ETHYLENE DICHLORIDE (EDC)

PRODUCT STEWARDSHIP MANUAL

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Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
ASTM	American Society for Testing Materials
EDC	Ethylene Dichloride
EU	European Union
IARC	International Agency for Research on Cancer
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
NTP	National Toxicology Program
OEL	Occupational Exposure Limit
PPE	Personal Protective Equipment
PTFE	Polytetrafluoroethylene
PVA	Polyvinyl Alcohol
SCBA	Self-Contained Breathing Apparatus
SDS	Safety Data Sheet
TLV	Threshold Limit Value
TWA	Time Weighted Average (8-hour)
VOC	Volatile Organic Compounds

Introduction

At Olin, our Product Stewardship program is guided by our core values – Act with Integrity, Drive Innovation and Improvement, and Lift Olin People. We are committed to the safe handling and use of our products – and enabling all of our collaborators throughout the value chain to do the same. As a responsible corporate citizen, we assess our products' safety, health, and environmental information and take appropriate steps to protect employees, public health, and the environment. Ultimately, our Product Stewardship program's success rests with each individual involved with Olin products – from the initial concept and research to the manufacture, sale, distribution, use, disposal, and recycling of each product.

Purpose of this Manual

This manual is designed to help you safeguard the health of your employees, encourage safe working practices, maintain Ethylene Dichloride (EDC) exposure levels at or below the current industrial health limits, and protect the environment. It is essential that everyone who comes into contact with EDC is thoroughly trained in safe work practices and the proper use of equipment. All personnel should be aware of potential hazards, understand what and how to use personal protective equipment, and know how to seek medical assistance and/or administer first aid.

Further, Olin recommends that every individual who handles, stores, or is regularly exposed to EDC, read and familiarize themselves with the contents of this manual and the appropriate Safety Data Sheet (SDS). Every individual who may use this product is required to know how to access and understand the information contained in the SDS. For the most current SDS, please contact us at info@olin.com.

Covered in this Manual

This manual contains information on the physical properties of EDC, health hazards, precautions for handling, first aid, personal protection, fire and explosion hazards, containment and cleanup of spills and leaks, disposal, and procedures and equipment for safe handling and storage of bulk shipments.

The information provided in this manual pertains only to intermediate uses of EDC and does not address the use of this product in solvent applications. Olin does not endorse or promote the use of EDC in non-intermediate end use applications.

KEEP THIS MANUAL AND THE CURRENT SDS NEARBY IN CASE OF EMERGENCY AND AS A USEFUL REFERENCE.

Product Stewardship

A Commitment to Health, Safety, and the Environment

This section discusses Olin's Product Stewardship philosophy, including:

- The role of the end user
- Information about Safety Data Sheets

Nearly 98 percent of the Ethylene Dichloride supply is used to manufacture Vinyl Chloride Monomers (VCM), which are then in turn used to create Polyvinyl Chloride (PVC) resins. The more popular end uses of EDC include manufacturing ethyleneamines, specialty chlorinated compounds, rigid and flexible products, construction piping, and flexible PVC for packaging, medical, furniture, and automotive applications. Olin does not endorse or promote the use of EDC in nonintermediate end use applications.

Olin is committed to assessing safety, health, and environmental information for our products, and then taking appropriate steps to protect employee and public health, and the environment. Olin has devoted resources to promoting the safe and effective use of EDC, as well as its proper storage and disposal.

Hazard vs. Risk

It is important to properly define the words "hazard" and "risk." Hazard refers to the intrinsic toxicological and ecotoxicological properties of a substance that have potential to cause harm to humans and/or the environment. Risk incorporates an estimate of the potential exposure to these hazards. Risk is a function of both exposure and hazard; with no exposure, there is no risk. Whether a hazardous substance poses a risk depends on the circumstances under which the substance is used or handled. For example, the likelihood of exposure to humans or the environment is reduced when a hazardous substance is used in a closed system, thereby reducing risk.

You Have a Role in Product Stewardship

In general, Product Stewardship is a way of assessing information on the health and environmental aspects of a product and then providing guidelines to protect the environment and those who use the product. At Olin, Product Stewardship is a process to make health, safety, and environmental protection an integral part of designing, manufacturing, marketing, distributing, using, recycling, and disposing of products.

Government regulations vary by location and are subject to change. It is ultimately your responsibility to ensure that your use of EDC complies with all applicable regulations, and that the application of this product meets all national, regional, and local regulations.

Safety Data Sheets

Always review the SDS before handling Ethylene Dichloride.

Never handle EDC before you have read the relevant SDS. SDSs are updated regularly and reflect the most current detailed information on health effects, handling precautions, first aid, cleaning up spills and leaks, and personal protective equipment. They may also provide additional information that is not contained in this manual.

The SDS must be readily accessible to all persons where the product is being used. It is your responsibility to ensure that the most up-to-date SDS, provided by the supplier, is available to, and understood by, all employees who work with EDC.

For current copies of SDSs, contact your Olin representative.

Human Health Considerations

Toxicity and Risk

Essentially all substances, both natural and man-made, are toxic to some degree. Toxicity is the observed manifested injury following exposure to a substance by inhalation, ingestion, or direct skin or eye contact.

Risk is determined by exposure and hazard. Thus, the potential risk of a hazardous substance can be considerably reduced with proper handling, such as the use of engineering controls, fume hoods, respirators, chemical goggles, and other safety equipment, all of which limit exposure. Used properly by trained personnel and stored carefully in accordance with applicable laws and regulations, EDC can be used safely.

Experience has shown that overexposure is most likely to arise during storage, filling, handling, and maintenance operations. Please read these sections carefully, as they will provide you with the proper guidelines for working with EDC.

Acute Toxicity: The observed harmful effects of a substance after only a single exposure – usually to a relatively high level or concentration of the substance in question.
Chronic Toxicity: The development of harmful effects as a result of long-term or frequent exposure to a substance.

Routes of Exposure

When considering toxicity, the route of exposure is important. The likely routes of workplace exposure are inhalation, ingestion, or direct contact with the skin or eyes.

Inhalation

Inhalation of vapor is the most likely route of exposure to EDC. Therefore, it is essential to keep ambient levels in the workplace at or below the regulated or recommended occupational exposure standards. Occupational Exposure Levels (OELs) for EDC have been determined by several authorities and regions (see Table 1, page 5). The developed OELs reflect maximum average airborne concentrations of a hazardous material to which healthy adult workers can be exposed during an 8-hour workday and 40-hour week over a working lifetime without experiencing significant adverse health effects. Groups such as the American Conference of Governmental Industrial Hygienists (ACGIH) have developed guidelines to assist professionals in the control of health hazards in the workplace. Industrial hygiene professionals around the world refer to these guidelines. Please contact Olin at info@olin.com for guidance in relation to your jurisdiction. For additional information on first aid measures for inhalation, see the First Aid section of this manual.

Odor Threshold

The characteristic smell of EDC has been described as "sweet," or "chloroform-like" with an odor threshold of 6-10 ppm. Although smell by itself is not adequate as a warning of overexposure, it is clear indication of a condition that needs further investigation. Individuals can become accustomed or insensitive to odor. Therefore, the perception of odor is not an adequate warning of excessive exposure. To ensure employee safety, a trained individual should monitor the work area regularly with appropriate monitoring methods.

