



A Guide to Formaldehyde



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This guide is intended to be consistent with all existing OSHA standards; therefore, if an area is considered by the reader to be inconsistent with a standard, then the OSHA standard must be followed instead of this guide.

To obtain additional copies of this guide, or if you have questions about North Carolina occupational safety and health standards or rules, please contact:

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Additional sources of information are listed on the inside back cover of this guide.

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Foreword

Formaldehyde in its simplest form is a colorless gas that is readily soluble in water. It has an acrid odor that can irritate the eyes and nose. Formaldehyde is commercially available as a solution called formalin, formed from various proportions of formaldehyde, water, and alcohol. Textile and wood product industries are large users of organic dyes and urea resins that contain formaldehyde. Formaldehyde is also used for disinfecting, embalming and producing some synthetic plastics.

Employers must be aware of workplace hazards facing their employees and take appropriate action to minimize or eliminate exposure to these hazards. *A Guide to Formaldehyde* describes how employers and employees can learn to protect their health in environments that contain formaldehyde.

In North Carolina, the N.C. Department of Labor enforces the federal Occupational Safety and Health Act through a state plan approved by the U.S. Department of Labor. NCDOL offers many educational programs to the public and produces publications to help inform people about their rights and responsibilities regarding occupational safety and health.

When reading this guide, please remember the mission of the N.C. Department of Labor is greater than just regulatory enforcement. An equally important goal is to help citizens find ways to create safe workplaces. Everyone profits when managers and employees work together for safety. This booklet, like the other educational materials produced by the N.C. Department of Labor, can help.

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Formaldehyde in the Workplace

What Is Formaldehyde?

Formaldehyde has the chemical elements carbon, hydrogen and oxygen in its structure. Hydrocarbons are among the most common of chemical compositions. The human body includes hydrocarbons among its elements and compounds, and it requires formaldehyde to metabolize biochemical substances.

Formaldehyde has a pungent odor and is very soluble in water. Formaldehyde is highly reactive and readily combines with many chemical compounds, and under normal conditions, it is a gas. In its simplest form, formaldehyde is a colorless gas. But the term formaldehyde is sometimes used to describe liquids composed of various mixtures of formaldehyde, water, and alcohol.

Formaldehyde is usually sold as an aqueous or watery solution called *formalin*, which contains 37 to 50 percent formaldehyde by weight. It is soluble in water, but not in most organic solvents, except alcohol and ether. It is principally used to produce resins, other industrial chemicals, and consumer items and as a bactericide or fungicide.

A mixture of polymers of formaldehyde (many molecules of formaldehyde linked together) is known as paraformaldehyde. Paraformaldehyde is a white powder containing 91 percent or more formaldehyde.

Sources of Formaldehyde

Formaldehyde is part of our general outdoor environment. It is released into the atmosphere through fumes from automobile and truck exhausts and by manufacturing facilities that burn fossil fuels. Uncontrolled forest fires and the open burning of waste give off formaldehyde. Because of formaldehyde's high water solubility, it is contained in rain water, oceans and surface waters.

Geographic location, wind conditions, cloud cover, rain or standing water, air temperature, and the season of the year are all important variants in the amount of formaldehyde in the ambient air.

Formaldehyde is also in our indoor work environment. A formaldehyde resin is used in the production of plywood and particle board. These wood products become part of the structure of various workplaces. For example, offices converted from mobile homes make use of large quantities of plywood. Paint used to cover walls contains formaldehyde. In the past, a foam made from a resin known as urea-formaldehyde was used as a thermal insulation in the outside walls of buildings. If the foam were formulated or mixed improperly, formaldehyde could be released into the building.

The paper products industry uses urea-formaldehyde resins. Paper products treated with formaldehyde include paper bags, waxed paper, paper towels and disposable sanitary products. All of these products are used in the work environment. The wood industry uses urea-formaldehyde resin as a binder in plywood and particleboard.

The textile industry uses formaldehyde resins to finish apparel fabrics. Formaldehyde also finds its way into the workplace through other textile products. Floor covering and carpet backing may contain formaldehyde polymers. The textile industry uses formaldehyde for fire retardation, increased water repellency, stiffness and wrinkle-resistance in fabric. Draperies, wallpaper, carpet and upholstered furniture contain formaldehyde.

Formaldehyde surrounds us generally in the workplace, just as it does in the home and elsewhere. However, employees may be additionally exposed from formaldehyde used in their work products.

Formaldehyde can lead to widespread exposure in downstream industries. When formaldehyde is present in disinfectants, preservatives and embalming fluid, worker exposure can occur. Formaldehyde is found in release agents in foundries. Laboratories in schools, hospitals, dental facilities and veterinary settings may make use of formaldehyde. Hospitals use it as a disinfectant and deodorizer. See Table 1 for a partial list of occupations that may involve exposure to formaldehyde. Also see Table 2.

