

Mobil

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CORPORATE MEDICAL DEPARTMENT

November 15, 1995

Ms. Kari Barrett
Chemical Manufacturers
Association
2501 M Street, NW
Washington, DC 20037

MEDICAL MANAGEMENT GUIDELINES

Kari
Dear Ms. Barrett:

Enclosed are the 10 Medical Management Guidelines (MMGs) that we discussed. Your assistance in distributing these draft documents as widely as possible for review and comment is appreciated. I've also enclosed a "Charge to Reviewers" statement that may be of value as well.

Please call (609-737-6102) if we should discuss our distribution strategy further. We had briefly discussed preparing a form letter addressed to the safety and health representative at each CMA member company seeking individuals interested in reviewing one or more of the 10 draft documents.

I will need to receive all comments on these MMGs by December 15th.

Thanks for your help on this project.

Sincerely,



David C. Logan, M.D.
Medical Director, Field Services
and Health Effects Programs

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enclosures

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cc: J. M. Cannella, M.D.

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Vinyl Chloride (C₂H₃Cl)

CAS 75-01-4; UN 1086

Synonyms include chloroethene, chloroethylene, 1-chloroethylene, ethylene monochloride, monochloroethylene, VC, VCM, vinyl chloride monomer.

- Persons exposed to vinyl chloride gas do not pose a risk of secondary contamination to personnel outside the Hot Zone. Persons whose clothing or skin is contaminated with liquid vinyl chloride or dust containing vinyl chloride can secondarily contaminate response personnel by direct contact or through off-gassing of vinyl chloride vapors.
- Vinyl chloride is a colorless, gas or liquid with a mild sweet odor. As a vapor, vinyl chloride is highly flammable at room temperature.
- Vinyl chloride is used in the production of plastics, in organic synthesis reactions, and historically as a chemical refrigerant. The primary route of exposure to vinyl chloride is via inhalation which, at high levels, can cause central nervous system depression and death. Systemic effects can be caused from exposure by any route.

Description

Vinyl chloride is a colorless vapor with a mild, sweet odor. At room temperature, vinyl chloride is highly flammable. If kept under high pressure, vinyl chloride can exist as a colorless liquid with a mild, sweet odor. Almost all vinyl chloride is anthropogenic. It is generally shipped as a liquefied compressed gas.

Routes of Exposure

Inhalation

Humans are primarily exposed to vinyl chloride by inhalation of the gaseous form. Breathing high levels of vinyl chloride (10,000 ppm for 5 minutes) can induce central nervous system depression, lightheadedness, nausea, and alterations of visual and auditory responses. At high air concentrations, death has been reported in humans (>10,000 ppm) and in animals (>100,000 ppm). Systemic effects of acute inhalation exposure include respiratory tract irritation, dysrhythmia, anorexia, nausea, and heartburn. Occupational exposures have resulted in an increased incidence of Raynaud's disease. Chronic exposures have led to cancer, particularly of the liver, lungs, brain, kidneys, and connective tissue.

Skin/Eye Contact

Vinyl chloride is a known skin irritant; contact with the liquid form of vinyl chloride may induce frostbite as it evaporates. Vinyl chloride is not well absorbed through the skin.