Ingestion

EDC is harmful if swallowed, however it is unlikely to be ingested during normal industrial handling. Swallowing larger amounts, either accidentally or intentionally, could result in serious injury or death. Do not eat, drink, or smoke in areas where EDC is stored or used.

Skin Contact

Skin contact should be avoided, as described in more detail below. Appropriate handling precautions and proper use of PPE should be employed to prevent skin contact.

Brief skin contact with EDC may cause skin irritation with local redness. The response may be more severe on covered skin (under clothing, or gloves). Prolonged skin contact with EDC may cause moderate skin irritation with local redness. Prolonged or repeated exposure may cause defatting of the skin leading to drying or flaking of the skin.

Eye Contact

EDC may cause serious eye irritation/eye damage and moderate corneal injury. Exposure to the eyes should be avoided with appropriate handling precautions and proper PPE. Vapor concentrations may cause lacrimation (tears). These concentrations are easily attainable at room temperature if vaporization is not properly controlled.

Carcinogenicity

EDC is a possible human carcinogen. It has caused cancer in laboratory animals. Carcinogenic effects in the animal study on EDC are believed to be related to the route of exposure and dose administered (greater than a dose the body can easily detoxify). EDC is not believed to present a risk of cancer to humans when handled as recommended.

Exposure Controls

Use engineering controls to maintain airborne levels of EDC below the exposure limit requirements or guidelines. Use only with adequate ventilation. The existing occupational exposure levels (OELs) must be adhered to for workers' safety.

Personal protective and emergency safety equipment should not be relied on as the primary means of protection against exposures to EDC. Rather, prevention of exposure should be the preferred precautionary measure. If exposure to concentrations above the various guidelines is unavoidable, an approved positive-pressure, air-supplied, or self-contained breathing apparatus with full face piece should be used.

While good ventilation is important, it cannot replace a closed, leak-tight system. All aspects of the handling operation must be carefully evaluated for the potential of exposure. Procedures that prevent exposure should be thoroughly explored, tested, and evaluated, and, if found effective, should become established practice. These may include the use of vapor return lines during product transfer, the use of dry disconnect fittings for transfer hoses, the use of closed loop sampling systems, and the like.

Additional Information

For more complete information on toxicity, exposure, and routes of exposure, refer to the SDS. The most current SDS is available from info@olin.com or your Olin representative.

Table 1: Workplace Control Parameters

Components	CAS No.	Value Type (Form of Exposure)	Control Parameters / Permissible Concentration	Basis
1,2-Dichloroethane	107-06-2	TWA	10 ppm	ACGIH
		TWA	50 ppm	OSHA Z-2
		CEIL	100 ppm	OSHA Z-2
		Peak	200 ppm	OSHA Z-2
		TWA	1 ppm (4 mg/m^3)	OSHA P0
		STEL	2 ppm (8 mg/m^3)	OSHA P0

Fire and Explosion Hazards

Flammability

EDC is highly flammable, with a Tag Closed Cup (ASTM D56) flash point of 55 °F (13 °C). The upper and lower flammability limits of EDC are shown in Table 2. EDC vapors are heavier than air and may travel long distances, accumulating in low lying areas. Ignition and/or flash back may occur. Ensure good ventilation and/or use of appropriate respiratory protection. All containers, personnel, and equipment must be electrically grounded before transfer or use of material. Due to the flammability of EDC, a deluge system and fire/smoke detectors should be installed, and non-sparking or explosion-proof equipment should be used in areas of storage/use.

Table 2: Flammable Limits in Air

Volume % of Ethylene Dichloride (EDC) in Air at Room Temperature		
	Lower Flammability Limit	Upper Flammability Limit
EDC	4.5% (v)	16.9% (v)
Note: Refer to the Safety Data Sheet for more information.		

Static Electricity

Many operations in processing can generate static electricity, and static charges can, under certain conditions, cause fires and explosions, especially in areas where flammable materials are used and stored.

For example, static charges can sometimes be generated when the product is transferred from a tank or other container to a storage vessel or processing line. Thus, tanks and lines should be well-bonded and grounded. A nitrogen pad in storage tanks is also recommended, as this can prevent oxidation of the product.

Submerged filling is required for all flammable liquids. To accomplish this, the inlet line should discharge at, or near, the bottom of the tank and should make electrical contact with the tank to prevent uncontrolled static buildup. Lined tanks should not be used with EDC.

Operators wearing rubber-soled shoes may pick up considerable static electricity, particularly on certain composition floors made of effective insulating materials. Thus, attention should be given to the:

- Grounding of all process equipment
- Use of static collectors and eliminator
- Use of adequate ventilation and good housekeeping to reduce vapor concentrations
- Use of conductive flooring materials

NFPA Rating

The current NFPA rating for EDC is Health = 2, Flammability = 3, and Instability = 0.

Incompatibility

EDC is thermally stable at typical use temperatures. Exposure to elevated temperatures can cause product to decompose. Avoid open flames, welding arcs, or other high-temperature sources that induce thermal decomposition. Avoid contact with oxidizing materials, alkali metal hydroxides, amines, ammonia, aluminum, and aluminum alloys. Decomposition products depend upon temperature, air supply, and the presence of other materials. Decomposition products can include but are not limited to hydrogen chloride.

For more complete information refer to the Safety Data Sheet.

General Safety and First Aid

General Safety Guidelines

- **Always consult the SDS** before beginning work and keep it nearby so you can refer to it in case of an accident or exposure.
- **The use of EDC in particular jurisdictions requires adherence to strictly controlled and regulated conditions** that may involve manufacture, purification, cleaning and maintenance of equipment, loading and unloading, waste disposal, storage, and/or total lifecycle of the product.
- **Educate all personnel on the properties and hazards of EDC.** Make certain that all personnel are familiar with recommended handling and disposal procedures.
- **Always use the appropriate PPE and safety equipment.** Wear protective garments, chemical-resistant gloves, and eye protection at all times.
- **Maintain adequate ventilation in all areas.**
- **Trained personnel should regularly monitor EDC concentrations in the air** to ensure safety and to comply with all applicable regulations.
- **Avoid skin and eye contact.** Prolonged or repeated contact of EDC with the skin may cause defatting of the skin leading to drying and flaking of the skin. EDC can cause moderate corneal injury and eye irritation.
- **An operable safety shower and eye wash station** should be within a reasonable distance from the unloading and storage/ product handling areas.
- **Do not smoke while handling EDC or in areas where this material is present.**
- **Ensure that spill containment is in place** to minimize the potential for environmental release into waterways, ditches, or storm sewers.
- **Due to flammability of EDC, a deluge system and fire/smoke detectors should be installed and active in EDC handling areas. Explosion-proof pumps and non-sparking tools are used.**

First Aid

- **Immediately seek fresh air and assistance** if you become light-headed while working with EDC. Dizziness and loss of coordination can lead to more serious accidents.
- **If inhaled, move person to fresh air.** If not breathing, give artificial respiration. If by mouth to mouth, use rescuer protection such as a pocket mask. If breathing is difficult, oxygen should be administered by qualified personnel. Call a physician or transport to a medical facility.
- **If skin contact does occur, immediately flush the skin with water while removing contaminated clothing and shoes.** Get medical attention if symptoms occur. Wash clothing before reuse. Contaminated leather items such as shoes should be disposed of properly. Suitable emergency safety shower facility should be available in the work area.
- **In case of eye contact,** immediately flush eyes with water, remove contact lenses, if present, after the first 5 minutes, then continue flushing eyes for at least 15 minutes. Obtain medical attention without delay, preferably from an ophthalmologist. Suitable emergency eye wash facility should be immediately available.
- **If swallowed, seek medical attention.** Do not induce vomiting unless directed to do so by medical personnel. Seek medical attention immediately. Never give anything by mouth to an unconscious person.

