety section and supervisory personnel justifying some addition, deviation, or alteration of procedures given herein.

An alert mind and sound, sound judgment can be much to

in in case


John V. Lynn

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April 18, 1962

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CASE INVA. RULES

The company will operate with a minimum of iron clad safety rules. At the present time, only seven such rules are to prevail.

Smoking will be permitted in designated areas only. The following is a list of areas where smoking will be permitted during normal operations.

1. Administration building excluding the explosion proof laboratory.

2. Load and Change House.

3. Engineering and Maintenance Office.

4. Control rooms including the first and second floors of the Control Room and the Maintenance Shop.

Fire extinguishers will be provided in these areas, therefore smoking is permitted in the plant.

This privilege will remain in effect only as long as it is not violated or abused.

5. Eye protection must be worn while inside the fenced plant area and the laboratories excluding walkways between the Engineering building, Administration building and the Main Gate.

6. No smoking when in fenced plant area, excluding the

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walkways between the Engineering building, the Administration building and the Main Gate. Non-conducting hard hats must be worn by maintenance men when working with electrical facilities.

4. The drinking of intoxicating liquids is strictly forbidden within the fenced area. No person "under the influence" of alcohol will be allowed to pass through the gates of the fenced plant area.

5. Shoes of the canvas or sandal type will not be worn in the fenced plant area or laboratories.

6. All injuries must be reported to first aid.

7. When tanks, tank cars, vessels or other enclosed areas are entered by personnel, suitable life belts, life lines, etc. should be used. A watch must be maintained outside the vessel continuously during occupancy.

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GENERAL SAFETY RULES

1. Smoking permitted in designated areas only. No matches or lighters permitted inside the plant gate. This includes lighters in automobiles and trucks.
2. Scuffling and horseplay of any nature often have unexpected and dangerous consequences and are not permitted.
3. When walking or riding bicycles on plant roads, use the left side of the road, facing vehicular traffic. Do not run.
4. Do not use compressed air to remove dust from clothing. Entrained particles may puncture the skin or enter the eyes. Never direct the force of an air hose at yourself or another person.
5. Good housekeeping eliminates the cause of many accidents. Therefore, whether you are a mechanic, operator, or an employee of any other classification, you are expected to keep the area in which you are working clean and orderly. Trash and waste should be placed in the containers provided. New materials being used or old equipment being removed should be placed in an orderly manner near the job site pending actual use or removal from the area. Oil spills, litter, etc., should be promptly cleaned up.

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6. Gasoline, naphtha, alcohol, or other volatile liquids should not be used for cleaning clothing, mechanical equipment, etc., except under conditions approved by the safety section.

7. Safety signs, including traffic signs on roads and parking areas are posted in various locations for your protection and benefit. You are expected to be governed by the directions given.

8. If travel over road or walkway become hazardous because of the presence of excavations or undesirable fumes, gases or liquids, suitable traffic warning signs or barricades should be promptly set up.

9. Wherever practicable, avoid working where overhead hazards are present. This area should be roped off and kept free of personnel. If necessary to do so, arrange for proper protection.

10. Protruding nails must be immediately removed or bent down on any boxes, boards, etc., even though the material is to be hauled to scrap.

11. Oil-soaked rags, old clothing, etc., should not be accumulated in piles. Spontaneous combustion may result. Such material should be placed in a covered metal container.

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12. Correct and safe procedures are known by our experienced mechanics, operators, and foremen. Avoid make-shifts where possible and discuss any potentially hazardous situation with your supervisor or the safety section before continuing.

13. Only approved electric lights and hand lights may be used. It is preferable that only 6-volt lighting be used in towers, drums, and vessels. At no time will lights of more than 32-volts be placed in towers, drums, or vessels.) All extension cords should be inspected by an electrician after each job and necessary repairs be made before re-use.

14. Materials should not be thrown to or dropped from elevated places, unless the area is properly fenced or other adequate precautions are taken to keep all personnel in the clear.