Table 1

Occupations That May Involve Exposure to Formaldehyde

Agriculture workers	Insulators
Botanists	Laboratory researchers/workers
Carpet manufacturers/installers	Lacquer producers and users
Disinfectant producers/users	Medical professionals
Dressmakers	Oil field workers
Drug makers	Paint and varnish manufacturers
Dye manufacturers	Paper manufacturers
Embalming fluid producers	Plastics manufacturers
Fabric store personnel	Plywood and particle board manufacturers
Fertilizer manufacturers and blenders	Poultry processors
Formaldehyde producers	Rubber workers
Formaldehyde resin producers	Sanitation workers
Foundry workers	Science instructors/teachers
Furniture makers and finishers	Taxidermists
Glue and adhesive makers	Textile workers: finishers, printers, cutters
Hazardous waste handlers	Veterinarians
Ink makers	Wood preservers

How Can Formaldehyde Affect Our Health?

Based on the best available evidence in OSHA's record on formaldehyde, OSHA determined that formaldehyde is genotoxic, showing properties of both a cancer initiator and promoter (early and late stage carcinogen). When inhaled, formaldehyde is a carcinogen in rats. In humans, formaldehyde exposure has been associated with cancers of the lung, nasopharynx and oropharynx, and nasal passages.

When humans are exposed to excess levels of formaldehyde, adverse health effects can result. Symptoms of excess exposure include respiratory irritation; watery, itchy eyes; itchy, runny, or stuffy nose; dry or sore throat; and headache. The EPA and OSHA recognize that contact with formaldehyde can cause skin irritation and dermatitis.

Normally, reactions to formaldehyde end within days or a few weeks of the cessation of exposure. Most people become acclimated to formaldehyde and come to experience its effects more mildly. But some people, especially those with allergic asthma, allergic hay fever, or infantile or childhood eczema, become sensitized and suffer a condition known as allergic contact dermatitis. Those with allergic contact dermatitis suffer itching, redness, swelling, multiple small blisters and scaling whenever subsequent exposure occurs. Sensitized individuals are usually unable to remain in formaldehyde-related jobs.

How Formaldehyde Enters the Body

There are four routes of exposure to a substance: ingestion, inhalation, skin absorption and eye contact. Since people may adapt to formaldehyde, dependency upon the perception of formaldehyde by odor and eye irritation can lead to over-exposure if the worker is relying on those cues as a warning against exposure.

Ingestion

Ingestion (eating or drinking) is not considered a common route of significant exposure to formaldehyde. Nevertheless, there have been reported cases of accidental formaldehyde ingestion. Swallowing liquids containing 10 to 40 percent formaldehyde results in severe irritation of the mouth, throat and stomach. Severe stomach pains will follow ingestion with possible loss of consciousness and death.

Inhalation

Inhaling formaldehyde can cause symptoms ranging from mild irritation to severe difficulty in breathing. The response depends on the concentration of the formaldehyde. For example, concentrations of 10 to 20 parts per million (ppm) cause difficulty in breathing, burning of the nose and throat, cough, and heavy tearing. The response also depends on the length of exposure and individual sensitivity. Additionally, one can become exposed by inhalation through off-gassing from formaldehyde-containing materials (downstream exposure).

Because formaldehyde is so soluble, inhaling or breathing it causes irritation of the eyes and nose. The eyes will tear and the mucus in the nose will run. Other reactions include headache, sinus fullness, sore throat and hoarseness. Higher concentrations of formaldehyde or long-term exposure can cause severe coughing, chest tightness, and swelling or spasms in the throat (glottis).

Some studies have linked formaldehyde exposure to allergic asthma. Formaldehyde resins have been linked to respiratory disease in some workers, with symptoms including both an immediate and a delayed asthmatic reaction.

Hypersensitivity pneumonitis (a flulike illness with fever, chills, cough and shortness of breath) has occasionally been associated with worker exposure to phenoformaldehyde Bakelite resins. Exposure to formaldehyde in concentrations of 100 ppm is considered immediately dangerous to life and health.

Skin Absorption

Skin absorption is one of the major routes of exposure to formaldehyde. Skin contact with formaldehyde can result in reactions ranging from mild irritation to severe allergic dermatitis. Concentrated solutions of formaldehyde will cause the skin to discolor, crack, dry and scale. Prolonged or repeated contact will cause numbness and hardening or tanning of the skin.

A number of factors affect skin absorption of formaldehyde. If there is an existing dermatitis or acne or if the skin is broken or irritated, absorption is increased. High humidity and the area of skin exposed also affect skin absorption of formaldehyde.

Formaldehyde is a chemical that causes a significant number of people to experience skin sensitization. Chemicals that cause sensitization are called allergens. Exposure to these chemicals causes the body to form antibodies. Future exposure to the substance, even in very small amounts, can cause symptoms.

Skin contact occurs in a variety of workplaces, such as veterinary clinics, schools, photography, plumbing, agricultural, pest control and medical settings (including pathology laboratories and morgues). In the fabric industry, material is treated with formaldehyde for use in making sheeting and garments. In garments, formaldehyde makes possible a durable press finish. Employees who work with such products are exposed to formaldehyde and subject to dermatitis. In recent times, technology has decreased the amount of free formaldehyde on fabrics, and the risk of dermatitis has been reduced.

