

OCCUPATIONAL SAFETY AND HEALTH GUIDELINE FOR o-CHLOROSTYRENE

INTRODUCTION

This guideline summarizes pertinent information about o-chlorostyrene for workers and employers as well as for physicians, industrial hygienists, and other occupational safety and health professionals who may need such information to conduct effective occupational safety and health programs. Recommendations may be superseded by new developments in these fields; readers are therefore advised to regard these recommendations as general guidelines and to determine periodically whether new information is available.

SUBSTANCE IDENTIFICATION

• Formula



• Structure



• Synonyms

2-Chlorostyrene; ortho-chlorostyrene

• Identifiers

1. CAS No.: 2039-87-4
2. RTECS No.: WL4160000
3. DOT UN: None
4. DOT label: None

• Appearance and odor

o-Chlorostyrene is a combustible liquid.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 138.6
2. Boiling point (760 mm Hg): 188.7°C (371.7°F)
3. Specific gravity (water = 1): 1.10 at 20°C (68°F)
4. Vapor density: Data not available
5. Melting point: -63.15°C (-81.67°F)
6. Vapor pressure at 25°C (77°F): 0.096 mm Hg
7. Solubility: Insoluble in water; soluble in alcohol ether, acetone, petroleum ether, and acetic acid.
8. Evaporation rate: Data not available

• Reactivity

1. Conditions contributing to instability: Heat, sparks and open flame
2. Incompatibilities: None reported
3. Hazardous decomposition products: Toxic gases and vapors (such as chlorine) may be released in a fire involving o-chlorostyrene.
4. Special precautions: None reported

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

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

Flammability

The National Fire Protection Association has not assigned a flammability rating for o-chlorostyrene; however, other sources report that this substance is combustible.

1. Flash point: 58.9°C (138°F)
2. Autoignition temperature: Data not available
3. Flammable limits in air: Data not available
4. Extinguisher: Use dry chemical, carbon dioxide, water spray, or foam

Fires involving o-chlorostyrene should be fought upwind from the maximum distance possible. Isolate the hazard area and deny access to unnecessary personnel. Firefighters should wear a full set of protective clothing and self-contained breathing apparatus when fighting fires involving o-chlorostyrene.

EXPOSURE LIMITS

• OSHA PEL

The Occupational Safety and Health Administration (OSHA) has not promulgated a permissible exposure limit (PEL) for o-chlorostyrene [29 CFR 1910.1000, Table Z-1].

• NIOSH REL

The National Institute for Occupational Safety and Health (NIOSH) has established a recommended exposure limit (REL) of 50 ppm (285 mg/m³) as a TWA for up to a 10-hr workday and a 40-hr workweek and 75 ppm (430 mg/m³) as a STEL [NIOSH 1992].

• ACGIH TLV

The American Conference of Governmental Industrial Hygienists (ACGIH) has assigned o-chlorostyrene a threshold limit value (TLV) of 50 ppm (283 mg/m³) as a TWA for a normal 8-hr workday and a 40-hr workweek and a STEL of 75 ppm (425 mg/m³) for periods not to exceed 15 min [ACGIH 1993].

• Rationale for limits

The ACGIH limits are based on the risk of liver, kidney, and narcotic effects associated with exposure to o-chlorostyrene.

HEALTH HAZARD INFORMATION

• Routes of exposure

Exposure to o-chlorostyrene can occur through inhalation, ingestion, and eye or skin contact.

• Summary of toxicology

1. *Effects on Animals:* In animals, o-chlorostyrene is toxic to the liver and kidneys. Applied to rabbit skin for 24 hr, 10 mg of o-chlorostyrene caused irritation [Sax and Lewis 1989]. The dermal LD₅₀ in rabbits is 20 g/kg [Sax and Lewis 1989]. The instillation of 500 mg into the eyes of rabbits also caused irritation [Sax and Lewis 1989]. The oral LD₅₀ in rats is 5.2 g/kg [Sax and Lewis 1989]. A group of 24 rats, 3 rabbits, 12 guinea pigs, and 1 dog of each sex were exposed 7 hr/day, 5 days/week for a total of 130 exposures in 180 days to an analytically determined average o-chlorostyrene concentration of 101 ppm (576 mg/m³). No adverse effects on appearance, growth, demeanor, mortality, hematology, or blood chemistry values were apparent; at autopsy, no changes in organ weights or gross pathology were evident. However, microscopic examination of the liver and kidney tissues of animals of all four species showed a slightly higher incidence than in controls of changes in these organs [ACGIH 1991].