15. Employees having no business in operating units areas should not loiter in or walk through these units.

16. When lifting heavy objects:

- A. Get directly over the load.
- B. Secure a solid foothold.
- C. Squat over the load.
- D. Keep the back as straight as possible.
- E. Rest the elbows on the legs and use them as levers.
- F. Secure a good handhold.

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- G. Be sure the body is in balance and not twisted.
- H. Lift the load principally by use of the legs.
- I. If the load is too heavy, get someone to help you.

17. All buildings should be well ventilated to avoid concentration of gases or fumes.

18. It is unsafe to walk on roofs made of transite or other brittle materials. Ceilings of many rooms are not constructed to support the added weight of a man. Therefore, if working in an attic, always step on beams or other structural members, not on the ceiling of the room below.

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FIRST AID

First aid facilities are maintained for the purpose of giving first aid treatment to injured employees. Trivial injuries, if left unattended, may result in serious conditions. For your protection, have each injury, no matter how small, treated immediately at the first aid room. Instructions of the attendant should be followed until discharged from further treatment.

In some injuries, such as severe fractures, movement by inexperienced personnel is dangerous to the injured person. Call the first aid attendant and ambulance to the scene. In case of electrocution, asphyxiation, or a severed artery, the ambulance should be summoned, the employee moved to a safe location, and suitable first aid administered at once. Do not gang up around the patient; leave plenty of room for those administering first aid and for necessary fresh air.

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RESPIRATORY EQUIPMENT

At times it becomes necessary to work in places where contamination of the atmosphere would interfere with normal breathing. Several types of respiratory equipment are provided to cope with such conditions.

- A. CANNISTER-TYPE GAS MASKS are designed to give protection against certain specified contaminants in low concentrations (not over 2%). The chemical in the cannister gradually becomes spent with use. In routine cases of use, it is, therefore, important to record on the form provided the exact length of time the cannister has been in use.
1. Be sure you are using the cannister specified for the gas encountered.
 2. Where possible, work on the windward side of the job when wearing a cannister mask.
 3. Carefully adjust the face or headpiece to avoid leakage. If you can smell the gas, either the cannister is spent, the headpiece is not fitted properly, or the concentration of gas is too high to be effectively removed. In either case, leave the contaminated area immediately and correct the deficiency before returning.

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- B. HOSE MASKS are supplied with fresh air from an external source

and may be used in any atmosphere. The pump which supplies the air must always be on the windward side of the job site and well in the clear of any air pollution.

- C. SELF-CONTAINED breathing apparatus may be used in any atmosphere except that care must be taken to keep the inside of the oxygen hoses and connections clean. Oil or grease on oxygen equipment may react violently with oxygen.
- D. REPLACEMENT contain cloth or other media to filter the air as you breathe. They should be used when working in dusty areas.

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CLOTHING

A. NORMAL WORK CLOTHING - Certain types of clothing are furnished for your protection when working under abnormal conditions. However, the type of clothing you wear each day while performing your normal duties can be an important factor in your continued safety and well-being.

1. Wear sufficient well-fitting clothing to cover the body. Going shirtless or in shorts or wearing sleeveless shirts is all right on the beach, but not in the plant. Wool is less flammable than cotton and some of the synthetic fabrics.
2. Greasy or oily clothing should be removed. It may burn like a torch if you get too close to a flame.
3. Avoid wearing rings, jewelry, or loose clothing, such as dangling sleeves, gloves, ties, etc., around moving machinery; for example, lathes, drill presses, emery wheels, rotating shafts, and motors.
4. Leather gloves are recommended when handling rough or sharp material, but leave them off when operating a grinding wheel or rotating or moving machinery.
5. Safety shoes with thick soles, metal toe cap, and non-sparking nails are recommended. Open toe shoes or

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sandals definitely invite injury and pain - leave them at home or in your locker.