Allergic contact dermatitis is seen among medical personnel who use formaldehyde. Pathologists use formaldehyde as a tissue fixative. Medical professionals may use it in disinfection procedures. Technicians and cleaning personnel in health care facilities are also routinely exposed to formaldehyde.

Other employees at similar risk include hairdressers; automotive industry workers who handle coolants and cutting oils; workers exposed to paint; and printing industry workers who are exposed to ink and who routinely handle journals and newspapers. (See Table 2 for a list of occupations where there exists the potential for dermatitis from formaldehyde exposure.)

Table 2***Jobs and Exposures with Potential for Formaldehyde Dermatitis***

Job	Exposure
Actors and theatrical artists	Makeup
Artists, printers, silk screeners	Inks, paper, preservatives
Bakers	Disinfectants
Beauticians, barbers	Disinfectants, germicides, cosmetics
Butchers and food preparation workers	Cleaners, disinfectants
Biology laboratory instructors	Preservatives
Carpenters, cabinet makers	Adhesives, solvents
Cleaning personnel	Detergents, preservatives
Clinical biologists, histologists	Formalin
Dentists, hygienists, assistants	Disinfectants, medications
Dry cleaners	Spot removers
Electricians and electronics workers	Resins, metal cleaners
Farming industry	Metal cleaners, resins
Foundry workers	Resin emissions from sand molds
Leather and fur workers	Tanning
Machinists	Metal cleaners, cutting fluids
Mechanics	Metal and tire cleaners, sealants
Medical personnel	Disinfectants, medicines
Morticians	Formalin
Painters	Resins
Paper workers	Resin emissions
Pathologists, histologists	Formalin
Pest control workers	Fumigants, cleaning agents
Pharmacists	Medicine, drug preservatives
Photographers	Developers, resin emissions
Plumbers, pipefitters	Metal cleaners, resins
Printers	Ink, paper
Stone workers	Cleaning solutions
Textile workers	Emissions from fabric finishes
Wallpaper hangers	Preservatives, adhesives
Welders	Metal cleaners, resins

Eye Contact

Eye contact results from spills or splashes of formaldehyde. Eye contact reactions range from mild irritation to permanent corneal cloudiness and loss of vision. The severity of injury is determined by the concentration of the solution and the length of contact. Eye irritation is a common complaint of people exposed to formaldehyde vapor. As the concentration of formaldehyde increases, the eyes become itchy and tear till they afford themselves some degree of natural protection by closing.

Responding to Emergencies From Formaldehyde Releases

If your work area has the potential for large formaldehyde releases, either from an accident or equipment failure, then your employer must develop an emergency procedure. Only employees trained per 29 CFR 1910.120, Hazardous Waste and Emergency Response (HAZWOPER), and equipped with appropriate personal protective equipment may attempt to stop formaldehyde leaks. Employees may dike large spills when they have been trained per HAZWOPER to take such actions.

Never attempt to rescue another employee from an area with high formaldehyde concentration unless you have received proper training and are equipped with appropriate personal protective equipment. If you are not trained per the HAZWOPER requirements, evacuate the area and call 911 for an outside hazardous material team.

Employees with hazard communication training can clean up small spills of formaldehyde. The employer must provide the employees with necessary personal protective equipment to minimize exposure.

A Standard Regulating Formaldehyde in the Workplace

Background Information

The federal Occupational Safety and Health Administration (OSHA) first regulated workers' exposure to formaldehyde in 1972, when it imposed a permissible exposure limit (PEL) of three parts of formaldehyde per million parts of air (3 ppm) as an eight-hour time weighted average (TWA). At that time, the standard was based on findings showing that formaldehyde was an eye, skin and respiratory irritant. Later research showed that formaldehyde might also cause cancer in humans. Based on this new research, OSHA issued a new standard (29 CFR 1910.1048) on Dec. 4, 1987.

The 1987 standard set the PEL at 1 ppm. In June 1989, the U.S. Court of Appeals for the District of Columbia ordered OSHA to justify more fully its new PEL and the absence of a medical removal protection (MRP) provision in the new standard. On May 27, 1992, OSHA published amendments to its 1987 standard (57 *Federal Register* 22290) in response to the 1989 court order. The amendments lowered the PEL to 0.75 ppm, required MRP, lifted a stay from the hazard communication provisions, and required annual employee training.

Highlights of the Formaldehyde Standard

The information that follows is intended to offer the reader a quick grasp of the standard. It is general information. It is not a substitute for the standard itself.

The Hazard

The standard intends to protect employees from exposure to formaldehyde. Formaldehyde gas, all mixtures or solutions equal to or greater than 0.1 percent formaldehyde, and materials capable of releasing formaldehyde into the air are considered a health hazard.

The Extent of the Standard's Protection

The standard applies to all occupational exposures to formaldehyde, that is, from formaldehyde gas, its solutions and materials that release formaldehyde.

