

Chloroform Standard**I. RECOMMENDATIONS FOR A CHLOROFORM STANDARD**

The National Institute for Occupational Safety and Health (NIOSH) recommends that worker exposure to chloroform in the workplace be controlled by adherence to the following sections. The standard is designed to protect the health and provide for the safety of workers for up to a 10-hour workday, 40-hour workweek over a working lifetime. Compliance with all sections of the standard should prevent the adverse effects reported from exposure to chloroform in the workplace and materially reduce the risk of cancer from occupational exposure to chloroform. The standard is measurable by techniques that are valid, reproducible, and available. Sufficient technology exists to permit compliance with the recommended standard. The standard will be subject to further review and revision as necessary. "Occupational exposure to chloroform" is defined as exposure to chloroform in any establishment where chloroform is used, manufactured, or stored. Exposure to chloroform under any of the above conditions will require adherence to all of the following sections.

Section 1 — Environmental (Workplace Air)

Chloroform shall be controlled in the workplace so that the concentration of chloroform is not greater than 2 ppm (9.78mg/m³) of breathing zone air in a 45 liter air sample taken over a period not to exceed 1 hour in duration.

Procedures for sampling and analysis of chloroform in air shall be as provided in Appendices I and II, or by any method shown to

be equivalent in precision, accuracy, and sensitivity to the methods specified.

Section 2 — Medical

(a) Comprehensive preplacement and annual medical examinations shall be made available to all workers exposed to chloroform unless a different frequency is indicated by professional medical judgment based on such factors as emergencies, variations in work periods, and preexisting health status of individual workers.

(b) These examinations shall include, but shall not be limited to:

(1) A comprehensive and interim medical and work history giving special attention to gastrointestinal symptoms, mental status, and use of alcohol and barbiturates.

(2) A comprehensive medical examination, giving particular attention to cardiac rhythm, liver and kidney function. Liver function tests and urinalysis shall be performed.

(3) An evaluation of the worker's physical ability to safely wear a respirator.

(c) Employees shall be counseled regarding the increased hazards of working with chloroform resulting from use of alcohol.

(d) Medical records shall be maintained for all persons employed in work involving occupational exposure to chloroform for at least 30 years after the individual's employment is terminated. The medical representatives of the Secretary of Health, Education, and Welfare, of the Secretary of Labor, of the employer, and



U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
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of the employee or former employee shall have access to these records.

(e) Initial examinations for presently employed workers shall be offered within 6 months of the promulgation of a standard incorporating these recommendations.

Section 3 — Labeling (Posting)

(a) All shipping and storage containers of chloroform shall bear the following label in addition to, or in combination with, labels required by other statutes, regulations, or ordinances.

CHLOROFORM
DANGER! EXTREME HEALTH HAZARD
MAY CAUSE CANCER
MAY BE ABSORBED THROUGH SKIN
Avoid breathing of vapor.
Keep containers closed when not in use.
Use only with adequate ventilation.
Avoid skin or eye contact.
May generate toxic phosgene gas on contact
with flame or hot metal surface.

(b) In areas where there is occupational exposure to chloroform, the following warning sign shall be posted in readily visible locations, particularly at the entrances to the area.

DANGER! EXTREME HEALTH HAZARD
CANCER-SUSPECT AGENT
USED IN THIS AREA
UNAUTHORIZED PERSONS KEEP OUT

The sign shall be printed both in English and in the predominant language of non-English-speaking workers, if any, unless employers use other equally effective means to ensure that these workers know the hazards associated with chloroform and the locations of areas in which there is occupational exposure to chloroform. Employers shall ensure that illiterate workers also know these hazards and the locations of these areas.

Section 4 — Personal Protective Equipment and Protective Clothing

(a) Protective Clothing

(1) Coveralls or other full-body protective clothing shall be worn in areas where there

is occupational exposure to chloroform. Protective clothing shall be changed at least daily at the end of the shift and more frequently if it should become grossly contaminated.

(2) Impervious gloves, aprons, and footwear shall be worn at operations where chloroform may contact the skin.

(3) Eye protective devices shall be provided by the employer and used by the employees where contact of chloroform with eyes is likely. Selection, use, and maintenance of eye protective equipment shall be in accordance with the provisions of the American National Standard Practice for Occupational and Educational Eye and Face Protection, ANSI Z87.1-1968. Unless eye protection is afforded by a respirator hood or facepiece, protective goggles or a face shield shall be worn at operations where there is danger of contact of the eyes with wet materials containing chloroform because of spills, splashes, or excessive vapors in the air.

(4) The employer shall ensure that all personal protective devices are inspected regularly and maintained in clean and satisfactory working condition.