6. Hard hats and safety glasses have prevented serious injury to many people. They must be worn by everyone entering the plant.

B. CLOTHING AND SAFETY EQUIPMENT FOR SPECIAL JOBS -

1. Special protective clothing and equipment is provided for use during certain hazardous operations and should be worn for your protection. Consult specific area safety rules.
2. Defective or damaged apparel or other safety equipment should not be worn or used, but should be promptly replaced or repaired.
3. The manufacturer gave much thought to the design of the safety equipment and apparel provided. Don't change or alter it, without first obtaining the agreement of the safety supervisor.
4. Life belts with tag lines, all in good condition, should be worn by men working at heights where not protected by handrails or enclosed platforms and when in tank cleaning, excavation or pit work.
5. The wearing of goggles will protect your eyes from many hazards encountered in the plant. Obtain and wear the

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proper type when welding, chipping, or working in a dusty atmosphere or on jobs where chemicals or other liquids or gases that are painful or harmful to the eyes may be released.

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FIRE EQUIPMENT

1. To insure maximum protection, all fire-fighting equipment must be instantly available. Therefore, cars, trucks, or other equipment must not be left within 10 feet of any fire plug. Areas adjacent to hand extinguishers, fire blankets, etc., should be kept free from all obstructions.
2. Chemicals from fire extinguishers are to be used for fire fighting only and not for any other purposes. To insure that all extinguishers are ready for use at all times, be sure to request the safety section to check and refill it when one has been partially or completely discharged.
3. The immediate availability of fire blankets has saved many lives; therefore, do not remove them from their boxes except in cases of emergency.
4. CO₂ extinguishers should be used with caution inside buildings, vessels, and enclosures. If any difficulty in breathing in the area is observed, you should leave the area immediately.
5. Tie-in on the fire water system must be approved by the safety section.
6. If the fire water is to be used for any purpose other than fire fighting or training, a hazardous work permit should be obtained.

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HEALTH

In case you begin to feel ill on the job, do not continue to work. Report to your Supervisor and then get medical care.

It is important to come to work well rested and with a good breakfast. Fatigue caused by lack of sleep or food decreases efficiency and is a factor in many accidents.

Keep toilets, washrooms, drinking fountains, and locker rooms neat, sanitary, and attractive.

It is a good idea to wash your hands when you finish a job, especially before eating. The Company provides a mild, yet effective soap. Wash your hands frequently, especially after handling chemicals, oils, and solvents. Do not wash hands in gasoline or solvents as they can cause serious skin ailments and internal poisoning.

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SAFE HANDLING OF OUR PRODUCTS1. VINYL CHLORIDE

Aside from the risk of fire and explosion, Vinyl Chloride presents no other very serious problem in general handling. The presently accepted maximum allowable concentration is 500 parts per million.

In concentrations well above 500 parts per million, Vinyl Chloride acts as a mild general anesthetic.

In contact with the skin, Vinyl Chloride is irritating. Prolonged contact will result in refrigeration and freezing.

Vinyl Chloride is not a serious industrial hazard provided precautions are taken to avoid leaks or spills which might provide a fire or explosion hazard. Where serious leaks or spills do occur, the workman present in the area should be evacuated, and persons returning to the area to repair or clean up equipment should be provided with appropriate gas masks, self-contained Oxygen units, or air-supplied hoods.

Employees working in areas where Vinyl Chloride is handled or stored should be thoroughly and repeatedly warned of the anesthetic properties of Vinyl Chloride gas and instructed as to what to do if anesthetic effects are detected in

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themselves or in others. Emphasis in training should be placed:

- (1) the use of artificial respiration in cases where breathing has stopped because of deep anesthesia.
- (2) the necessity of immediate removal of contaminated clothing and shoes in case of a liquid spill.
- (3) repeated washing of the eyes with copious amounts of water in case of liquid splashes.