Limits Beyond Which Employees May Not Be Exposed to Formaldehyde

The employer must ensure that no employee is exposed to an airborne concentration of formaldehyde that exceeds 0.75 parts of formaldehyde per million parts of air (0.75 ppm) as an eight-hour time-weighted average (TWA). This limit is one of two permissible exposure limits (PEL). The standard also provides a short-term exposure limit (STEL). The employer must ensure that no employee is exposed to an airborne concentration of formaldehyde that exceeds two parts formaldehyde per million parts of air (2 ppm) as a 15-minute STEL.

Monitoring of Employee Exposure May Be Required

Ensuring that employees are not excessively exposed to formaldehyde may mean that the employer must monitor employees to measure levels of exposure. If formaldehyde or formaldehyde-releasing agents are in the workplace, the employer is not obligated to monitor if it is able to document through objective data that employees cannot be exposed at or above the STEL, at or above the action level, or under foreseeable conditions of use.

In documenting that employees are not exposed at or above the action level or STEL, the employer should consider all relevant information. Relevant information may include insurance company and trade association data, and information from suppliers. Additionally, exposure data collected from similar operations and previous sampling results from the same employer may be used. If the employer can demonstrate conclusively that no employee is exposed at or above the action level or the STEL through the use of objective data, the employer need not monitor until such time that conditions have changed and the determination is no longer valid.

Determining Which Employees Are Potentially Exposed

If the employer determines that employee exposure at or above the action level or the STEL is possible, the employer must measure employee exposure. The first step in making that determination is to determine all situations where formaldehyde is used in a manner such that it may be released into the workplace atmosphere or contaminate the skin. Tables 1 and 2 may be helpful in determining occupations where formaldehyde exposure occurs.

Monitoring

Initial Monitoring

The employer must monitor each potentially exposed employee or develop a representative sampling strategy for each exposure work group. Appendix B of the standard discusses the relative merits of various sampling strategies and monitoring methods. Initial monitoring must be repeated if there is a change in production, equipment, process, personnel or control measures that may result in new or additional exposure to formaldehyde.

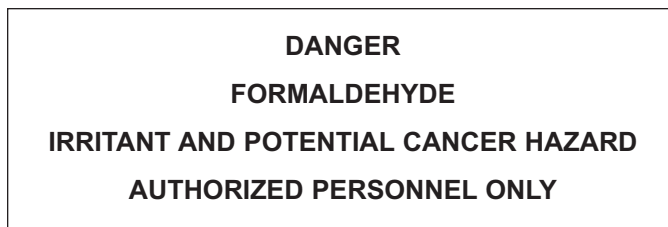
Periodic Monitoring

If monitoring shows employee exposure at or above the action level, monitoring must be repeated every six months. If monitoring shows employee exposure at or above the STEL, monitoring must be repeated every year under the worst conditions. The standard specifies the level of accuracy required of the monitoring process and describes conditions under which monitoring may be terminated. Employees must also be allowed to observe the monitoring process. Additionally, employees must be provided timely written notification of the results of monitoring and a description of the corrective action being taken.

Actions to Take When Monitoring Reveals Excess Exposure

Regulated Areas

If monitoring reveals concentrations of airborne formaldehyde at or in excess of the TWA or STEL, access ways to the area must be posted with signs saying:



Employees must be informed of these areas, and access must be limited to people who have been trained to recognize the dangers of formaldehyde. Additionally, the employer who established the regulated area must inform any other employers on the site of the restricted area locations and access requirements.

Engineering and Work Practice Controls

Engineering and work practice controls must be instituted to reduce exposure levels to or below the TWA or the STEL. If it is established that engineering controls are not feasible to comply, then the controls must be used to the extent feasible and supplemented with respirators.

Respiratory Protection

With regard to respirators, the formaldehyde standard specifies circumstances in which respirators must be used. A respiratory protection program which meets the requirements of 29 CFR 1910.134, Respiratory Protection, must be implemented.

Respirators must be provided at no cost to the employees who are required to wear them. The employer is responsible for ensuring that employees properly use the respirators. Respirators must be properly fit tested. Fit testing procedures can be found in paragraph (f) and in Appendix A of 29 CFR 1910.134. Quantitative or qualitative fit testing, which the employer must perform prior to initial use of the respirator and then annually, must be conducted for employees required to wear respirators with a tight-fitting face piece. Some principal considerations of fit test requirements, however, include the following:

- ◆ The most comfortable respirator must be used.
- ◆ The employee will be shown how to put on the respirator. He or she must have several choices and must wear the respirator for at least five minutes when selecting it.
- ◆ The assessment of comfort and fit must consider:
 - Position of the respirator on the nose and fit across the bridge of the nose
 - Room for eye protection
 - Room to allow talking
 - Proper placement of the chin
- ◆ When a tight-fitting positive or negative pressure respirator is used, the test must not be conducted if there is any hair growth between the skin and the face piece.
- ◆ The employer must certify that a successful fit test has been performed. The date completed; name of employee; and type, brand and size of the respirator will be part of the certification.
- ◆ During fit testing, specific exercises must be performed by the employee, including normal breathing, deep breathing, moving the head from side-to side and up and down, grimacing, and bending over.

