Environment

INFORMATION FROM KODAK

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About the OSHA Formaldehyde Standard

INTRODUCTION

Formaldehyde in the workplace is regulated by the federal government through the Occupational Safety and Health Administration (OSHA). The OSHA Formaldehyde Standard 29CFR §1910.1048 requires employers who have formaldehyde in the workplace to:

- Determine employee exposure levels (see KODAK Publication No. J-111, *Determining Workplace Exposure to Formaldehyde*).
- Train employees in the hazards of formaldehyde and means of protection against those hazards (see KODAK Publication No. J-114, *Formaldehyde Training*).
- Institute spill and emergency plans (see KODAK Publication No. J-112, *Formaldehyde Emergencies*).
- Institute proper chemical handling practices.
- Institute methods of control to protect employees, and provide protective equipment.
- Provide medical surveillance and medical removal to employees, as necessary.
- Maintain accurate records.
- Post entrances and accessways with sign "Danger—Formaldehyde—Irritant and Potential Cancer Hazard. Authorized Personnel Only."

STANDARDS

The federal government, through OSHA, and the American Conference of Governmental Industrial Hygienists (ACGIH—an organization of professional Industrial Hygienists), set limits for exposure to certain chemicals in the workplace. OSHA limits are legally binding. ACGIH limits are not legally binding but are widely accepted on a voluntary basis. If your workplace plans to follow ACGIH recommendations for formaldehyde, you may need to consider workplace controls in addition to those specified by the OSHA standard because the ACGIH limits are more restrictive.

OSHA EXPOSURE LIMITS FOR AIRBORNE CONCENTRATIONS

The OSHA limits for formaldehyde in air that trigger employer action are:

0.1 ppm, 8-h TWA	OSHA trigger for "potential hazard"
0.5 ppm, 8-h TWA	OSHA Action Level (AL)
0.75 ppm, 8-h TWA	OSHA Permissible Exposure Limit (PEL)
2.0 ppm, 15-min STEL	OSHA Short-Term Exposure Limit (STEL)

TWA = Time-Weighted Average

ACGIH EXPOSURE LIMITS FOR AIRBORNE CONCENTRATIONS

0.3 ppm, Ceiling	ACGIH Ceiling Limit

The federal government sets limits for employee exposure to certain fchemicals in the work-place. Formaldehyde is regulated by the Occupational Safety and Health Administration (OSHA).

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QUICK GUIDE TO FORMALDEHYDE COMPLIANCE REQUIREMENTS

Use the table below as a guide to determine which formaldehyde compliance requirements apply to your workplace.

Notes:

Housekeeping requirements include leak detection, preventative maintenance, and spill cleanup.	**Regulated area** requirements include posting entrances and limiting access to areas where formaldehyde is used.
Air Monitoring requirements include employee notification within 15 days of receipt of results.	**Controls** include engineering and work practice controls.

Amount of Fromaldehyde		Training*	Exposure monitoring*	Medical surveillance*	Controls*	Eyewashes and showers	Regulated areas	Housekeeping*	Protective equipment*
Concentration in solution (%)									
0 – <0.1									
0.1 – <1		●	●			●†		●	
≥1		●	●			●		●	●
Concentration in air (ppm)									
As 8-h TWA	0 – <0.1								
	0.1 – <0.5	●	●					●	
	0.5 – <0.75	●	●	●				●	
	≥0.75	●	●	●	●‡		●**	●	●‡
As 15-min STEL	≥2	●	●	●	●‡		●**	●	●‡

* Recordkeeping requirements may apply.
† Eyewash station only.
‡ Respirators required until controls implemented.
** Post area, limit access, written action plan.

EMPLOYEE AWARENESS AND TRAINING

The OSHA Formaldehyde Standard requires training for employees in workplaces with levels of formaldehyde ≥0.1 parts per million (ppm) as an 8-h Time-Weighted Average (TWA) in air, and in workplaces with solutions containing ≥0.1% formaldehyde. Employers must inform all affected employees of the location of written training materials and make them readily available to employees at all times. Employers must also document training and keep training records. KODAK Publication No. J-114, *Formaldehyde Training*, includes some training materials that can help guide you through the training process

Initial and annual formaldehyde training must cover all aspects of employee safety, including the discussion and explanation of:

- The potential health effects of exposure to formaldehyde.
- The signs and symptoms of exposure to formaldehyde and instructions for reporting these.
- The content of the current OSHA Formaldehyde Standard.
- The contents of Material Safety Data Sheets (MSDSs) for any products used in the workplace that contain or release formaldehyde.
- The purpose for medical surveillance and medical removal provisions.
- Operations in work areas where formaldehyde is present and the related work practices that must be followed to prevent exposure.
- Engineering and work practice controls as they pertain to employee protection, including the purpose, proper use, and limitations of personal protective equipment.
- Spill, emergency and cleanup procedures, including the specific duties or assignments of each employee in the event of an emergency.