Safe Handling and Exposure Control

Personal Protective Equipment

The principal goal of any system or plant operation design should be to minimize the need for personal protective equipment. However, personal protective equipment may be necessary in certain operations or in areas where vapor or liquid exposure is possible. The selection and use requirements of this equipment require careful management considerations. For example, an overall appraisal of plant operations, exposure potential, the nature and duration of possible exposure, the level of training provided to workers on the use of personal protective equipment, etc., must be made. This appraisal should be conducted by a qualified industrial hygienist in conjunction with engineering, maintenance, and the supervisory and management staff. Upon completion of the appraisal, a comprehensive program of personal protection should be prepared. As part of this program, specific approved equipment (including manufacturer, make, and model) should be identified. The plan should also cover equipment maintenance and repair, cleaning and storage, as well as training on use, effectiveness, etc.

Do not work in areas contaminated by EDC vapor unless you are properly equipped and trained. You must have appropriate protective equipment and use it in accordance with the manufacturer's instructions and all applicable regulations. Protect yourself and safeguard the health and safety of operators, maintenance employees, and all others who work with EDC.

Eye Baths and Showers

Ensure that eye baths and safety showers are readily available for emergency use and that access routes to these facilities are free of obstructions. Regularly test eye baths and showers for proper operation, including temperature and adequate water flow. These facilities should be operational in any kind of weather.

What to Wear

Even well-engineered systems will generally require the use of some personal protective clothing, especially in the event of spill, leaks, or other events and activities where there is a possibility of exposure.

For personnel who unload tanks, tank cars, tank trucks, sampling lines, etc. – or when there is other potential for gross contact – proper protective equipment should include:

- Protective clothing chemically resistant to this material. Selection of specific items such as face shield, boots, apron, or full body suit will depend on the task.
- Hard hat for physical hazard protection.
- Chemical worker goggles. If exposure causes eye discomfort, use a full-face respirator.
- Respiratory protection should be worn when there is a potential to exceed the exposure limit requirements or guidelines. If there are no applicable exposure limit requirements or guidelines, use an approved respirator. Selection of air-purifying (organic vapor cartridge filter) or positive pressure supplied air will depend on the specific operation and the potential airborne concentration of the material. For emergency conditions, use an approved positive-pressure self-contained breathing apparatus.
- Impervious gloves made from chemically resistant materials. Examples of preferred glove barrier materials include ethyl vinyl alcohol laminate (EVAL), polyvinyl alcohol (PVA), and Viton™. The end user is responsible for evaluating and choosing PPE as part of their hazard mitigation program, based on their application, duration of use, and workplace exposure potentials. Refer to Section 8 of the SDS for more information.

The following additional protective equipment may be indicated for maintenance personnel:

- Chemical goggles or face shield.
- Rescue harness and lifeline for entering tanks and other enclosed or confined spaces.
- Positive-pressure air-line masks with proper reduction valves and filters, or self-contained, positive-pressure breathing apparatus. ***NOTE: Never use an industrial cartridge respirator for entry into tanks or other confined spaces.*** *Approved industrial respirators should only be used for temporary emergency use, such as escaping from contaminated areas. They also should not be used as a substitute for adequate ventilation or proper equipment operation.*
- Employees should be taught the proper method of putting on and taking off protective clothing and equipment to avoid exposure from contaminated clothing. It is suggested that customers obtain information from the manufacturers and/or suppliers of protective clothing and equipment about the performance of their products under various work-related conditions. Also, customers should ask specifically about the resistance of these items to ethylene dichloride.

Protective Equipment Maintenance

It is important to maintain and service all equipment according to manufacturers' recommendations. Conduct regular practice drills using personal protective equipment (PPE) to make sure equipment fits properly, hoses are secure, etc. All respiratory protection programs must

conform to applicable occupational safety and health requirements.

Monitoring Solvent Vapor Levels

There are several ways of measuring the concentration of EDC in the air; however, special training is needed to ensure that the measurements are reliable and meaningful. Therefore, make sure that vapor levels are checked regularly by trained specialists.

Direct Exposure Measurements

The simplest method for performing spot measurements is to use a commercially available colorimetric device, such as a Draeger tube or an MSA/Auer tube. These devices give only spot measurements and can be affected at times by humidity or by other chemicals present in the air, making results difficult to interpret. Sophisticated instruments for continuous measurement of vapors – such as infrared spectrometers, flame ionization detectors, or photo ionization detectors – are also available. However, special training is required to become proficient with their use. Always read the instructions carefully before using any detection device.

Indirect Exposure Measurements

Indirect exposure measurements are more accurate than direct methods. The most common indirect devices (vapor monitoring badges and personal monitoring pumps) sample a known quantity of air either by diffusion or drawing through a tube containing activated carbon. A laboratory analyzes the carbon to determine the contaminants present and measure their concentrations.

This method also tends to be the most accurate and is valid in the range of ACGIH or TLV concentration values (National Institute of Occupational Safety and Health—NIOSH method 1003).

Entry Guidelines for Tanks, Pits, and Other Confined Areas

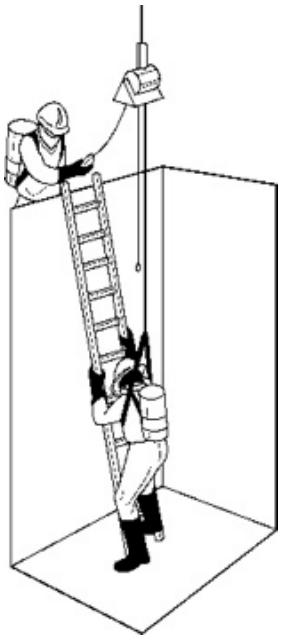
Confined-area entry is the most hazardous operation involving EDC. EDC vapors are heavier than air, and high concentrations can collect in low, confined, and unventilated spaces such as tanks or pits. It is therefore important to keep the tank ventilated and use appropriate respiratory protection during the entire cleaning or repair operation. The tank should be ventilated through openings at the bottom and top of the tank or exhausted mechanically from the lowest point in the confined area.

Additionally, the oxygen level in the tank should be measured by oxygen meter before and during any entry into the confined area. **Oxygen levels should never fall below 19.5 percent.**

A common industrial cartridge respirator does not provide protection if oxygen levels are too low. Failure to use supplied air respirators (Self-Contained Breathing Apparatus (SCBA) or airline respirator) when entering confined or unventilated areas is dangerous. Very high vapor concentrations combined with insufficient oxygen levels can cause dizziness, loss of coordination, unconsciousness, even death. Individuals who are familiar with the hazards, appropriate safety precautions, equipment, and rescue and first aid guidelines associated with the use of EDC should supervise tank and pit cleaning operations (see the sections on The Supervisor's Role and Observers, on this page).