2. *Effects on Humans:* No toxic effects of o-chlorostyrene exposure have been reported in humans.

• Signs and symptoms of exposure

1. *Acute exposure:* Based on effects seen in animals, contact of the skin or eyes with o-chlorostyrene may cause irritation.

2. *Chronic exposure:* Based on effects seen in animals, long-term exposure to o-chlorostyrene may cause hematuria, proteinuria, acidosis, an enlarged liver, jaundice, and elevated liver enzymes.

• Emergency procedures

WARNING!

Seek immediate medical attention for severely affected victims or for victims with signs and symptoms of toxicity or irritation!

Keep unconscious victims warm and on their sides to avoid choking if vomiting occurs. Initiate the following emergency procedures:

1. *Eye exposure:* Irritation may result from exposure to concentrated solutions, vapors, mists, or aerosols of o-chlorostyrene. *Immediately and thoroughly* flush the eyes with large amounts of water, occasionally lifting the upper and lower eyelids.
2. *Skin exposure:* Irritation may result. *Immediately* remove contaminated clothing and *thoroughly* wash contaminated skin with soap and water.
3. *Inhalation exposure:* Move the victim to fresh air *immediately*.

If the victim is not breathing, clean any chemical contamination from the victim's lips and perform cardiopulmonary resuscitation (CPR); if breathing is difficult, give oxygen.

4. *Ingestion exposure:* Take the following steps if o-chlorostyrene or any material containing it is ingested:

—Have the victim rinse the contaminated mouth cavity several times with a fluid such as water.

—Have the victim drink a glass (8 oz) of fluid such as water.

—Induce vomiting by giving syrup of ipecac as directed on the package. If ipecac is unavailable, have the victim touch the back of the throat with a finger until productive vomiting ceases.

—Do *not* force an unconscious or convulsing person to drink fluid or to vomit.

5. *Rescue:* Remove an incapacitated worker from further exposure and implement appropriate emergency procedures (e.g., those listed on the material safety

data sheet required by OSHA's hazard communication standard [29 CFR 1910.1200]). All workers should be familiar with emergency procedures and the location and proper use of emergency equipment.

EXPOSURE SOURCES AND CONTROL METHODS

The following operations may involve o-chlorostyrene and may result in worker exposures to this substance:

—Use in organic synthesis and in the preparation of specialty polymers

The following methods are effective in controlling worker exposures to o-chlorostyrene, depending on the feasibility of implementation:

—Process enclosure

—Local exhaust ventilation

—General dilution ventilation

—Personal protective equipment

Good sources of information about control methods are as follows:

1. ACGIH [1992]. Industrial ventilation—a manual of recommended practice. 21st ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
2. Burton DJ [1986]. Industrial ventilation—a self study companion. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.
3. Alden JL, Kane JM [1982]. Design of industrial ventilation systems. New York, NY: Industrial Press, Inc.
4. Wadden RA, Scheff PA [1987]. Engineering design for control of workplace hazards. New York, NY: McGraw-Hill.
5. Plog BA [1988]. Fundamentals of industrial hygiene. Chicago, IL: National Safety Council.

MEDICAL MONITORING

Workers who may be exposed to chemical hazards should be monitored in a systematic program of medical surveil-

lance that is intended to prevent occupational injury and disease. The program should include education of employers and workers about work-related hazards, early detection of adverse health effects, and referral of workers for diagnosis and treatment. The occurrence of disease or other work-related adverse health effects should prompt immediate evaluation of primary preventive measures (e.g., industrial hygiene monitoring, engineering controls, and personal protective equipment). A medical monitoring program is intended to supplement, not replace, such measures. To place workers effectively and to detect and control work-related health effects, medical evaluations should be performed (1) before job placement, (2) periodically during the term of employment, and (3) at the time of job transfer or termination.