Protective Equipment and Clothing

The standard requires compliance with other applicable standards regarding protective equipment and clothing. Such equipment and clothing must be provided at no cost to the employee. The employer is responsible for ensuring that the employees wear and use the clothing and equipment. Guidelines are provided for the selection and maintenance of protective equipment and clothing.

Hygiene Protection

The standard requires compliance with another applicable standard (29 CFR 1910.141) regarding the provision of quick change rooms for changing from work clothing into protective clothing. If there is the possibility that employees' skin and eyes may be splashed with formaldehyde, appropriate quick drench showers and eyewash facilities are required.

Housekeeping and Emergencies

For operations involving formaldehyde liquids or gas, there must be a program to detect leaks and spills. The program must encompass preventive and corrective maintenance and provisions to contain spills, decontaminate work areas and dispose of waste containing formaldehyde. However, employees must be properly trained per the HAZWOPER Standard to respond to spills that may be defined in that standard as an emergency response. The employer must develop appropriate procedures to be implemented in the event of an emergency.

Medical Surveillance

A medical surveillance program must be instituted for: (1) all employees exposed to formaldehyde at concentrations at or above the action level or STEL; (2) employees who develop signs and symptoms of overexposure to formaldehyde; and (3) all employees exposed to formaldehyde in an emergency. The program must be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

The program must make available a medical disease questionnaire. The questionnaire must be administered by a licensed physician or by someone under the physician's supervision. Appendix D of the standard includes an acceptable medical disease questionnaire.

A medical examination must be given to any employee designated by the physician on the basis of the questionnaire, to all employees who are required to wear a respirator—both at the time of initial assignment and annually, and to employees exposed in an emergency.

Under the medical removal provisions, an employee must be transferred to a job where formaldehyde does not exceed the action level if exposure causes significant eye, nose, throat or dermal sensitization. If job transfer is not possible, the employee must be removed from formaldehyde exposure until a physician determines whether the employee can return to work where there is exposure or for six months (whichever comes first). The employee has the right to seek a second medical opinion and resolution of any disagreement through a review by a third physician. During medical removal, the employee's seniority, benefits and earnings may not be reduced unless offset by other employment or public- or employer-funded compensation program.

Hazard Communication

The standard's hazard communication provisions cross-reference requirements in the generic standard at 29 CFR 1910.1200. A written hazard communication program must include labels and other forms of warning, material safety data sheets, and employee information and training. Labels are required for all substances with 0.1 percent or more of formaldehyde and materials capable of releasing formaldehyde in excess of 0.1 ppm. If it is foreseeable that formaldehyde levels may exceed 0.5 ppm, labels must warn that formaldehyde is a Potential Cancer Hazard.

Training and Training Materials

Information and training must be provided in a manner in which the employee can understand, at the time of initial assignment, whenever a new exposure to formaldehyde is introduced into the work area, and at least annually. This guide might be used to inform employees of the contents of the standard. The appendix in this guide might be used to train about MSDSs. Training should also include (among other things):

- ◆ Potential health hazards posed by formaldehyde (see Part 1 of this guide), including symptoms associated with formaldehyde exposure
- ◆ Work operation considerations, including:
 - Importance of engineering controls
 - Safe work practices
 - Use and limitations of personal protective equipment
 - Housekeeping procedures
 - Emergency procedures, including the specific duties or assignments of each employee in the event of an emergency

Employees should be informed of the location of written training materials on formaldehyde. The materials should be made available without cost.

Recordkeeping

Exposure, medical and respirator fit testing records must be maintained. Exposure records must be maintained for 30 years and medical records must be maintained for life of employment plus 30 years. If the employer determines that exposure monitoring is not required, the objective data supporting that determination must be maintained. Exposure and medical records must be made available to the employee (or former employee) and his or her representative per certain requirements of 29 CFR 1910.1020, Access to Employee Exposure and Medical Records. The standard explains any conditions that the employer may require to be met prior to releasing the records.

Appendix

Material Safety Data Sheet

Identification

NAME: Formaldehyde Solutions

CHEMICAL FAMILY: Aldehyde

SYNONYMS: Formalin; Methanal

FORMULA: CH₂O

CAS NAME: Formaldehyde Solutions

Physical Data

BOILING POINT: 760 mmHg 94.3°–100°C (201°–212°F)

MELTING POINT: Polymerizes and separates below 0°–67°C (32°–153°F)

SPECIFIC GRAVITY: 1.08–1.13

VAPOR PRESSURE: 23–26 mmHg at 25°C (77°F); 39 mmHg at 37.8°C (100°F)

VAPOR DENSITY (Air = 1): –1

SOLUBILITY IN WATER: 100%

pH INFORMATION: 2.8–4.0

EVAPORATION RATE (Butyl Acetate = 1): Similar to water: >1

FORM: Liquid

APPEARANCE: Clear (turns milky on cooling)

COLOR: Colorless

ODOR: Pungent

Hazardous Components

APPROXIMATE MATERIAL(S) CAS NO. & PERCENT

Formaldehyde 50-00-0: 22–56

Methanol 67-56-1: 1–15

Hazardous Reactivity

INSTABILITY

No known hazardous instability

INCOMPATIBILITY

Reacts with many compounds. Reaction with phenol, strong acids, or alkalis may be violent. Reaction with hydrochloric acid may form bis-chloromethyl ether, an OSHA-regulated carcinogen.