General Tank-Entry Guidelines

1. Obtain written permission to enter the tank.
2. Lock out power feeds.
3. Shut off heating systems.
4. Drain solvent.
5. Disconnect all pipelines, including vents into or out of the tank. Cap pipe ends or install a blank in the pipeline.
6. Air-dry the tank.
7. Vent solvent vapors properly.
8. Monitor the air in the area/vessel to ensure that the oxygen concentration is sufficient and the solvent vapors are at acceptable levels for the respirator/PPE.
9. Display "Employee in Tank" signs at all entry points.
10. Have a person wearing proper PPE stationed outside the tank as an observer.
11. Follow all applicable regulations for confined-area entry.



The Supervisor's Role

The crew supervisor should carefully inspect the tank before cleaning or repair operations begin. Make certain that manholes are easily accessible, brightly illuminated, and large enough to accommodate safety gear. Steps and ladders must be rigid and well secured. If possible, provide mechanical hoisting equipment in the event it becomes necessary to evacuate injured or disabled employees.

The supervisor should also make sure that all employees entering the tank or serving as observers have the necessary, chemical-resistant protective equipment. Check the fit, operation, and suitability of all safety equipment, clothing, and breathing equipment.

Observers

Station a fully equipped observer outside the tank at all times. He or she must be capable of performing rescue guidelines. If you are the observer outside the tank, stay alert. Watch for signs of overexposure (headache, dizziness and drowsiness, progressing to incoordination and unconsciousness) in both the employee in the tank and yourself. Make sure that other employees are within calling distance, and that a notification guideline is in place.

Additional Information

More information on confined-area entry is available from relevant regulatory authorities and from national publications on confined spaces such as the ASTM Standard Practice for Confined Area Entry.[1]

Proper Handling Related to Heat

Keep Solvents Away from Flames and Heat

Do not use or store EDC near open flames or excessive heat (such as ovens, furnaces, space heaters, welding operations, and pilot lights). When EDC vapors are exposed to extreme heat, they can decompose, yielding highly corrosive or toxic products such as hydrogen chloride.

[1]In the U.S., information is available from the American Society for Testing Materials (ASTM): ASTM Standard Practice for Confined Area Entry, D-4276. Contact ASTM at www.astm.org, or ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. In the UK, the Health and Safety Executive has a publication called "Confined Spaces, A brief guide to working safely." Other jurisdictions have varying legislation on confined spaces, and this should be confirmed with national regulatory authorities.

Hydrogen chloride is a strong respiratory irritant. If you are experiencing eye, nose, or throat irritation, leave the area immediately.

If processes involving extreme heat, such as welding operations, must be conducted in an area where EDC may be present, ensure that there will be adequate ventilation. If acceptable levels cannot be achieved, any employees in that area should wear a positive-pressure breathing apparatus.

Proper Ventilation

If hot processes are unavoidable in areas where EDC vapors are present, the products of combustion should be vented outside the building through corrosion-resistant ducts. The air supply for space heaters, ovens, or furnaces should never be drawn from areas containing EDC vapor. For example, they should not have their intakes located near exhaust vents that carry EDC vapor.

Welding and Torch-Cutting

Do not weld in any area where EDC vapors may exist. Avoid arc welding near equipment containing this material because air currents may direct vapors toward the welding operation.

The special precautions that apply to welding also apply to torch cutting. Do not torch cut in an area where EDC vapors may be present, because of flammability and decomposition.

Environmental Considerations

Environmental Precautions

Prevent EDC from entering soil, ditches, sewers, waterways, and/or groundwater. The potential for mobility of EDC in soil is very high. EDC is essentially non-biodegradable.

General Safety Guidelines to Prevent Water, Soil, and Air Contamination

- Use nozzles, hoses, and couplings whenever transferring solvent.
- Connect hoses securely and pressure test with dry nitrogen to ensure a leak-free system before performing filling operations.
- Be aware of residual amounts of solvent in pipes and hoses. If possible, purge all lines and hoses with air or nitrogen before disassembling or disconnecting.
- Utilize a proven dry-disconnect coupling, or purge and cap lines and hoses, to prevent contamination. Capping hoses that contain residual liquid solvent is not recommended, as the hose may rupture if the solvent heats up and expands.
- Whenever possible, install permanent piping for applications that involve frequent filling and emptying.
- Conduct all solvent operations in secondary containment areas that are coated with solvent-resistant materials and that can accommodate the volumes being handled, and isolated from drains to the sewer or ground (see Secondary Spill Containment, page 12).
- All emissions from the storage tank during filling should be returned to the carrier vessel using a vapor balance piping system or captured by venting through a scrubber/disposal device (e.g., a VRU or to a vent burner). No vapor emissions should be vented to the atmosphere.
- Do not dispose of contaminated water in the sewer or septic system or pour it on the ground.
- Repair minor leaks in pumps, pipes, hoses, couplings, and other equipment.
- Immediately clean up leaks and spills when they occur.

Additional Information

To find more information about EDC, or to request the most current version of the Safety Data Sheet or Product Stewardship Manual, please contact us at info@olin.com.

Storage and Equipment

This section provides important information on proper storage guidelines for EDC. Specific recommendations are presented for:

- Bulk storage
- Tank specifications
- Underground storage
- Tank cleaning, repair, and maintenance
- EDC sampling
- Secondary containment
- Location of pipes, elbows, and fittings
- Related equipment

There are specific national and local regulations governing the use of solvent-resistant materials and solvent-tight containers for storage facilities. The user is responsible for reviewing and following all applicable laws and regulations.

Bulk Storage

Construction materials for storage tanks must be mild steel, carbon steel, or stainless steel. For existing tanks, SA-283 Grade C should be used; new tanks should be constructed from SA-516 Grade 70, ASTM A36, or ASME SA-36.