- **Preplacement medical evaluation**

Before a worker is placed in a job with a potential for exposure to o-chlorostyrene, a licensed health care professional should evaluate and document the worker's baseline health status with thorough medical, environmental, and occupational histories, a physical examination, and physiologic and laboratory tests appropriate for the anticipated occupational risks. These should concentrate on the function and integrity of the liver and kidneys.

A preplacement medical evaluation is recommended to detect and assess medical conditions that may be aggravated or may result in increased risk when a worker is exposed to o-chlorostyrene at or below the prescribed exposure limit. The licensed health care professional should consider the probable frequency, intensity, and duration of exposure as well as the nature and degree of any applicable medical condition. Such conditions (which should not be regarded as absolute contraindications to job placement) include a history and other findings consistent with diseases of the liver or kidneys.

- **Periodic medical examinations and biological monitoring**

Occupational health interviews and physical examinations should be performed at regular intervals during the employment period, as mandated by any applicable Federal, State, or local standard. Where no standard exists and the hazard is minimal, evaluations should be conducted every 3 to 5 years or as frequently as recommended by an experienced occupational health physician. Additional examinations may be necessary if a worker develops symptoms attributable to o-chlorostyrene exposure. The interviews, examinations, and medical

screening tests should focus on identifying the adverse effects of o-chlorostyrene on the liver or kidneys. Current health status should be compared with the baseline health status of the individual worker or with expected values for a suitable reference population.

Biological monitoring involves sampling and analyzing body tissues or fluids to provide an index of exposure to a toxic substance or metabolite. No biological monitoring test acceptable for routine use has yet been developed for o-chlorostyrene.

- **Medical examinations recommended at the time of job transfer or termination**

The medical, environmental, and occupational history interviews, the physical examination, and selected physiologic or laboratory tests that were conducted at the time of placement should be repeated at the time of job transfer or termination. Any changes in the worker's health status should be compared with those expected for a suitable reference population.

WORKPLACE MONITORING AND MEASUREMENT

A worker's exposure to airborne o-chlorostyrene is determined by using a charcoal tube (100/50-mg sections, 20/40 mesh). STEL and TWA samples are both collected at a maximum flow rate of 0.2 liter/min until a maximum air volume of 20 liters (TWA) or 3 liters (STEL) is collected. The sample is then treated with carbon disulfide to extract the o-chlorostyrene. Analysis is conducted by gas chromatography using a flame ionization detector. This method is included in the OSHA Laboratory In-House Methods File [OSHA 1989].

PERSONAL HYGIENE

If o-chlorostyrene contacts the skin, workers should immediately wash the affected areas with soap and water.

Clothing contaminated with o-chlorostyrene should be removed immediately, and provisions should be made for safely removing this chemical from these articles. Persons laundering the clothes should be informed of the hazardous properties of o-chlorostyrene.

A worker who handles o-chlorostyrene should thoroughly wash hands, forearms, and face with soap and water before eating, using tobacco products, or using toilet facilities.

Workers should not eat, drink, or use tobacco products in areas where o-chlorostyrene or a solution containing o-chlorostyrene is handled, processed, or stored.

STORAGE

o-Chlorostyrene should be stored in a cool, dry, well-ventilated area in tightly sealed containers that are labeled in accordance with OSHA's hazard communication standard [29 CFR 1910.1200]. Containers of o-chlorostyrene should be protected from physical damage and should be stored separately from heat, sparks, and open flame. Because containers that formerly contained o-chlorostyrene may still hold product residues, they should be handled appropriately.

SPILLS AND LEAKS

In the event of a spill or leak involving o-chlorostyrene, persons not wearing protective equipment and clothing should be restricted from contaminated areas until cleanup is complete. The following steps should be undertaken following a spill or leak:

1. Do not touch the spilled material; stop the leak if it is possible to do so without risk.
2. Notify safety personnel.
3. Remove all sources of heat and ignition.
4. Ventilate the area of the spill or leak.
5. For small liquid spills, absorb with sand or other non-combustible absorbent material and place into closed containers for later disposal.
6. For large liquid spills, call the local fire department.