Ingestion	Ingestion is not a major route of exposure for vinyl chloride because of its high volatility (i.e., gas at room temperature) and its low solubility in water.
Sources/Uses	Vinyl chloride is widely employed in industry in the production of low-cost polymers, such as polyvinyl chloride (PVC). PVC is found in automotive parts and accessories, furniture, packaging materials, pipes, wall coverings, and wire coating. Vinyl chloride has been used as an extraction solvent for heat-sensitive materials and in the production of chloroacetaldehyde and trichloroethane. Historically, vinyl chloride has been used as a chemical refrigerant.
Standards and Guidelines	OSHA permissible exposure limit (PEL) = 1 ppm (averaged over an 8-hour work shift) OSHA short term exposure limit (STEL) = 5 ppm (15-minute exposure) NIOSH immediately dangerous to life or health (IDLH) = not determined
Physical Properties	Description: Colorless gas with faint, sweet odor; colorless liquid with faint, sweet odor; odor threshold 300–500 ppm Warning properties: faint, sweet odor Molecular weight = 62.5 Boiling point = 7.88° F (-13.4° C) Freezing point = -244.84° F (-153.8° C) Vapor pressure = 2530 mm Hg at 68° F (20° C) Vapor density = 2.16 (air = 1) Water solubility = 0.01% at 77° F (25° C) Flammability = flammable gas Flammability range is 3.6–33% (concentration in air)
Incompatibilities	Vinyl chloride reacts with copper, oxidizers, aluminum, peroxides, iron, and steel. It polymerizes in the presence of light. An unstable polyperoxide is formed in vinyl chloride through oxidation by atmospheric oxygen in the presence of contaminants. Long-term storage under these conditions may result in increased concentrations of polyperoxides, leading to violent chemical reactions and explosions.

Health Effects

- The primary route of exposure to vinyl chloride in humans is inhalation; the central nervous system is the primary target of acute vinyl chloride toxicity. Breathing high levels of vinyl chloride (10,000 ppm for 5 minutes) can induce central nervous system depression, lightheadedness, nausea, and alterations of visual and auditory responses. Exacerbation of pre-existing asthmatic conditions can also occur. Vinyl chloride has been shown to induce liver cancer in humans and in laboratory animals with chronic exposure. Immunological effects and effects on reproductive function may also occur.
- Ingestion is not a major route of exposure for vinyl chloride. The potential for toxic effects from contaminated water exposure is unlikely due to vinyl chloride's low solubility in water. Dermal exposure to vinyl chloride occurs by contact with either the gas or liquid forms. Absorption through the skin of either phase of vinyl chloride is considered negligible when compared to the respiratory route.

Acute Exposure

Central Nervous System

The central nervous system is the primary target organ of vinyl chloride toxicity. The symptoms most commonly reported in acute exposure are those related to the anesthetic properties of vinyl chloride, including dizziness, ataxia, fatigue, drowsiness, headache, and loss of consciousness. Symptoms of acute exposure resolve quickly when the victim is removed from the source of exposure. The threshold for central nervous system symptoms is approximately 8,000 ppm. Humans exposed to 8,000–25,000 ppm vinyl chloride for 3 minutes reported dizziness, disorientation, a burning sensations in the feet, and headache upon recovery. Alterations of visual and auditory responses have also been reported.

Cardiovascular

Dysrhythmia is a possible effect of acute vinyl chloride exposure. The threshold for cardiac dysrhythmia, however, is not known. It is likely that vinyl chloride lowers the myocardial threshold to the dysrhythmogenic effects of catecholamines and may predispose to ventricular fibrillation. In animals, exposure has led to ECG abnormalities, including ventricular ectopy, heart block and T-wave inversions.

Chronic exposure to vinyl chloride can cause a syndrome of acroosteolysis (dissolution of the bones of the terminal phalanges of the fingers, toes, and sacroiliac joints), Raynaud's disease, and scleroderma-like skin changes.