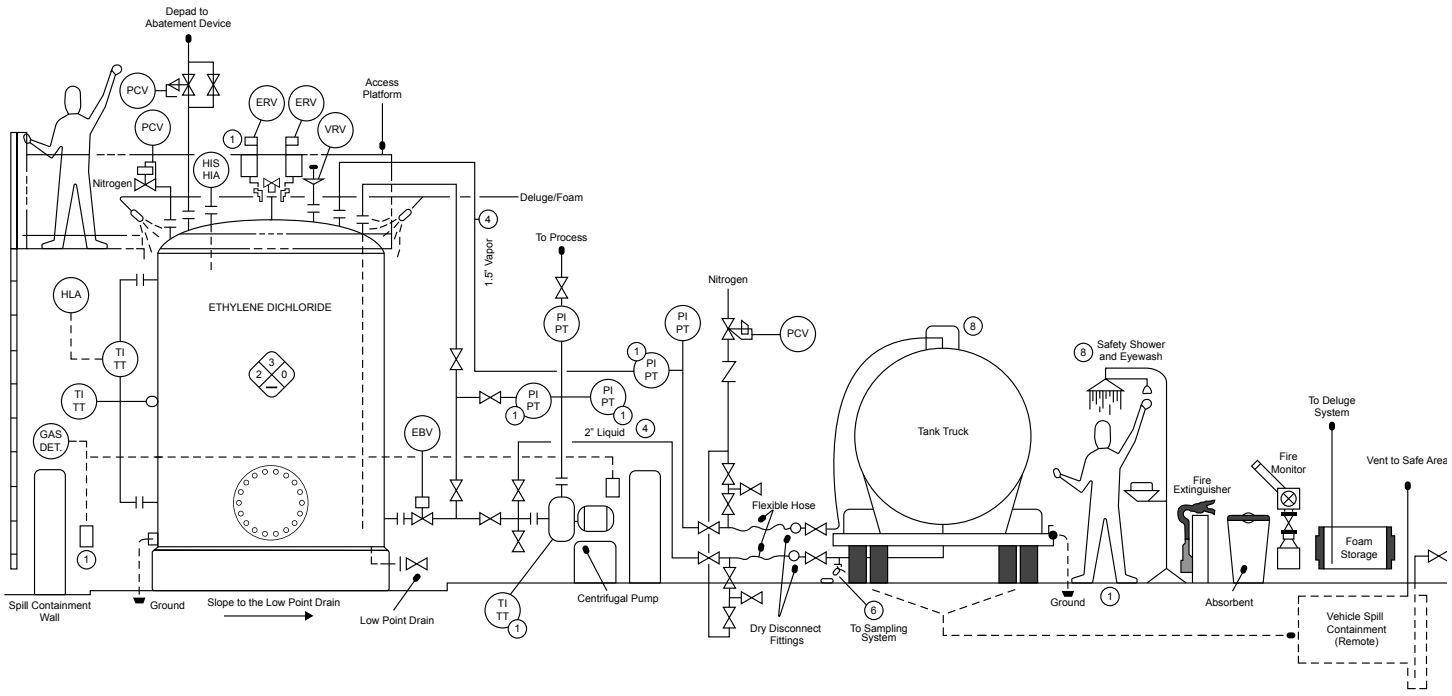
Equipment used in handling, storing, or processing EDC–including tanks, pumps, piping, valves, meters, and other instrumentation–must not contain aluminum or other white metals, such as magnesium or zinc (see Figure 1). A reaction between these metals and the solvent may cause corrosion and could ultimately cause equipment failure. Storage tanks must not be lined.

Storage tanks should be dedicated to storage of EDC and the capacity must be sufficient to allow unloading the entire transportation carrier in one continuous operation.

Storage tanks should be padded with nitrogen (< 5 ppm oxygen, having a dewpoint < -40 °C) to keep oxygen and moisture out of the tank and to reduce the possibility of flammable vapor mixtures forming above the liquid EDC. Tank vents should be equipped with a flame arrestor and condensers to minimize vapor emissions.

Relief systems on storage tanks should consist of a pressure/vacuum relief valve (usually located on the outlet of the vent condenser) and an emergency relief valve in case of fire.

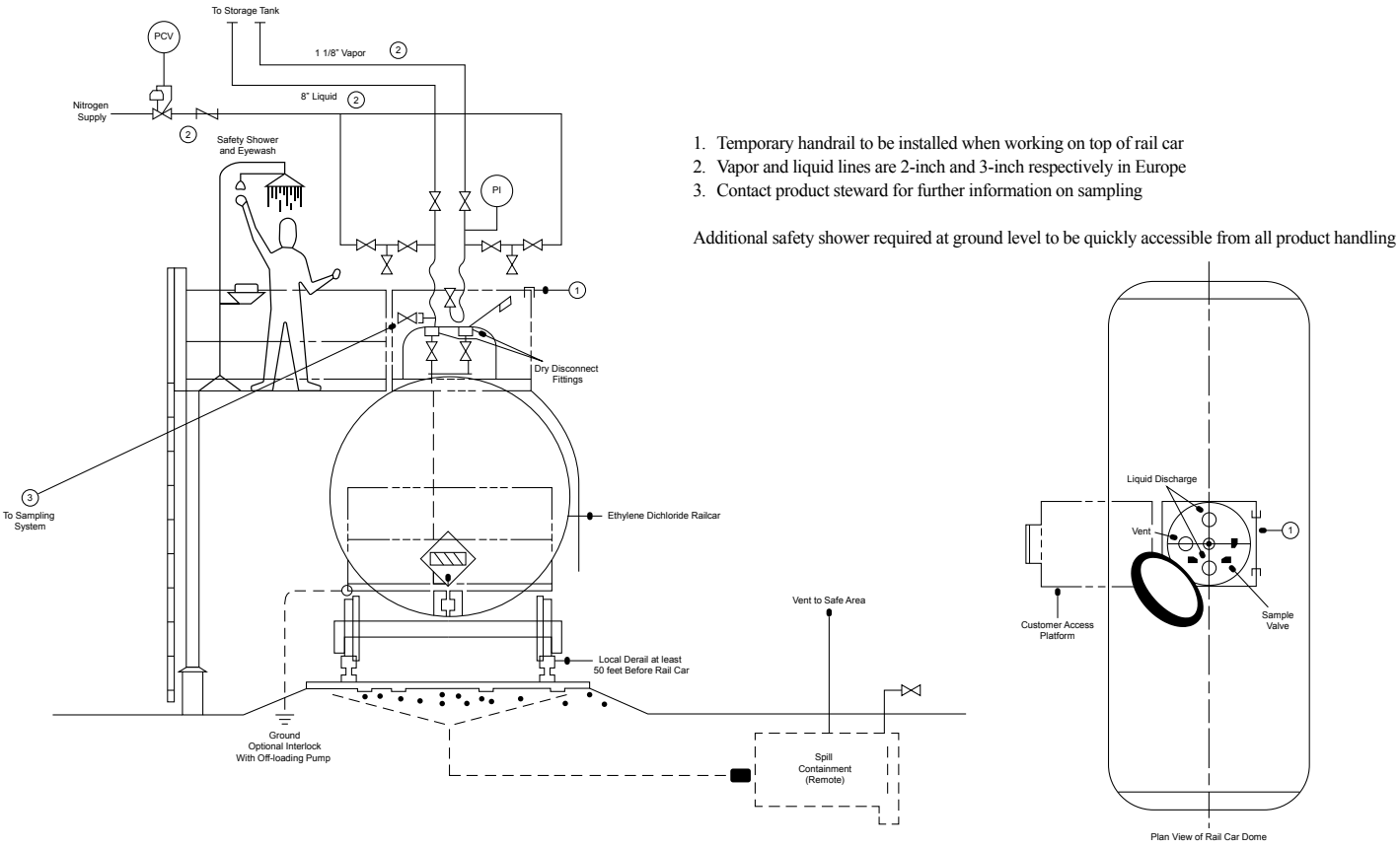
Figure 1: Bulk Storage and Tank Truck Offloading Schematic for EDC



LEGEND

EBV – Emergency Block Valve
ERV – Emergency Relief Valve
FI – Flow Indicator
FT – Flow Transmitter
Gas Det – Flammable Gas Detector
HLA – High Level Alarm
HLS – High Level Switch
LI – Level Indicator
LT – Level Transmitter
NIT – Nitrogen
PCV – Pressure Control Valve
PI – Pressure Indicator
PT – Pressure Transmitter
TI – Temperature Indicator
TT – Temperature Transmitter
VRV — Vacuum Relief Valve

Figure 2: Rail Car Off-Loading Schematic



Tank Specifications

Tank specifications should be in accordance with all applicable laws and regulations. EDC has a specific gravity greater than 1 (water =1), which should be reflected in the tank design.