DECOMPOSITION

Occurs slowly at elevated temperatures, releasing formaldehyde gas.

POLYMERIZATION

Nonhazardous polymerization may occur at low temperatures, forming paraformaldehyde, a white solid.

Fire and Explosion Data

FLASH POINT: 54°–88°C (129°–192°F) METHOD TCC

FLAMMABLE LIMITS IN AIR, PERCENT BY VOLUME:

Lower 7

Upper 73

AUTOIGNITION TEMPERATURE: 424°C (795°F)

FIRE AND EXPLOSION HAZARDS

OSHA Class II or IIIA Combustible Liquid. Follow appropriate National Fire Protection Association (NFPA) codes.

EXTINGUISHING MEDIA

Alcohol foam, dry chemical, carbon dioxide (CO₂), water spray.

SPECIAL FIREFIGHTING INSTRUCTIONS

Cool container with water spray or fog to help absorb escaping fumes. Evacuate affected area. Stay upwind and avoid contact with smoke and fumes. If contact cannot be avoided, wear personal protective equipment including chemical splash goggles and air mask with breathing air supply. Runoff from fire control may cause pollution.

Health Hazard Information

PRINCIPAL HEALTH HAZARDS

Causes eye burns. Harmful if inhaled or absorbed through the skin; causes general tissue damage. Causes skin, nose, throat, and lung irritation. May cause allergic skin reaction. May be fatal or cause blindness if swallowed. Cannot be made non-poisonous.

Formaldehyde:

Inhalation 4-hour LC₅₀: 250 ppm in rats

Skin absorption LD₅₀: 270 mg/kg in rabbits

Oral LD₅₀: 500 mg/kg in rats

Formaldehyde is a mild to moderate skin irritant, is an eye irritant, and can produce permanent eye damage and skin sensitization in animals. Toxic effects described in animals from exposure by inhalation to the vapor or mist include severe irritation to the upper respiratory tract and mucosal surfaces, eye irritation, and nonspecific effects such as weight loss and irritation. Toxic effects observed in animals from exposure by ingestion include severe irritation to mucosal surfaces and decreased body weight. Tests in some animals demonstrate carcinogenic activity. Formaldehyde shows mutagenic activity in bacterial and mammalian cell culture test systems but is generally negative in whole animal systems. Tests for teratogenic activity by several routes have been negative; however, one study indicated slightly decreased fetal weights, but only at high dose levels expected to also cause maternal toxicity. No malformations were observed. The available data are inadequate to assess reproductive effects, although limited studies do not suggest such effects.

Human health effects of overexposure by skin contact with formaldehyde solutions include irritation with discomfort or rash, or allergic skin rash. Eye contact with formaldehyde solutions may cause eye irritation with discomfort, tearing, and blurring of vision; or eye corrosion with corneal or conjunctival ulceration. Effects of overexposure to formaldehyde vapors may include discomfort, such as nausea, headache, or weakness; irritation of the upper respiratory passages; temporary lung irritation effects with cough, discomfort, difficulty breathing, or shortness of breath. On rare occasions, respiratory sensitization (asthma) has been reported in individuals. Gross overexposure by ingestion and, rarely, inhalation has been fatal. A Soviet study of questionable merit on women exposed to urea formaldehyde resin in textile processing noted effects on pregnant workers and their offspring. However, these effects could be explained by other factors and have not been substantiated by other studies. Individuals with preexisting diseases of the lungs, eyes, or skin may have increased susceptibility to the toxicity of excessive exposures.

CARCINOGENICITY

Formaldehyde is listed by the International Agency for Research on Cancer as probably carcinogenic to humans, on the basis of animal evidence and at least limited human data (IARC group 2A); listed by the National Toxicology Program as reasonably anticipated to be carcinogenic; listed by ACGIH as an A2 Industrial Substance Suspect of Carcinogenic Potential for Man; and OSHA, in its formaldehyde standard (29 CFR 1910.1048), considers formaldehyde a potential carcinogen. Formaldehyde (gas) is a chemical known to the state of California to cause cancer.

EXPOSURE LIMITS [PEL (OSHA), TLV (ACGIH)]

Formaldehyde: OSHA 8-hour time-weighted average (TWA) = 0.75 ppm; the OSHA short-term exposure limit (STEL) = 2 ppm, 3 mg/m³ (15-minute TWA, see 29 CFR 1910.1048). The ACGIH the TLV = 0.3 ppm ceiling, 0.37 mg/m³ ceiling, A2—Suspect Human Carcinogen

SAFETY PRECAUTIONS

Do not get in eyes.
Avoid contact with skin and clothing.
Avoid breathing mist or vapor.
Wash thoroughly after handling.

FIRST AID

In case of eye contact: immediately flush eyes with plenty of water for at least 15 minutes. Seek medical attention. In case of skin contact: immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Seek medical attention. Wash clothing before reuse.