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<i>Respiratory</i>	Little information about the acute inhalation effects of vinyl chloride in humans is available. Vinyl chloride inhalation results in a sense of breathlessness and mild respiratory tract irritation. Wheezing and chemical bronchitis are potential pulmonary consequences of vinyl chloride exposure. Asthma may be provoked in those who are prone to broncho-constriction secondary to respiratory irritants. In laboratory animals, acute exposures to high concentrations (>100,000 ppm) of vinyl chloride cause respiratory inflammation, respiratory depression, pulmonary congestion, edema, hemorrhages, and death.
<i>Hematologic</i>	Limited evidence in humans believed to have been exposed to high concentrations of vinyl chloride vapor demonstrated that the blood failed to clot, and may be related to the presence of thrombocytopenia. Hematologic effects due to vinyl chloride are very limited.
<i>Gastrointestinal</i>	Acute vinyl chloride inhalation exposure may cause anorexia. Other symptoms may include nausea, heartburn, and abdominal distention. The threshold for these effects has not been established in humans. Because of the low solubility of vinyl chloride in water, there is little likelihood of acute toxic effects from ingestion. There are no studies of ingestion of liquid vinyl chloride in humans.
<i>Dermal</i>	Acute exposure to vinyl chloride gas may have an irritant effect on the skin. Exposure to escaping compressed gas or liquid vinyl chloride results in a frostbite effect on exposed skin. Absorption of vinyl chloride through the skin is negligible compared to respiratory absorption.
<i>Ocular</i>	Corneal and conjunctival burns result from exposure to vinyl chloride gas or liquid.
<i>Potential Sequelae</i>	Symptoms of acute inhalation exposure to vinyl chloride resolve quickly when the victim is removed from the source of exposure. Asthma may be provoked in persons with prior history of asthma.

Chronic Exposure

Carcinogenicity

The Environmental Protection Agency (EPA) has classified vinyl chloride as a carcinogen. Vinyl chloride has been shown to induce cancer in humans and in laboratory animals when they are exposed for chronic durations. Vinyl chloride has been documented to induce cancers of the liver (angiosarcoma), brain and central nervous system, respiratory tract, and lymphatic/hematopoietic system (leukemia and lymphomas, particularly in women).

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***Reproductive and
Developmental Effects***

Vinyl chloride has been shown to decrease sexual performance in both men and women. In men, chronic occupational exposure to vinyl chloride has been associated with decreased libido, impotence, and decreased testosterone production. In women, vinyl chloride exposure also induced a decrease in sexual function, in addition to an increased incidence and severity of elevated blood pressure and edema during pregnancy (i.e., eclampsia). These studies were often complicated by co-exposure to other chemicals, but are considered to be strongly suggestive of vinyl chloride toxicity. Animals studies have demonstrated decreased male fertility after exposure to vinyl chloride.

Human studies evaluating the fetotoxicity and teratogenicity in humans exposed to vinyl chloride are inconclusive. Several animal studies have shown that vinyl chloride induced developmental effects, such as decreased litter size and fetal weight, and delayed ossification when pregnant animals inhaled <500 ppm vinyl chloride. Lower inhaled vinyl chloride concentrations (<14 ppm) resulted in decreased maternal erythrocyte counts, with fetal hemorrhages apparent in rats.

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Prehospital Management

- Victims exposed only to vinyl chloride gas do not pose a risk of contamination to rescuers. Victims or their clothing contaminated with liquid vinyl chloride may secondarily contaminate rescue personnel by direct contact or off-gassing.
- Protective equipment includes respiratory and skin protection. A self-contained breathing apparatus or full-face supplied-air respiratory, and eye protection are necessary protection against gas exposure. Protective clothing is necessary when contact with liquid vinyl chloride is expected.
- The central nervous system is the primary target organ system. Vinyl chloride also irritates the respiratory mucosa.
- There is no specific antidote or specific treatment for vinyl chloride toxicity. Medical treatments are limited to supportive therapy.

Hot Zone

Rescuers should be trained and appropriately equipped with personal protective equipment and/or clothing before entering the Hot Zone. Vinyl chloride presents both gaseous and liquid contact exposure dangers. If appropriate protective equipment is not available and/or the rescuers have not been trained in its use, call for assistance from a local or regional HAZMAT team or other properly equipped response organization.

Rescuer Protection

Vinyl chloride gas is readily absorbed by inhalation, is a mild respiratory tract irritant, and may exacerbate pre-existing asthmatic conditions. Contact with escaping compressed gas or the liquid phase of vinyl chloride results in frostbite of contacted body surfaces. Vinyl chloride is not well absorbed through the skin.