- Ensure tanks are clean, dry, and free from rust.
- Ensure tanks have appropriate pressure-vacuum relief valves, a vent dryer or inert gas pad, and optimal vapor return lines for transfer operations.
- Use closed-loop filling systems with a vapor return line between delivery and storage vessels. Vapor return is also advised for in-process filling operations.
- Ensure tanks are grounded to prevent the build-up of static electricity.
- If the tank is located in a containment area, you should follow the applicable laws and regulations for EDC-resistant materials.

Underground Storage

Locating single-walled storage tanks without adequate leakage control systems underground is **not recommended and may be specifically prohibited** in some areas. The escape of EDC through unobserved leaks may pollute soil and groundwater and may lead to high costs for removing contaminated wastes.

Tank Cleaning, Repair, and Maintenance

When handling EDC, always ensure that you wear the appropriate personal protective equipment, as a minimum, protective clothing chemically resistant to this material, gloves, and safety glasses. For details see Personal Protective Equipment on page 7.

Practice continuous maintenance on your tanks to prevent loss of solvent.

Tank cleaning should be directed by thoroughly trained personnel who are familiar with the hazards, appropriate safety precautions, equipment, and first aid guidelines applicable to working with EDC.

In some areas, applicable laws and regulations may require that cleaning, repair, and maintenance work be performed by certified companies only. All equipment should be maintained and serviced according to the manufacturer's recommendations.

A simple halide leak detector can be used to check connections, valves, pump packing and any other accessible parts of the system. Be sure that all connections are made with a material that will not react with the EDC–polytetrafluoroethylene (PTFE) or Teflon® tape is recommended to wrap screwed fitting threads before assembly.

Sampling

Visual inspection does not always detect moisture and other contaminants. Consider these recommended guidelines when sampling EDC:

- Dry bottles before taking samples.
- Sample bottles should be made of narrow-mouthed glass (preferably amber-colored), with a maximum fill just below the shoulder of the bottle. Completely filling sample bottles can result in broken containers due to thermal expansion.
- Label bottles.
- Bottle caps should be of a type that will seal against the neck of the bottle. Conical cap liners made of polyethylene work well, as do flat liners made of soft Teflon® or foamed polyethylene.
- Store samples in tightly sealed secondary containers, in a cool place and away from direct sunlight, or properly dispose of samples after testing.
- Transport and store samples in appropriately sized secondary containers.

The best method of obtaining samples from delivered tank cars and tank trucks is to take them from a sample point on the unloading line. Take the sample when the line is full of liquid, and before off-loading the product into a storage vessel.

When sampling from storage tanks, withdraw samples from the center of the tank, away from the bottom or sides of the tank. To do this, insert the sampling device into the top of the tank, or collect the sample from a drain on piping to or from an operating recirculation pump.

Secondary Spill Containment

To help prevent soil and groundwater contamination, a secondary containment system is strongly recommended, and is a legal requirement in many countries. Always consult local regulations for requirements that may be more detailed or restrictive than the following general information.

Secondary containment systems may take the form of a dual-walled container, a dike around the tank area or a sump below the tank area. The system should be designed specifically for the chemicals being handled, and it should be constructed from EDC-resistant material. Acceptable construction includes double metal-bottomed (checked periodically for leaks), or a solid concrete foundation (not a ring) under a steel bottom designed for periodic leak detection. In addition, the system should be large enough to contain the full potential volume of material in the primary storage vessel/container. Drains to a collection point must be installed and must be independent of the sewage/drainage system for external discharge already located at the site. Treat any liquid found in retention basins as contaminated EDC waste, unless it is proven to be solvent-free.

Overfill Protection

Overfill protection is required for loading storage tanks. Acceptable overfill protection:

- Positive displacement integrating flow meter
- Integrated flow meter with instrument failure detection
- Alarmed high-level detection devices in the tank being loaded
- Level change (redundant levels) in the tank from which material is being removed, if material is not flowing into and out of this tank simultaneously

Redundancy is recommended. Mixing of the above protection methods to achieve redundancy is allowed.

Location of Pipes, Elbows, and Fittings

Do not bury pipelines, elbows, and fittings. The pipelines should be readily accessible for frequent inspection, and for immediate detection and repair of leaks. Piping may also be placed in an appropriately sized and EDC-resistant trough to collect any leaking solvent. If buried pipes are unavoidable, they must be jacketed, and a leakage alarm system must be provided for the void between the jacket and the pipe.

Related Equipment

Pipes

Pipes may be made of carbon steel or stainless steel. To prevent joint failure and the release of solvent, be sure that all piping connections are made with EDC-resistant materials. Recommended pipe connections are first welded, then flanged, and lastly screwed to ensure a leak-free system. Slip-on sockets and soldered connections are not acceptable for service with EDC.

Schedule 40 carbon steel pipe is usually sufficient, unless purity requires stainless steel. If you must use screwed fittings, wrap the threads of the fittings with tape made from polytetrafluoroethylene (PTFE) or Teflon® to prevent leaks. Do not use "pipe dope." Remove cutting oils and other dirt before placing the pipe in service. Pipe sections that can be closed off by valves should be protected with relief valves if pressures can exceed the burst pressure of the pipe.

Unloading Hose

A two-inch-diameter, seamless, flexible metal hose, preferably stainless steel, can be used to unload tank cars. PTFE-lined hose sheathed in a metal braid (such as stainless steel or bronze) or in neoprene rubber is also satisfactory. Interlocked, spiral-type hose should never be used, as it will allow EDC to leak through the packing. Order hose in the required length, with fittings already installed by the manufacturer.

Use of dedicated transfer hoses for EDC is preferred over common use unloading hoses found on transport equipment or unloading stations. Develop hose-inspection and pressure-testing programs to ensure that the integrity of hoses is maintained, and that replacement occurs when needed.

Pumps

When selecting a pump, it is important to consider the vapor pressure of the product when the lifting capability of the pump is calculated. Centrifugal pumps or positive displacement pumps of ductile iron or carbon steel casing are satisfactory for transferring EDC. Pumps should be equipped with a stainless-steel shaft and double mechanical seals. Aluminum and other white metals (such as magnesium or zinc) must not be used in any part of the system. Cast iron is not recommended for pumps as it may lead to leaking of the product.

Valves

Steel ball, gate, or globe valves are satisfactory. Ball valves should have a PTFE seat, and globe valves should have a metal seat. Rings of PTFE or flexible graphite may be used as stem packing. Where full-line flow is desired, ball or gate valves are recommended. Where throttling is necessary, globe or needle valves may be used. Swing and lift valves are both satisfactory as backflow prevention (check) valves. Aluminum and other white metals (such as magnesium or zinc) must not be used in any part of the system. Cast iron is not recommended for valves, as it may lead to leaking of the product.

Seals and Gaskets

These materials must be EDC-resistant, flexible enough to conform to the flange, and resilient enough to recover from compression. Teflon® (PTFE) is recommended for use with EDC. Do not use any rubbers for seal or gasket materials.