In addition, employees must be instructed to immediately report any health problems they suspect are attributable to formaldehyde exposures

EXPOSURE MONITORING

If you determine that there is potential employee exposure to formaldehyde >0.1% in solution and no objective data are available for your use, you are obligated to perform initial air monitoring. Use of objective data is explained in KODAK Publication No. J-111, *Determining Workplace Exposure to Formaldehyde*.

If airborne concentrations of formaldehyde are above the Action Level (AL) upon initial monitoring, air monitoring is required at least every 6 months.

If airborne concentrations of formaldehyde are above the Short-Term Exposure Limit (STEL) on initial monitoring, air monitoring is required at least once a year.

You must also perform air monitoring when changes occur which could result in new or additional exposure, and upon reports of respiratory or skin signs / symptoms associated with formaldehyde exposure.

You can discontinue periodic air monitoring when two consecutive sampling periods, seven days apart, are below the AL and STEL.

Air monitoring must be:

- Representative of employee's full shift or short-term exposure, as appropriate.
- Representative of the job and work operation.
- Taken for:
  - Each job classification in each work area.
  - Each shift, if exposures are different.

Employers are required to:

- Notify affected employees in writing of results of air monitoring within 15 days of the receipt of the sampling data results by distributing copies or by posting notices
- Develop a written plan to reduce levels below the OSHA TWA of 0.75 ppm and the STEL of 2 ppm.
- Provide written notice of plans to employees.
- Allow affected employees or designated representative to observe monitoring.

MEDICAL SURVEILLANCE

Medical surveillance is intended to identify employees who are or who might be adversely affected by formaldehyde exposure, even if the exposure is below the Permissible Exposure Limit (PEL).

Medical surveillance must be provided:

- Prior to a job assignment where formaldehyde exposure is at or above the Action Level of 0.5 ppm or above the STEL of 2 ppm, then annually thereafter.
- For all employees exposed to formaldehyde in emergencies.
- If employees develop signs or symptoms of formaldehyde overexposure.

Medical surveillance consists of:

- Administration of a medical disease questionnaire (see OSHA Formaldehyde Standard 29CFR §1910.1048, Appendix D).
- Review of the questionnaire by a licensed physician.
- Providing medical examinations for:
  - Employees believed to be at increased risk based on the questionnaire.
  - Respirator wearers at time of initial assignment and then annually thereafter.
  - Personnel exposed to formaldehyde in an emergency.

MEDICAL REMOVAL

OSHA's 1992 Medical Removal Protection (MRP) provision supplements the medical surveillance requirements listed above. MRP provisions apply when an employee reports significant symptoms, such as significant irritation of the eyes and upper airways, respiratory or skin allergy, or skin irritation attributed to workplace formaldehyde exposure. MRP provisions do not apply for skin exposures to products containing less than 0.05% formaldehyde.

Medical removal begins with a physician's review of the employee's symptoms. This may or may not include an exam. During a remediation and evaluation period, steps such as first aid, improved ventilation, changes in personal protective equipment, restricted activity, or temporary removal are used to improve the employee's condition. During temporary removal, the employee must be transferred to comparable work for which he or she is qualified or can be trained in a short period, and where the airborne formaldehyde exposure is as low as possible (not greater than 0.5 ppm). The employer must guarantee the employee's job seniority, pay, and benefits for up to six months.

During the removal period, follow-up medical exams and multiple physician reviews may be performed.

WORKPLACE CONTROLS

Controls can include substitution, engineering controls, work practice changes, and use of personal protective equipment.

The employer should substitute formaldehyde with a product containing a less hazardous chemical or a lower percentage of formaldehyde if possible. If you cannot do this, then try a process change or improving your method of ventilation. Next, change your work practices. For example, when cleaning a piece of equipment, consider using cold instead of hot water to minimize the amount of volatile chemicals. Changing the personal protective equipment should only be considered as a final alternative to all other controls.

An Industrial Hygiene or Safety professional can provide specific guidance concerning workplace controls.