SPECIAL REQUIREMENTS

U.S. Environmental Protection Agency (EPA) requirements for emergency planning, reportable quantities of hazardous releases, community right-to-know, and hazardous waste management may change over time. Users are therefore advised to determine periodically whether new information is available.

• Emergency planning requirements

o-Chlorostyrene is not subject to EPA emergency planning requirements under the Superfund Amendments and Reauthorization Act (SARA) [42 USC 11022].

• Reportable quantity requirements for hazardous releases

Employers are not required by the emergency release notification provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) [40 CFR 355.40] to notify the National Response Center of an accidental release of o-chlorostyrene; there is no reportable quantity for this substance.

• Community right-to-know requirements

Employers are not required by Section 313 of SARA to submit a Toxic Chemical Release Inventory Form (Form R) to EPA reporting the amount of o-chlorostyrene emitted or released from their facility annually.

• Hazardous waste management requirements

EPA considers a waste to be hazardous if it exhibits any of the following characteristics: ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR 261.21-261.24. Although o-chlorostyrene is not specifically listed as a hazardous waste under the Resource Conservation and Recovery Act (RCRA) [42 USC 6901 et seq.], EPA requires employers to treat waste as hazardous if it exhibits any of the characteristics discussed above.

Providing detailed information about the removal and disposal of specific chemicals is beyond the scope of this guideline. The U.S. Department of Transportation, EPA, and State and local regulations should be followed to ensure that removal, transport, and disposal of this substance are conducted in accordance with existing regulations. To be certain that chemical waste disposal meets EPA regulatory requirements, employers should address any questions to the RCRA hotline at (800) 424-9346 or at (202) 382-3000 in Washington, D.C. In addition, relevant State and local authorities should be contacted for information about their requirements for waste removal and disposal.

RESPIRATORY PROTECTION

• Conditions for respirator use

Good industrial hygiene practice requires that engineering controls be used where feasible to reduce workplace concentrations of hazardous materials to the prescribed exposure limit. However, some situations may require the use of respirators to control exposure. Respirators must be worn if the ambient concentration of

o-chlorostyrene exceeds prescribed exposure limits. Respirators may be used (1) before engineering controls have been installed, (2) during work operations such as maintenance or repair activities that involve unknown exposures, (3) during operations that require entry into tanks or closed vessels, and (4) during emergencies. Workers should use only respirators that have been approved by NIOSH and the Mine Safety and Health Administration (MSHA).

- **Respiratory protection program**

Employers should institute a complete respiratory protection program that, at a minimum, complies with the requirements of OSHA's respiratory protection standard [29 CFR 1910.134]. Such a program must include respirator selection, an evaluation of the worker's ability to perform the work while wearing a respirator, the regular training of personnel, respirator fit testing, periodic workplace monitoring, and regular respirator maintenance, inspection, and cleaning. The implementation of an adequate respiratory protection program (including selection of the correct respirator) requires that a knowledgeable person be in charge of the program and that the program be evaluated regularly. For additional information on the selection and use of respirators and on the medical screening of respirator users, consult the *NIOSH Respirator Decision Logic* [NIOSH 1987b] and the *NIOSH Guide to Industrial Respiratory Protection* [NIOSH 1987a].

PERSONAL PROTECTIVE EQUIPMENT

Protective gloves and clothing should be worn to prevent any skin contact with o-chlorostyrene. Chemical protective clothing should be selected on the basis of available performance data, manufacturers' recommendations, and evaluation of the clothing under actual conditions of use. No reports have been published on the resistance of various protective clothing materials to o-chlorostyrene permeation. If permeability data are not readily available, protective clothing manufacturers should be requested to provide information on the best chemical protective clothing for workers to wear when they are exposed to o-chlorostyrene.

If o-chlorostyrene is dissolved in an organic solvent, the permeation properties of both the solvent and the mixture must be considered when selecting personal protective equipment and clothing.

Safety glasses, goggles, or face shields should be worn during operations in which o-chlorostyrene might contact

the eyes (e.g., through splashes of solution). Eyewash fountains and emergency showers should be available within the immediate work area whenever the potential exists for eye or skin contact with o-chlorostyrene. Contact lenses should not be worn if the potential exists for o-chlorostyrene exposure.

REFERENCES CITED

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