Meters

Meters for measuring flow, pressure, and/or temperature should be suitable for use with EDC. Obtain information on suitability directly from the manufacturer. Meters should not have any aluminum, magnesium, or zinc components, or any alloys of these materials.

Explosion-Proof Equipment

Equipment used with an EDC storage tank area must have an Electrical Hazard Classification of Class 1 Division 2, Zone 2, or Category 3 (NEC and ATEX Classifications).

Incompatible Materials

Avoid contact with oxidizing materials. Avoid contact with alkali metal hydroxides, amines, and ammonia. Avoid contact with metals such as aluminum and aluminum alloys. Do not use epoxy linings or rubber components in the system.

Bulk Transportation and Unloading

This section reviews both road and rail shipments and presents important information on proper handling guidelines for EDC. Specific recommendations are presented for unloading bulk solvent. Overexposure to EDC is most likely to arise during storage, filling, handling, and maintenance operations. Please read this section carefully, as it will provide you with the proper guidelines for working with EDC.

Bulk Shipments

Olin EDC is supplied – and shipped – only in bulk quantities (tank truck, rail car, barge, ship, and/or intermodal ISO containers).

Personnel involved in unloading should have a thorough knowledge of both the configuration and equipment of the carrier. They should also be educated in both the hazardous properties of EDC and the proper use of personal protective clothing and equipment.

Unloading Bulk Solvent

Properly trained and equipped personnel, providing constant supervision for unloading, should carry out unloading operations in well-lit areas that have secondary containment made of a solvent-resistant material. The area should be protected from road, rail, or pedestrian traffic during unloading. Whenever a container is unloaded by gravity or a pump, a vapor piping system should connect between the shipping container and the receiving tank to reduce solvent losses.

The preferred method, and that with the greatest control, is unloading from the bottom of the shipping container with a pump, rather than by gravity. If pumping facilities are not available, and the tank relief devices have a sufficiently high rating (check the maximum allowable pressure), the contents may be unloaded through a dip tube, with gas pressure applied into the top of the tank. Connect the inert gas line to the top of the tank using a pressure control valve and a pressure relief device set at 50 percent of the tank relief valve set pressure. Clean, dry nitrogen at a pressure of 20-30 psig (1034-1551 mmHg gauge) is suitable for this purpose. **Do not use air pressure, because moisture in the air could contaminate the EDC.**

Other important information:

- The unloading procedure should be documented, and all personnel trained on the procedures and product hazards.
- Verify that the receiving tank is correct and ensure that it has adequate capacity.
- Set air valves and vapor return lines prior to beginning pumping operations.
- The use of dedicated unloading hoses is preferred. If these are not available, the transfer hose must be cleaned before use.
- Equipment, product pipes (including the connection points), storage tank and utilities should be tagged/labeled clearly.
- All system components (transport container, unloading system, lines, pumps, and storage tank must be electrically grounded.
- The unloading system must be pressure checked prior to each unloading with inert gas (or equivalent) to ensure a leak-free system.
- At the beginning of the transfer, flush the hoses with a small amount of EDC for cleaning purposes, and collect it for waste disposal.
- After the flush, a sample of EDC may be taken into a glass container for analysis (see Sampling, page 11).
- Repeat flushing as necessary until the hose is clean and you obtain an uncontaminated EDC sample.
- Equipment should be in place to prevent backflow of liquid tank material to the carrier vessel.
- A remote shutoff/emergency stop should be in place for unloading.
- When unloading is complete, collect all solvent drained from hoses, valves, etc. for use or disposal.
- Hoses should be drained and capped after use.
- An IR-type combustible gas detection system should be used in the unloading and storage areas.

Transfer from Storage to Point of Use

The simplest and most economical method of transfer is to pipe the EDC directly to the point of use, using gravity flow. If the point of use is far away, or higher than the storage tank, then use an appropriate pump with permanently installed pipe.

When delivering EDC to the bottom of a receiving vessel, make sure it is at a point below the fluid surface to minimize turbulence and unnecessary evaporation, and to avoid the buildup of static electricity that could result in a fire from a created spark. Regularly inspect and properly maintain all piping, valves, and pumps.

Do not transfer even small amounts of EDC in open containers. If permanently installed piping is not available, use a mobile tank with covered openings and pressure relief to move the solvent to the application that needs filling. Always use proper nozzles and approved fluid flow lines to connect the mobile tank to the machine. Vapor return lines from the point of use back to the storage tank will minimize solvent vapor emissions during transfer.

Accidental Release and Disposal

Handling

Those responsible for handling, treating, storing, and disposing of EDC and solvent wastes must understand and follow approved guidelines and relevant government regulations for these practices. Laws dictating how a user may handle, treat, store, and dispose of hazardous waste vary. Olin recommends that you contact a licensed disposal contractor to handle any waste or contaminated material where this is to be sent off-site. If you intend to treat any contaminated material on-site, Olin recommends that you contact a qualified environmental engineering company to assist with the permitting and design of any such treatment system and contact the local environmental regulator with respect to any permits or licenses that may be required.

What to Do When Spills or Leaks Occur

Spilled EDC and EDC-contaminated water should never be allowed to drain off into sewers or any body of water, or onto the ground. It is important to inspect and maintain your process equipment, holding tanks, and spill-control devices continually, and to know what to do ahead of time if a spill or leak occurs. Be prepared by having proper protective equipment identified and available for personnel cleaning up any spills.

If you or a fellow employee experience dizziness, loss of coordination, or eye irritation–or if breathing becomes difficult–leave the area immediately and seek fresh air. Call a physician and/ or take the employee to an emergency medical facility. If a colleague stops breathing, remove to fresh air and perform mouth-to-mouth resuscitation and seek medical assistance immediately.

Emergency Guidelines for Spills and Leaks

Guidelines for Small Spills and Leaks

1. Maintain proper protective equipment and keep it available for personnel cleaning up the spill.
2. Contain the spill.
3. Stop the leak using proper protective equipment and ventilation.
4. Clean up small spills and leaks immediately using an inert absorbent and/or absorption pads to reduce the potential for a fire.
5. Place solvent-laden materials and/or binders in a covered, solvent-resistant metal container.
6. Arrange for proper waste disposal according to applicable laws and regulations.
7. Contact the supervisor, even for small spills and leaks.

Guidelines for Large Spills

1. Evacuate the area and call for help immediately.
2. Ventilate the area.
3. Notify the supervisor.
4. Protect yourself. Do not approach the spill area without wearing self-contained, positive-pressure respiratory equipment, and suitable protective clothing.
5. Dike area to contain the spill.
6. Block floor drains, if present, to prevent the spill from spreading further.
7. Pump spilled EDC into a solvent-resistant container using explosion-proof equipment. Close and label the container.
8. Absorb residual spilled solvent with an inert absorbent and/ or absorption pads, and then transfer to a closed container for proper disposal.
9. Spills may have to be reported to the proper authorities if quantities exceed reportable volumes.

The preferred method for disposing of EDC and the materials used for spill cleanup is to send the waste, via an authorized waste hauler, to a licensed reclaimer or to a government-approved incinerator. Perform repairs and/or take corrective action to prevent recurrence.

Disposal

Use an authorized processor or a special waste treatment plant to dispose of EDC waste and water contaminated with EDC.