No personal protective equipment is an adequate substitute for safe working conditions and intelligent conduct on the part of employees who work with Vinyl Chloride. Furthermore, the correct usage of personal protective equipment requires education of the worker in the proper employment of the materials available to him.

2. ACETYLENE

Pure Acetylene is a colorless, odorless gas slightly lighter than air. The product Acetylene gas produced in this plant is not odorless due to the presence of small amounts of impurities. Acetylene has a very wide explosive range 2.5 - 80% by volume in air and is itself relatively non-toxic. However, exposure to high concentration of Acetylene may cause headache, dizziness or unconsciousness due to lack

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of Oxygen.

In addition to its wide explosive range, Acetylene explosions are possible even in the absence of air. In the latter case, if sufficient energy is imparted to the gas to start a decomposition and form a flame front, the flame front will travel throughout the system until the supply of Acetylene is exhausted or conditions become such that the flame front is no longer self-sustaining (as in a flame-arrestor).

Acetylene decompositions are of two types - deflagrations, which result in a slow-moving (about 20 feet per second) flame front and produce pressures about ten times the initial pressure; and detonations which result in a high velocity (about 6,000 feet per second) flame front and pressure up to 100 times the initial pressure. In long lines, a deflagration flame front may change to a detonating flame front.

An Acetylene plant has several possible safety hazards. Hazardous gases such as Acetylene, Natural Gas, Oxygen and Off-Gas mixtures are potentially dangerous and must be handled with caution. The following general rules should be followed at all times.

1. Report all leaks to foreman at once.

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2. Abnormal operating conditions should be reported to foreman at once.

3. Operators should know the location, purpose and operation of all gas masks and other safety equipment, all fire fighting equipment and all emergency shut-down switches.

3. OXYGEN

Oxygen is an active element which, although it does not burn, supports combustion and which combines directly or indirectly, with all elements except the rare gases. Oxygen is colorless, odorless, and tasteless. It is only slightly soluble in water and is a poor conductor of heat and electricity. Liquid Oxygen is pale blue, slightly heavier than water, magnetic, non-flammable, and does not produce toxic or irritating vapors.

WARNING: Keep all combustible materials especially oil and grease away from Oxygen. Do not permit smoking or open flames in any area where Oxygen is stored or used. Do not permit organic material or flammable substances of any kind to come in contact with liquid Oxygen. Some of the materials that can react violently with Oxygen under certain

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conditions of pressure and temperature are oil, grease, asphalt, kerosene, cloth, wood, paint, tar, and dirt which may contain grease or oil. Under certain conditions, mixtures of powdered organic materials with liquid Oxygen can detonate.

CAUTION: When organic materials, such as those listed above are exposed to liquid Oxygen, they will burn violently if ignited, even several minutes after they have been in contact with the liquid. Any clothing that has been splashed or soaked with liquid Oxygen should be removed immediately and aired away of sources of ignition for at least one hour until it is completely free of Oxygen.

HANDLING LIQUID OXYGEN: Always handle liquid Oxygen carefully. At extremely low temperature, it can produce an effect on the skin similar to a burn. The gases issuing from this liquid are also extremely cold and can produce burns. Delicate tissues, such as those of the eyes, can be damaged by an exposure to the cold gases which is too brief to affect the skin of the hands or the face.

Never allow any unprotected part of your body to touch uninsulated pipe or vessels containing liquified atmospheric

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gases; the extremely cold metal may stick fast and tear the flesh when you attempt to withdraw from it.

Protect your eyes with a face shield or safety goggles (safety spectacles without side shield do not give adequate protection). Always wear gloves when handling anything that is, or may have been, in contact with liquid. Asbestos gloves are recommended. The gloves should fit loosely, so that they can be thrown off quickly if liquid should spill or splash into them. When handling liquid in open containers, it is advisable to wear high-top shoes. Trousers (which should be cuff-less if possible) should be worn outside the shoes.

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