If inhaled: remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

If swallowed: induce vomiting immediately as directed by medical personnel. Following this, give activated charcoal slurry. Call a physician.

Protection Information

GENERALLY APPLICABLE CONTROL MEASURES

Provide ventilation adequate to keep formaldehyde concentrations below indicated exposure limits.

PERSONAL PROTECTIVE EQUIPMENT

Have available and wear as appropriate: chemical splash goggles; full-length face shield/splash goggle combination; neoprene, nitrile, butyl, or polyvinyl gloves; coveralls with long sleeves. Selection and maintenance of personal protective equipment shall be in accordance with 29 CFR 1910.1048(h). If exposure limits may be exceeded, the appropriate respirator as specified in 29 CFR 1910.1048(g), should be used. Wear self-contained breathing apparatus and full body protection for entry into areas where concentrations exceed 100 ppm and for emergency reentry into areas of unknown concentrations.

Disposal Information

AQUATIC TOXICITY

Formaldehyde: The 96-hour LC₅₀ in fathead minnows is 38–48 mg/l.

SPILL, LEAK, OR RELEASE

Wear self-contained breathing apparatus and full body protection. Soak up small spills with earth, sand, or other noncombustible absorbent material and remove in covered metal containers. Dike large spills and neutralize with diluted (5 percent) solutions of ammonia, sodium sulfite, or sodium bisulfite and remove. Flush area with plenty of water. Comply with federal, state, and local regulations on reporting releases.

WASTE DISPOSAL

Cleanup material is a RCRA hazardous waste. Comply with federal, state, and local regulations.

Additional Information

STORAGE CONDITIONS

Keep container closed. Keep away from heat and flame. Store in heated tank or warm room, above minimum storage temperature for grade handled.

SARA/TITLE III HAZARD CATEGORIES AND LISTS

Product Hazard Categories:

Chronic Health: Yes

Acute Health: Yes

Fire Hazard: Yes

Pressure Hazard: No

Reactivity Hazard: No

Lists:

Extremely Hazardous Substance: Yes

CERCLA Hazardous Substance: Yes

Toxic Chemical: Yes

Glossary

Action Level. Concentration of a specific substance, calculated on an eight-hour time-weighted average (TWA), which initiates certain required activities such as exposure monitoring and medical surveillance.

Aqueous Solution. A watery or water-based solution.

Carcinogen. A substance that produces cancer.

Dermatitis. A disorder or irritation of the skin. Signs may include itching, redness, rashes and various skin lesions.

Hazard. The risk presented by a particular exposure to do harm by virtue of its explosiveness, flammability, corrosiveness, toxicity, etc., and the ease with which contact can be established with the substance.

Metabolize. The changes that occur in substances entering the body till they are used or excreted from the body.

MSDS. Material safety data sheet. Substances that are considered potentially dangerous are required by OSHA to have an MSDS. Information required to be on the MSDS includes product name, ingredients, the manufacturer, possible safety and health hazards, and health precautions to follow.

PEL. Permissible exposure level. A term used to indicate the permissible amount of exposure to a specific substance, based on an eight-hour time-weighted average (TWA).

Protective Equipment and Clothing. Equipment or clothing provided to the worker to prevent contact with a specific substance. Should be chosen based on the concentration, method of exposure and conditions of use. Can include respirators, gloves, clothing, goggles and face shields.

Respirator. A device worn over the nose and mouth to protect one from inhaling harmful substances. The respirator must be selected to protect against the specific substance and must be approved by the National Institute of Occupational Safety and Health (NIOSH).

Solubility. The ability of a substance to be dissolved into solution.

STEL. Short-term exposure limit. A term used to indicate the maximum amount of time (usually minutes) that it is safe for one to be exposed to a substance in high concentrations

Toxic. The ability of a substance to cause harm to the body. Toxicity is influenced by how much and how often one is exposed to a particular substance.

TWA. Time-weighted average. A term used to determine and set exposure limits for a particular substance.

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- International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, UAW, *et al.* v. Pendergrass; Amalgamated Clothing and Textile Workers Union, *et al.* v. Whitfield, Deputy Secretary of Labor; Formaldehyde Institute, Inc., *et al.* v. Whitfield; International Molders and Allied Workers Union, AFL-CIO-CLC, *et al.* v. Dole, U.S. Court of Appeals for the District of Columbia Circuit, Docket Nos. 87-1743, 87-1744, 88-1021, and 88-1063 (June 9, 1989), 1989 OSHD (CCH) ¶28,564.