Never dispose of EDC waste by pouring it on the ground, down a sewer, or into a septic system. Do not dispose of EDC wastes in landfills. This practice is illegal in most countries. In addition, the wastes from different solvents should never be mixed, even in disposal. Doing so would make reclamation and recycling impractical, and, in some countries, such mixing is illegal. Be sure to review all applicable laws and regulations before disposing of EDC wastes.

Appendix A - Physical and Chemical Properties

Table 3: Physical Properties of Ethylene Dichloride

Properties	EDC
Chemical Formula	CH_2ClCH_2Cl
Appearance/Odor	Colorless liquid/sweet odor
Molecular Weight	98.9 g/mol
Boiling Point @ 760 mmHg	182.5 °F (83.6 °C)
Freezing Point	-33 °F (-36 °C)
Specific Gravity @ 77/77 °F (25/25 °C)	1.25
Pounds per Gallon @ 77 °F (25 °C)	10.50
Vapor Density (air=1.00)	3.42
Flash Point, Tag Closed Cup ASTM D56	55 °F (13 °C)
Flammable Limits (Volume% of Solvent in Air) @ 25 °C Lower Limit Upper Limit	 4.5 16.9
Autoignition Temperature	824 °F (440 °C)
Vapor Pressure @ 32 °F (0 °C)	33.3 hPa
Relative Vapor Density	3.42
Relative Density @ 77 °F (25 °C)	1.2455
Density @ 68 °F (20 °C)	1.253 g/L
Water Solubility (g/L) @ 77 °F (25 °C)	7.9 g/L
Viscosity, Kinematic @ 68 °F (20 °C)	0.67 St

Disclaimer: The data above represent physical properties only and should not be construed as product specifications.

Appendix B - Property vs. Temperature Graphs

Figure 3: Vapor Pressure of Ethylene Dichloride

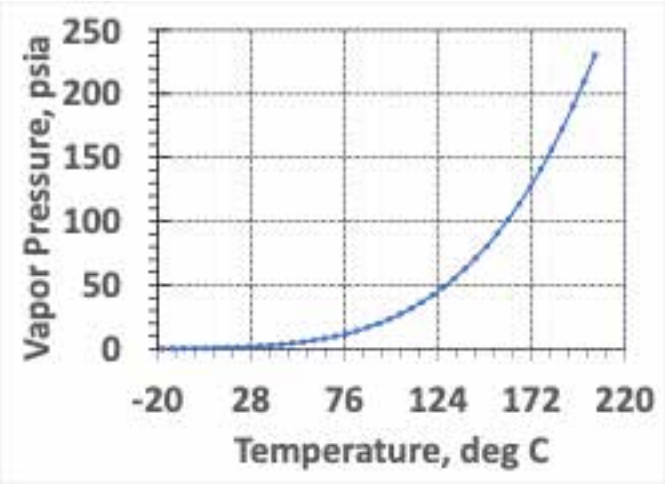
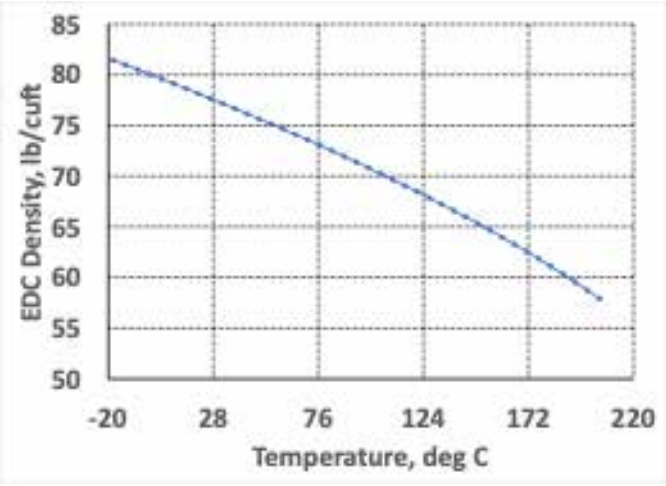
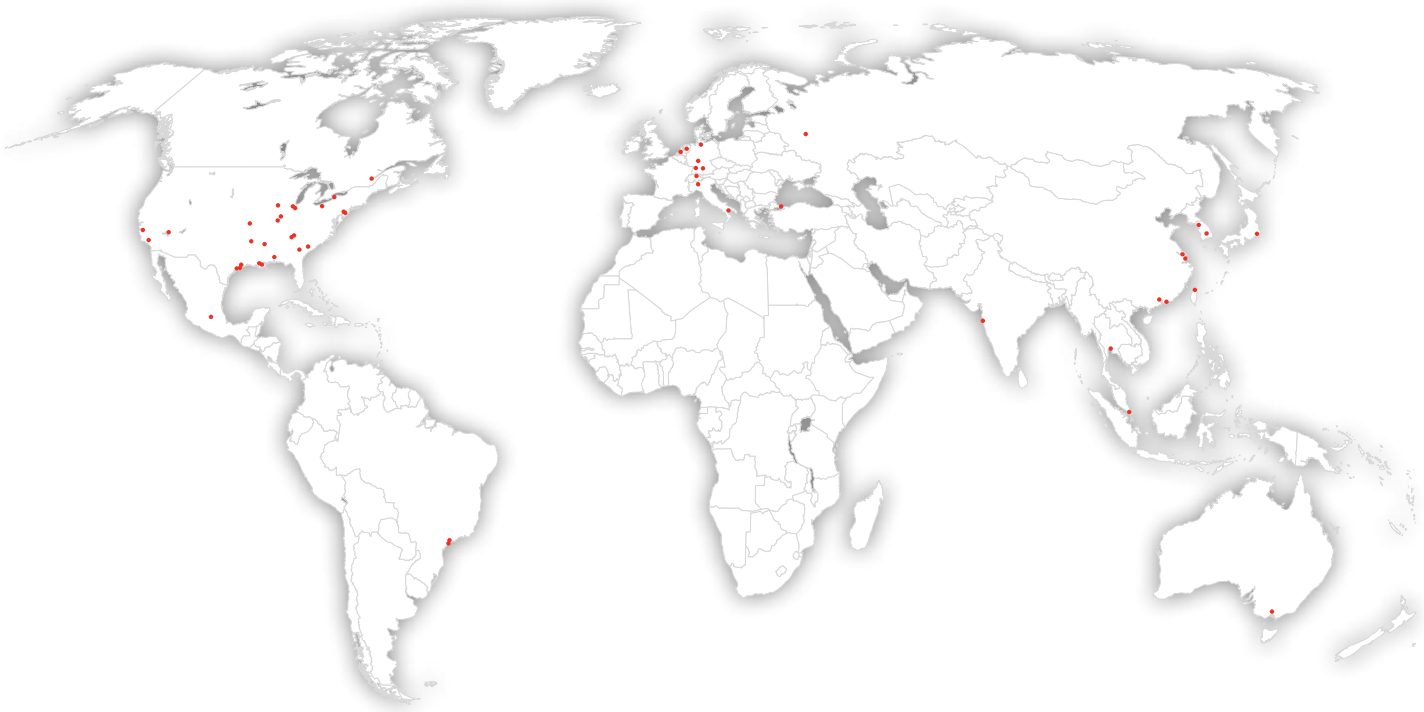


Figure 4: Density of Liquid Ethylene Dichloride





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