Respiratory protection can be provided by self-contained breathing apparatus or full-face supplied air. Eye protection against gas exposure is also necessary. Particle filter masks are not effective.

Skin protection is not generally required when only vapor is expected. When contact with liquid is anticipated, protective clothing is recommended to prevent skin irritation or injury.

Immediate Care

In cases of suspected trauma, quickly stabilize the cervical spine. Ensure a patent airway in the unconscious victim while supporting breathing and circulation. The most important aspect of initial care is to safely remove the victim to an area of fresh air.

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<i>Victim Removal</i>	If victims can walk, lead them out of the Hot Zone to the Decontamination Zone. Victims who are unable to walk may be removed on backboards or gurneys. If these are not available, carefully carry or drag victims to safety.
Decontamination Zone	Patients exposed only to vinyl chloride gas who have no skin or eye irritation do not need decontamination. They may be transferred immediately to the Support Zone. Others require selective decontamination (see <i>Basic Decontamination</i> below).
<i>Rescuer Protection</i>	Victims exposed only to vinyl chloride gas do not retain or release this chemical in toxic quantities. Rescuers should be protected against direct contact when caring for victims who may be contaminated with liquid vinyl chloride or vinyl chloride-containing dust.
<i>Immediate Care</i>	The majority of victims exposed to vinyl chloride will recover quickly after being removed to fresh air. In victims more seriously affected, evaluate and support the airway, breathing, and circulation. Intubate the trachea in cases of respiratory compromise. If the patient's condition precludes intubation, surgically create an airway. Administer supplemental oxygen as required. Assist ventilation with a bag-valve-mask device, if necessary.
<i>Basic Decontamination</i>	Irrigate exposed eyes with plain water or saline for 3–5 minutes. Remove contact lenses if present. Flush exposed skin and hair with plain water for 2–3 minutes (preferably under a shower), then wash with mild soap, rinsing thoroughly with water. Induction of vomiting is not recommended. Contaminated clothing should be bagged for cleaning or disposal. As soon as basic contamination is complete, those victims who have not fully recovered should be transported to the Support Zone.
Support Zone	Victims who have undergone decontamination or have been exposed only to gas pose no serious risks of secondary contamination of rescuers. In such cases, Support Zone personnel require no specialized protective gear.
<i>ABC Reminders</i>	Quickly ensure a patent airway. Administer supplemental oxygen as required. Assist ventilation with a bag-valve-mask device if necessary. Establish intravenous access in patients with respiratory symptoms or findings suggesting asthma or stridor. Report to the base station and the receiving medical facility the condition of the patient, any treatment given, and the estimated duration of transport.

Additional Decontamination

In the presence of continued skin or eye irritation, further decontamination may be indicated (see *Basic Decontamination* above).

Advanced Treatment

Intubate the trachea in cases of respiratory compromise. Respiratory clinical monitoring should be especially useful for patients with a past history of asthma or wheezing. Cardiac monitoring should be initiated before administering bronchodilator therapy. Bronchodilator therapy should be considered and initiated promptly if deemed clinically appropriate. Patients who are comatose, seizing, or hypotensive, should be treated according to ACLS protocols.

***Transport to
Medical Facility***

Report to the base station and the receiving medical facility the condition of the patient, any treatment given, and the estimated duration of transport.

Multi-Casualty Triage

Patients who do not recover fully after being removed from the source of exposure should be transported to a medical facility for evaluation.

Asymptomatic patients may be discharged from the scene, after recording their names, addresses, and telephone numbers. If available, a brief individual description of their own exposure proximity and other "dose" information should also be obtained.

Patients with prior asthma history should be warned about this potential sequela, or clinically evaluated for bronchodilator therapy. These patients should be advised to rest and to seek medical care promptly if symptoms develop or recur (see the reverse side of the *Vinyl Chloride Patient Information Sheet*).