The following industry guides are available from the N.C. Department of Labor's Occupational Safety and Health Division:

- #1. *A Guide to Safety in Confined Spaces*
- #2. *A Guide to Procedures of the N.C. Safety and Health Review Commission* (downloadable PDF **ONLY**)
- #3. *A Guide to Machine Safeguarding*
- #4. *A Guide to OSHA in North Carolina*
- #5. *A Guide for Persons Employed in Cotton Dust Environments* (downloadable PDF **ONLY**)
- #6. *A Guide to Lead Exposure in the Construction Industry* (downloadable PDF **ONLY**)
- #7. *A Guide to Bloodborne Pathogens in the Workplace*
- #8. *A Guide to Voluntary Training and Training Requirements in OSHA Standards*
- #9. *A Guide to Ergonomics*
- #10. *A Guide to Farm Safety and Health* (downloadable PDF **ONLY**)
- #11. *A Guide to Radio Frequency Hazards With Electric Detonators* (downloadable PDF **ONLY**)
- #12. *A Guide to Forklift Operator Training*
- #13. *A Guide to the Safe Storage of Explosive Materials* (downloadable PDF **ONLY**)
- #14. *A Guide to the OSHA Excavations Standard*
- #15. *A Guide to Developing and Maintaining an Effective Hearing Conservation Program*
- #16. *A Guide to Construction Jobsite Safety and Health/Guía de Seguridad y Salud para el Trabajo de Construcción*
- #17. *A Guide to Asbestos for Industry*
- #18. *A Guide to Electrical Safety*
- #19. *A Guide to Occupational Exposure to Wood, Wood Dust and Combustible Dust Hazards* (downloadable PDF **ONLY**)
- #20. *A Guide to Crane Safety*
- #23. *A Guide to Working With Electricity*
- #25. *A Guide to Personal Protective Equipment*
- #26. *A Guide to Manual Materials Handling and Back Safety*
- #27. *A Guide to the Control of Hazardous Energy (Lockout/Tagout)*
- #28. *A Guide to Eye Wash and Safety Shower Facilities*
- #29. *A Guide to Safety and Health in Feed and Grain Mills* (downloadable PDF **ONLY**)
- #30. *A Guide to Working With Corrosive Substances* (downloadable PDF **ONLY**)
- #31. *A Guide to Formaldehyde* (downloadable PDF **ONLY**)
- #32. *A Guide to Fall Prevention in Industry*
- #32s. *Guía de Protección Contra Caídas en la Industria* (Spanish version of #32)
- #33. *A Guide to Office Safety and Health* (downloadable PDF **ONLY**)
- #34. *A Guide to Safety and Health in the Poultry Industry* (downloadable PDF **ONLY**)
- #35. *A Guide to Preventing Heat Stress*
- #38. *A Guide to Safe Scaffolding*
- #40. *A Guide to Emergency Action Planning*
- #41. *A Guide to OSHA for Small Businesses in North Carolina*
- #41s. *Guía OSHA para Pequeños Negocios en Carolina del Norte* (Spanish version of #41)
- #42. *A Guide to Transportation Safety*
- #43. *A Guide to Combustible Dusts*

Occupational Safety and Health (OSH) Sources of Information

You may call 1-800-NC-LABOR (1-800-625-2267) to reach any division of the N.C. Department of Labor; or visit the NCDOL home page on the World Wide Web: <http://www.nclabor.com>.

N.C. Occupational Safety and Health Division

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Local Telephone: (919) 807-2900 Fax: (919) 807-2856

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 3rd Floor)

For information concerning education, training and interpretations of occupational safety and health standards contact:

Education, Training and Technical Assistance Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2875 Fax: (919) 807-2876

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 4th Floor)

For information concerning occupational safety and health consultative services and safety awards programs contact:

Consultative Services Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2899 Fax: (919) 807-2902

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 3rd Floor)

For information concerning migrant housing inspections and other related activities contact:

Agricultural Safety and Health Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2923 Fax: (919) 807-2924

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 2nd Floor)

For information concerning occupational safety and health compliance contact:

Safety and Health Compliance District Offices

Raleigh District Office (313 Chapanoke Road, Raleigh, NC 27603)

Telephone: (919) 779-8570 Fax: (919) 662-4709

Asheville District Office (204 Charlotte Highway, Suite B, Asheville, NC 28803-8681)

Telephone: (828) 299-8232 Fax: (828) 299-8266

Charlotte District Office (901 Blairhill Road, Suite 200, Charlotte, NC 28217-1578)

Telephone: (704) 665-4341 Fax: (704) 665-4342

Winston-Salem District Office (4964 University Parkway, Suite 202, Winston-Salem, NC 27106-2800)

Telephone: (336) 776-4420 Fax: (336) 776-4422

Wilmington District Office (1200 N. 23rd St., Suite 205, Wilmington, NC 28405-1824)

Telephone: (910) 251-2678 Fax: (910) 251-2654

To make an OSHA Complaint, **OSH Complaint Desk:** (919) 807-2796

For statistical information concerning program activities contact:

Planning, Statistics and Information Management Bureau

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2950 Fax: (919) 807-2951

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 2nd Floor)

For information about books, periodicals, vertical files, videos, films, audio/slide sets and computer databases contact:

N.C. Department of Labor Library

Mailing Address:
1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 807-2848 Fax: (919) 807-2849

Physical Location:
111 Hillsborough St.
(Old Revenue Building, 5th Floor)

N.C. Department of Labor (Other than OSH)

1101 Mail Service Center
Raleigh, NC 27699-1101
Telephone: (919) 733-7166 Fax: (919) 733-6197