(5) Work clothing may not be taken home by employees. The employer shall provide for maintenance and laundering of protective clothing.

(6) The employer shall ensure that precautions necessary to protect laundry personnel are taken while soiled protective clothing is being laundered.

(7) The employer shall ensure that chloroform is not discharged into municipal waste treatment systems or the community air.

(b) Respiratory Protection from Chloroform
Engineering controls shall be used wherever feasible to maintain chloroform concentrations at or below that recommended in Section 1 above. Compliance with the environmental exposure limit by the use of respirators is allowed only when chloroform concentrations are in excess of the workplace environmental limit because required engineering controls are being installed or tested, when nonroutine maintenance or repair is being accomplished, or during emergencies. When a respirator is thus permitted, it shall be se-

lected and used in accordance with the following requirements:

(1) For the purpose of determining if it is necessary for workers to wear respirators, the employer shall measure the concentration of chloroform in the workplace initially and thereafter whenever process, worksite, climate, or control changes occur which are likely to increase the concentration of chloroform.

(2) The employer shall ensure that no worker is exposed to chloroform above the workplace environmental limit because of improper respirator selection, fit, use, or maintenance.

(3) A respiratory protection program meeting the requirements of 29 CFR 1910.134 and 30 CFR 11 which incorporates the American National Standard Practices for Respiratory Protection Z88.2-1969 shall be established and enforced by the employer.

(4) The employer shall provide respirators in accordance with Table I-1 and shall ensure that the employee uses the respirator provided anytime the concentration of chloroform exceeds the level described in section 1.

(5) Respirators described in Table I-1 shall be those approved under the provisions of 29 CFR 1910.134 and 30 CFR 11.

(6) The employer shall ensure that respirators are adequately cleaned, and that employees are instructed on the use of respirators assigned to them, their location in the workplace, and on how to test for leakage.

(7) Where an emergency may develop which could result in employee injury from chloroform, the employer shall provide an escape device as listed in Table I-1.

TABLE I-1
RESPIRATOR SELECTION GUIDE
FOR PROTECTION AGAINST
CHLOROFORM

Self-contained breathing apparatus with positive pressure in full facepiece, or Combination supplied-air respirator, pressure-demand type, with auxiliary self-contained air supply

Section 5 — Informing Employees of Hazards from Chloroform

At the beginning of employment or assignment for work in a chloroform area, employees with occupational exposure to chloroform shall be informed of the hazards, relevant signs and symptoms of overexposure, appropriate emergency procedures, and proper conditions and precautions for the safe use of chloroform.

Instruction shall include, as a minimum, all information in Appendix III which is applicable to the specific chloroform product or material to which there is exposure, as well as information which indicates that chloroform causes cancer in experimental animals. This information shall be posted in the work area and kept on file, readily accessible to the worker at all places of employment where chloroform is involved in unit processes and operations.

A continuing educational program shall be instituted to ensure that all workers have current knowledge of job hazards, proper maintenance procedures, and cleanup methods, and that they know how to use respiratory protective equipment and protective clothing correctly.

Information as specified in Appendix III shall be recorded on the Material Safety Data Sheet or a similar form approved by the Occupational Safety and Health Administration, US Department of Labor.

Section 6 — Work Practices

(a) Control of Airborne Contamination

Emission of vapors of chloroform shall be controlled at the sources of dispersion by means of effective and properly maintained methods such as fully enclosed operations and local exhaust ventilation, under negative pressure if possible. No recirculation of ventilation control ventilation or process air shall be permitted. Other methods may be used if they are shown to effectively control airborne concentrations of chloroform within the limit of the recommended standard.

(b) Control of Contact with Skin and Eyes

(1) Employees working in areas where contact of skin or eyes with chloroform is possible shall wear full-body protective clothing, including neck and head coverings, and gloves, in accord with Section 4(a).

(2) Clean protective clothing shall be put on before each work shift.

(3) If, during the shift, the clothing becomes wetted with chloroform, it shall be removed promptly and placed in a special container for garments for decontamination or disposal. The employee shall wash the contaminated skin area thoroughly with soap and a copious amount of water. A complete shower is preferred after anything but limited, minor contact. Then, clean protective clothing shall be put on before resuming work.

(4) Small areas of skin (principally the hands) contaminated by contact with chloroform shall be washed immediately and thoroughly with an abundance of water. Water shall be easily accessible in the work areas as low-pressure, free-running hose lines or showers.

(5) If chloroform comes into contact with the eyes, the eyes should be flushed with a large volume of low-pressure flowing water for at least 15 minutes. Medical attention shall be obtained without delay, but not at the expense of immediate and thorough flushing of the eyes.