Emergency Department Management

- Patients do not pose a serious contamination risk to others.
- The central nervous system is the primary target organ system. Vinyl chloride also irritates the respiratory mucosa.
- Treatment consists of supportive measures and monitoring for complications. Patients exposed to escaping compressed vinyl chloride gas and/or liquid vinyl chloride may have areas of frostbite requiring medical attention. Potential pulmonary consequences can include asthma, wheezing, and chemical bronchitis, potentially requiring bronchodilator use.

Decontamination Area

Previously decontaminated patients and those who were exposed only to vinyl chloride gas who have no eye or skin irritation do not need further decontamination. They may be transferred directly to the Critical Care Area. Others may require further decontamination.

ABC Reminders

Evaluate and support the airway, breathing, and circulation. Intubate the trachea in cases of respiratory compromise. If the patient's condition precludes intubation, surgically create an airway. Establish intravenous access in seriously symptomatic patients if it has not been done previously.

Basic Decontamination

No additional decontamination is necessary as vinyl chloride would no longer be present as a liquid or gas.

Critical Care Area

ABC Reminders

Patients who are comatose, seizing, hypotensive, or experiencing cardiac dysrhythmias should be treated in the conventional manner.

Early dyspnea can indicate upper airway obstruction from epiglottic swelling, reflex bronchospasm or direct pulmonary injury, which require very different treatments. Patients require careful assessment for stridor, wheezing, and rales (for each of the mentioned diagnoses) in addition to use of X-ray, blood-gas, and pulmonary function testing.

Administer high concentrations of humidified oxygen to patients with shortness of breath, monitoring with ABG and/or oximetry determinations. Early and aggressive bronchodilator therapy is recommended for patients with asthma.

Monitor fluid status closely. Over hydration should be avoided to avoid contributing to pulmonary edema.

Inhalation Exposure

Continue to support oxygenation and ventilation as required.

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<i>Skin Exposure</i>	Liquid vinyl chloride may cause frostbite. If frostbite is present, treat in the conventional manner. There may also be chemical irritation or thermal injury that should be managed as the burns from any other cause. Airway compromise from mucosal injury may be a concern for the first days in cases of high-concentration exposure.
<i>Eye Exposure</i>	Eye exposure to vinyl chloride is unlikely, because it is gaseous at room temperature and a liquid when kept under pressure.
<i>Ingestion Exposure</i>	Ingestion of vinyl chloride is largely impossible, because it is gaseous at room temperature and a liquid when kept under pressure.
<i>Antidotes and Other Treatments</i>	There are no known antidotes for vinyl chloride exposure effects.
<i>Laboratory Tests</i>	Patients who have respiratory complaints should be evaluated with pulse oximetry (or ABG measurements) and chest radiography. Vinyl chloride blood or plasma levels are not clinically useful but may be used to document an exposure.
Disposition and Follow-up	
<i>Delayed Effects</i>	Recovery from acute exposure effects is usually rapid and complete. The only intervention necessary is supportive. Any persistent effects should be treated symptomatically.
<i>Patient Release</i>	Patients who remain medically stable and asymptomatic 12 hours after exposure may be discharged. They should be informed as to what symptoms to look for that would mandate immediate return (see the reverse side of <i>Vinyl Chloride Patient Information Sheet</i>).
<i>Follow-Up</i>	No follow-up is generally necessary as recovery is usually rapid and complete. Any persistent effects should be treated symptomatically.
<i>Reporting</i>	If a work-related incident has occurred, file a clinical report to Workers' Compensation. In some states and circumstances, additional reports to Public Health authorities are mandatory; contact your state or local health department. Other persons may still be at risk in the setting where this incident occurred. If the incident occurred in the workplace, discussing it with company personnel may prevent future incidents. If a public health risk exists, notify your state or local health department or other responsible public agency. When appropriate, inform patients that they may request an evaluation of their workplace from OSHA or NIOSH.