EMERGENCY SHOWERS AND EYEWASHES

Employers are required to provide conveniently located, quick-drench showers or the equivalent for employees who could become splashed with solutions of 1% or greater. You must also provide appropriate eyewash facilities within the immediate work area for use by employees whose eyes could be splashed with solutions containing 0.1% or greater formaldehyde.

Limit the use of portable units or hand-held fixtures to small spills (generally less than 8 oz / 250 ml), provided that all affected body areas can be flushed continuously for 15 minutes. For this reason, bottle-type eyewashes are not acceptable.

ANSI Z358.1-1990 has suggested the following criteria for acceptable eyewashes and quick-drench showers:

- Location must be clearly marked, well lighted, and easily accessible, i.e., no obstacles, doorways, or turns.
- For concentrated solutions, location should be 10 seconds, 10–20 feet (3–6 metres) travel maximum; for other solutions, location should be 10 seconds, 100 feet (30.5 metres) travel maximum.
- Eyewashes should be able to deliver 0.4 gallons / min (1.5 litres / min) for 15 minutes minimum; showers should be able to deliver 30 gallons / min (113.6 litres / mm) for 15 minutes minimum.

REGULATED AREAS

Employers are required to post signs at all entrances and accesses to areas where the concentration of airborne formaldehyde exceeds either the OSHA 8-h TWA of 0.75 ppm or the OSHA 15-min STEL of 2 ppm. The OSHA standard specifies the information required for the sign as follows: "Danger—Formaldehyde—Irritant and Potential Cancer Hazard. Authorized Personnel Only." The sign is intended to limit access so that only authorized persons who have been trained to recognize the hazards of formaldehyde enter that area.

HOUSEKEEPING

Employers must conduct a program to detect leaks and spills, including regular visual inspections of operations involving formaldehyde.

Preventative maintenance of equipment, including surveys for leaks, must be done at regular intervals. We recommend you do inspections on a monthly basis.

PROTECTIVE EQUIPMENT AND CLOTHING

Employers must provide protective equipment. It must be:

- Free to employees.
- Properly used.
- Selected based on form of formaldehyde, conditions of usage, hazard.
- Repaired or replaced as necessary to ensure effectiveness.

Contaminated/used equipment must be:

- Put in designated storage areas if contaminated and NOT taken home.

  Storage areas must be posted with labels / signs containing the words: "Danger: Formaldehyde—contaminated equipment (clothing). Avoid inhalation and skin contact."
- Put in designated storage areas if contaminated and NOT taken home.
- Cleaned or laundered before reuse.

Employers must:

- Select appropriate eye protection* and impervious† boots, gloves and clothing depending on the concentration of formaldehyde and potential for exposure.
- Require full body protection before entry to areas that exceed 100 ppm or during emergencies when air concentrations are unknown.
- Inform persons who are laundering, cleaning or repairing contaminated protective equipment and clothing of the potential harmful effects of formaldehyde and how to handle that equipment / clothing safely.

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* Gas-proof goggles if not wearing a full face respirator. If a face shield is worn, goggles are also required when formaldehyde can reach the eye.

† Nitrile, neoprene, or butyl rubber are suitable.

RESPIRATORS

When required for your operations, respirators must:

- Be provided free of charge to employees.
- Be properly used.
- Reduce the air concentration of formaldehyde to at or below the 0.75 ppm 8-h TWA or the 2 ppm 15-min STEL.

Employers must:

- Comply with the requirements of the OSHA Formaldehyde Standard* as to use and selection of respirators.
- Establish a respirator program (see OSHA Respiratory Protection Standard 29CFR §1910.134 for details).
- Ensure that quantitative or qualitative face-fit tests for negative-pressure respirators are performed initially and annually.
- Require respirators (1) in emergencies; (2) until you have installed or implemented feasible engineering and work practice controls; (3) during work operations when engineering and work practice controls are not feasible; (4) when feasible engineering and work practice controls are not yet sufficient to reduce exposure to, at, or below permissible exposure limits.
- Provide a powered air purifying respirator for employees who cannot wear a negative pressure respirator.

* Formaldehyde Concentration (ppm) and Minimum Respirator Required:
Up to 7.5 ppm—Full facepiece with cartridges or canisters specifically approved for protection against formaldehyde. You can substitute a half-mask respirator (with cartridges specifically approved for protection against formaldehyde) for the full facepiece respirator providing that you also use effective gas-proof goggles.
Up to 75 ppm—Full face mask with chin style or chest- or back-mounted type with industrial-size canister specifically approved for protection against formaldehyde. Type C supplied-air respirator, pressure demand or continuous flow type, with full facepiece, hood, or helmet.
Above 75 ppm or unknown (emergencies)—Self-contained breathing apparatus (SCBA) with positive-pressure full facepiece.