(c) Procedures for emergencies, including firefighting, shall be established to meet foreseeable events. Necessary emergency equipment, including appropriate respiratory protective devices, shall be kept in readily accessible locations. Only self-contained breathing apparatus with positive pressure in the facepiece shall be used in firefighting. Appropriate respirators shall be available for use during evacuation.

(d) Special supervision and care shall be exercised to ensure that the exposures of repair and maintenance personnel to chloroform are within the limit prescribed by this standard.

(e) Prompt cleaning of spills of chloroform: Spills shall be channeled for appropriate treatment or collection for disposal. They may not be channeled directly into the municipal sanitary sewer system.

(f) General requirements:

(1) Good housekeeping practices shall be observed to prevent or minimize contamination of areas and equipment and to prevent build-up of such contamination.

(2) Good personal hygiene practices shall be encouraged.

(3) Equipment shall be kept in good repair and free of leaks.

(4) Containers of chloroform shall be kept covered insofar as is practical.

(g) A regulated area shall be established and maintained where:

(1) Carbon tetrachloride is manufactured, reacted, mixed with other substances, repackaged, stored, handled, or used.

(2) Concentrations of chloroform are in excess of the workplace environmental limit in Section 1.

(h) Access to the regulated areas designated by Section 6(h) shall be limited to authorized persons. A daily roster shall be made of persons authorized to enter; these rosters shall be maintained for 30 years.

(j) Employers shall ensure that before employees leave a regulated area they remove and leave protective clothing at the point of exit.

Section 7 — Sanitation

(a) Washing Facilities

Emergency showers and eye-flushing fountains with cool water under adequate pressure shall be provided and be readily accessible in areas where contact of skin or eyes with chloroform may occur. This equipment shall be frequently inspected and maintained in good working condition.

Showers and washbasins shall be provided in the employees' locker areas. Employers shall ensure that employees exposed or potentially exposed to chloroform during their work shift shall wash before eating or smoking periods taken during the work shift.

(b) Food Facilities

Food storage, preparation, and eating shall be prohibited in areas where chloroform is handled, processed, or stored. Eating facilities provided for employees shall be located in areas ventilated in such a manner to ensure that contamination from chloroform is prevented. Surfaces in these areas shall be kept free of chloroform. Employers shall ensure that before employees enter premises reserved

for eating, food storage, or food preparation, they remove protective clothing. Washing facilities should be accessible nearby.

(c) Employees may not smoke in areas where chloroform is handled, processed, or stored.

(d) Clothing and Locker Room Facilities

Locker room facilities for employees required to change clothing before and after work shall be provided in an area separate and ventilated in such a manner to ensure that contamination from chloroform is non-existent. The facilities shall provide for the storing of street clothing and clean work clothing separately from soiled work clothing. Showers and washbasins should be located in the locker area to encourage good personal hygiene.

Covered containers should be provided for work clothing discarded at the end of the shift or after a contamination incident. The clothing shall be held in these containers until removed for decontamination or disposal.

Section 8 — Monitoring and Recordkeeping Requirements

In any workplace where chloroform is handled or processed, surveys shall be repeated semi-annually. Requirements set forth below apply to areas in which there is occupational exposure to chloroform.

Employers shall maintain records of workplace environmental exposures to chloroform based on the following samples, analytical, and recording schedules.

(a) In all monitoring, samples representative of the exposure in the breathing zone of

employees shall be collected by personal samplers.

(b) An adequate number of samples shall be taken in order to determine the occupational exposure of each employee.

(c) The first determination of the exposure of employees to chloroform shall be completed within 6 months after the promulgation of a standard incorporating these recommendations.

(d) A reevaluation of the exposure of employees to chloroform shall be made within 30 days after installation of a new process or process change.

(e) A reevaluation of employee exposure to chloroform shall be repeated at 1-week intervals when the airborne concentration has been found to exceed the recommended workplace environmental limit. In such cases, suitable controls shall be instituted and monitoring shall continue at 1-week intervals until 3 consecutive surveys indicate the adequacy of controls.

(f) Records of all sampling and analysis of chloroform and of medical examinations shall be maintained for at least 30 years after the individual's employment is terminated. Records shall indicate the details of (1) type of personal protective devices, if any, in use at the time of sampling, and (2) methods of sampling and analysis used. Each employee shall be able to obtain information on his own exposure. If the employer who has or has had employees with occupational exposure to chloroform ceases business without a successor, he shall forward their records by registered mail to the Director, National Institute for Occupational Safety and Health.

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