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Vinyl Chloride (C₂H₃Cl)

Patient Information Sheet

This handout provides information and follow-up instructions for persons who have been exposed to vinyl chloride.

What is vinyl chloride?

Vinyl chloride is primarily a manufactured chemical. It is a colorless vapor at room temperature with a mild sweet odor. Vinyl chloride can exist as a liquid when kept under high pressure. Vinyl chloride is used in the production of polyvinyl chloride (PVC) which in turn is used to make a variety of plastic products including pipe and packing materials.

What immediate health effects can be caused by exposure to vinyl chloride?

Inhaling vinyl chloride causes sleepiness and/or dizziness and exacerbation of pre-existing asthmatic conditions. Breathing high concentrations of vinyl chloride may result in loss of consciousness. Extremely high concentrations of vinyl chloride, when breathed, may cause death. If the skin comes in contact with liquid vinyl chloride, it can produce frostbite (numbness, redness, and blistering of the skin).

Can vinyl chloride poisoning be treated?

There is no known antidote for vinyl chloride. There is usually rapid and complete recovery from the acute effects of exposure with supportive care.

Are any future health effects likely to occur?

A single small exposure from which a person recovers quickly is not likely to cause delayed or long-term effects. Symptoms due to chronic exposure may be delayed for years. The liver is the main target of chronic exposure. Vinyl chloride is a known human carcinogen causing a rare form of cancer of the liver.

What tests can be done if a person has been exposed to vinyl chloride?

There are several tests that can show if you have been exposed to vinyl chloride. These specialized tests are generally not available in your doctor's office and must be obtained at a medical center.

Where can more information about vinyl chloride be found?

More information about vinyl chloride can be obtained from your regional poison control center; your state, county, or local health department; the Agency for Toxic Substances and Disease Registry (ATSDR); your doctor; or a clinic in your area that specializes in occupational and environmental health. If the exposure happened at work, you may wish to contact your employer, the Occupational Safety and Health Administration (OSHA), or the National Institute for Occupational Safety and Health (NIOSH). Ask the person who gave you this form for help in locating these telephone numbers.

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Follow-up Instructions

Keep this page and take it with you to your next appointment. Follow *only* the instructions checked below.

- ☐ Call your doctor or the Emergency Department if you develop any unusual signs or symptoms within the next 24 hours, especially:
- shortness of breath limiting normal activity
 - coughing, wheezing, or chest tightness
 - persistent pain or irritation in your eyes
 - increased redness or pain or a pus-like discharge in the area of your skin that has come in contact with vinyl chloride.
- ☐ No follow-up appointment is necessary unless you develop any of the symptoms listed above.
- ☐ Call for an appointment with Dr. _____ in the practice of _____. When you call for your appointment, please say that you were treated in the Emergency Department at _____ Hospital by _____ and were advised to be seen again in _____ days.
- ☐ Return to the Emergency Department/_____ Clinic on (date) _____ at _____ AM/PM for a follow-up examination.
- ☐ Do not perform vigorous physical activities for 1 to 2 days.
- ☐ You may resume everyday activities including driving and operating machinery.
- ☐ Do not return to work for _____ days.
- ☐ You may return to work on a limited basis. See instructions below.
- ☐ Avoid exposure to cigarette smoke for 72 hours; smoke may worsen injury to your stomach or have other effects.
- ☐ Avoid drinking alcoholic beverages for at least 24 hours; alcohol may worsen injury to your stomach or have other effects.
- ☐ Avoid taking the following medications: _____
- _____
- ☐ You may continue taking the following medication(s) that your doctor(s) prescribed for you: _____
- _____
- ☐ Other instructions: _____
- _____
- _____
- _____

Signature of patient _____ Date _____

Signature of physician _____ Date _____