EMERGENCIES

OSHA requires employers to prepare for any possible equipment failure, spill or rupture of containers, or failure of control equipment that would result in an uncontrolled release of formaldehyde that could result in injury or loss of life. Where such potential exists, employers must establish procedures for evacuation and access to emergency medical care, and for obtaining needed equipment for evacuation and reentry into the area. Employers must establish procedures for equipment repair, spill cleanup, decontamination, and waste disposal.

OSHA does not specify the exposure level that triggers emergency provisions. To determine if there is a need to provide for emergencies, consider whether employees' lives or health could be jeopardized in the worst predictable accident unless employees are promptly evacuated from the area.

Even relatively small spills (a pint or less of 37% formalin, for example) in a ventilated area can generate potentially life-threatening airborne levels.

A 30-minute exposure to 100 ppm is potentially fatal, and pulmonary edema (excess fluid in the lungs) can occur after exposures to 50 ppm.

See KODAK Publication No. J-112, *Formaldehyde Emergencies*, for more information about formaldehyde emergencies.

RECORDKEEPING RETENTION TIMES

Employers are required to maintain accurate records as follows:

- Air monitoring (actual measurements or objective data)—retain for at least 30 years.
- Medical records and medical surveillance records—retain for the duration of employment plus 30 years.
- Respirator fit testing—retain until replaced by a more recent record.
- Training—length of retention not specified.
- Housekeeping—length of retention not specified.
- Controls—length of retention not specified.

Consult OSHA Formaldehyde Standard 29CFR §1910.1048 for more details on which specific records you must keep.

HEALTH EFFECTS OF EXPOSURE TO FORMALDEHYDE

Table I. Potential Short-Term (Acute) Health Effects from Exposure to Airborne Formaldehyde*

Exposure	Concentration (ppm)	Duration Causing Effect	Signs and Symptoms*
	<0.05	Minutes to hours	Usually no effects observed
OSHA trigger for "potential" hazard 0.1 ppm	0.05 – 0.1	Minutes to hours	Mild eye and throat irritation in a few sensitive individuals
ACGIH Ceiling Limit 0.3 ppm OSHA "Action Level" 0.5 ppm	0.1 – 0.5	Minutes to hours	Slight odor detected. Mild nose and throat irritation and dryness, mild eye irritation and tearing.
OSHA 8-hr PEL 0.75 ppm OSHA 15-min STEL 2 ppm	0.5 – 2	Minutes to hours	Variable symptoms including thirst, headache, fatigue, nausea, dizziness; mild upper/lower respiratory tract irritation, dry and sore throat; irritation of eyes/nose/throat
	5	Minutes	Avoidance: most people cannot tolerate prolonged exposure
	10	Minutes	Intolerable for most people
	5 – 30	Minutes	Coughing, wheezing, chest tightness, difficulty breathing, severe eye/nose/throat irritation
	30 – 50	Minutes	May cause damage to respiratory tract, severe eye irritation; may cause pulmonary edema
	100	30 Minutes	Immediately dangerous to life

* In addition to the effects noted above, allergic respiratory tract reactions might occur in certain sensitive individuals at any level of exposure.

Table II. Potential Short-Term (Acute) Health Effects from Exposure to Formaldehyde Solutions

Route of Exposure	Type of Solution	Signs and Symptoms*
Ingestion	Concentrated (≥10%)	Severe irritation and burns of the mouth, throat, and stomach; severe stomach pains with possible loss of consciousness and death. Solutions containing ≥4% methanol can cause blindness.
	Dilute	Irritation of the mouth, throat, and stomach
Skin Contact	Concentrated	Moderate irritation to severe burns, allergy
	Dilute	Mild irritation, allergy
Eye Contact	Concentrated	Moderate irritation to severe burns; possible blindness
	Dilute	Dilute

* Severity of effect depends on concentration and volume of solution, duration of exposure, and thoroughness of removal.

Table III. Potential Long-Term (Chronic) Health Effects from Exposure to Formaldehyde

Route of Exposure	Duration Causing Effect	Signs and Symptoms
Inhalation	Varies; single episodes to years	Asthma, bronchitis
	Years	Cancer of respiratory tract in rats exposed to very high concentrations; possible carcinogen in humans

GLOSSARY

Action Level (AL). An air concentration level, determined as an 8-hour time-weighted average, at which OSHA sets additional requirements. The OSHA AL for formaldehyde is 0.5 ppm.

American Conference of Governmental Industrial Hygienists (ACGIH). This organization develops and publishes recommended occupational exposure limits for hundreds of chemical substances and physical agents. Unlike OSHA Permissible Exposure Limits, these limits are not enforced by the federal government

Ceiling Limit (C). An airborne concentration of a toxic chemical in the work environment that should never be exceeded. ACGIH has set a ceiling limit of 0.3 ppm for formaldehyde.

CFR. Code of Federal Regulations. OSHA's regulations are collected in Title 29 of the CFR.

Federal Register. The Federal Register is a daily U.S. government publication that, along with other information, includes proposed and final regulations of federal agencies.

Material Safety Data Sheet (MSDS). Chemical manufacturers and importers are required to develop an MSDS for each hazardous chemical they produce or import, and must provide the MSDS at the time of initial shipment of a hazardous chemical to the distributor or user. MSDSs include information regarding the specific identity of the hazardous chemical(s), information on the physical and chemical characteristics, known health effects, exposure limits, emergency and first-aid procedures, etc. MSDSs must be readily available in the workplace.

Occupational Safety and Health Administration (OSHA). A Federal Agency within the U.S. Department of Labor. There are also state OSHA agencies.

Parts Per Million (ppm). The number of parts of a vapor, gas or other contaminant per million parts of air. A unit of measure for airborne concentrations of vapors and gases.

Permissible Exposure Limits (PEL). Approved levels or concentrations, averaged over a time interval, for safe operating conditions.

Personal Protective Equipment (PPE). Devices worn by the employee to protect against hazards in the work environment. Respirators, gloves, and hearing protectors are examples.

Short-Term Exposure Limit (STEL). A 15-minute average established to prevent short-term, acute effects such as irritation. For operations that involve brief, but potentially intense exposure levels, short-term measurements are taken for up to a 15-minute period. The OSHA short-term limit for formaldehyde is 2 ppm.

8-hour Time-Weighted Average (TWA). The maximum average concentration of a chemical to which a worker can be exposed during an 8-hour workday, and a 40-hour work week. These limits are designed to prevent repeated and prolonged exposure to chemicals. If work shifts exceed eight hours, employers should adjust the limits to lower levels to minimize the effects of this prolonged exposure. An example of lower limits for a 12-hour workday is: 0.75 for the 8-hour TWA, compared to 0.5 for the 12-hour TWA.

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MORE INFORMATION

If you have environmental or safety questions about Kodak products or services, contact Kodak Environmental Services at 1-716-477-3194, between 8 a.m. and 5 p.m. (Eastern time) or visit KES on-line at www.kodak.com/go/kes.

Kodak also maintains a 24-hour health hotline to answer questions about the safe handling of photographic chemicals. If you need health-related information about Kodak products, call 1-716-722-5151.

For questions concerning the safe transportation of Kodak products, call Kodak Transportation Services at 1-716-722-2400.

Additional information is available on the Kodak website and through the U.S.A./Canada faxback systems.

The products and services described in this publication may not be available in all countries. In countries other than the U.S., contact your local Kodak representative, or your usual supplier of Kodak products.

The following publications are available from Kodak Customer Service or from dealers who sell Kodak products.

J-110	*Formaldehyde Use in Photographic Processing Facilities*
J-111	*Determining Workplace Exposure to Formaldehyde*
J-112	*Formaldehyde Emergencies*
J-114	*Formaldehyde Training*
J-115	*Formaldehyde Information*
J-311	*Hazard Communication for Photographic Processing Facilities*
J-312	*Personal Protective Equipment Requirements for Photographic Processing Facilities*
J-313	*Occupational Noise Exposure Requirements for Photographic Processing Facilities*
J-314	*Indoor Air Quality and Ventilation in Photographic Processing Facilities*
J-315	*Special Materials Management in Photographic Processing Facilities*
J-316	*Emergency Preparedness for Photographic Processing Facilities*
J-317	*Injury and Illness Management for Photographic Processing Facilities*

For more information about Kodak Environmental Services, visit Kodak on-line at:
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This publication is intended to assist managers of photographic processing facilities in their compliance requirements under the OSHA Formaldehyde Standard. Additional local and state requirements may also apply. Verify the specific requirements for your facility with your legal counsel.

EASTMAN KODAK COMPANY • ROCHESTER, NY 14650

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