



INDIANA UNIVERSITY

Laboratory Safety Guideline

Formaldehyde

Purpose and Background

Environmental Health and Safety (EHS) has developed this program to ensure a safe work environment and to protect the health and safety of faculty, staff, and students who utilize or are potentially exposed to formaldehyde. The Occupational Safety and Health Administration (OSHA) promulgated a final rule 29 CFR 1910.1048 on May 27, 1982. This standard applies to all occupational exposures to formaldehyde - formaldehyde gas, its solutions, and materials that release formaldehyde.

Scope

This program applies to all faculty, staff, and students who are exposed to formaldehyde.

Objectives

This program has the following objectives:

1. Identify employees exposed to formaldehyde at or greater than 0.1 parts per million (ppm) averaged over an eight-hour workday or to solutions that contain greater than 1% formaldehyde and provide information and training to this group regarding the hazards of formaldehyde exposure;
2. Improve engineering and work practice controls to limit exposure to less than the action level (0.5 ppm) for an eight-hour time weighted average or less than the short term exposure limit (STEL) of 2.0 ppm for any 15-minute period;
3. Provide personal protective equipment, signs, and labels to protect and notify employees for the hazards involved;
4. Provide information for emergencies involving exposure or spill cleanup; and
5. Institute a medical surveillance plan, if necessary.

Authority and Responsibility

Environmental Health and Safety:

1. Developing, implementing, and administering Formaldehyde program;
2. Identifying work areas within facilities that contain formaldehyde;
3. Determining which employees are covered by this regulation;
4. Performing all area evaluations;
5. Performing all area and personal air monitoring to determine exposure;
6. Providing training to employees who are covered by this regulation;
7. Determining appropriate personal protective equipment (PPE), work practices, and engineering controls;
8. Maintaining exposure and training records;
9. Reviewing and updating the program whenever new information is available; and
10. Ensuring compliance with all federal, state, and local regulations.



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University Departments:

1. Identifying those that are working with or are exposed to formaldehyde;
2. Providing the appropriate PPE, work practices, and engineering controls;
3. Ensuring that all faculty, staff, and students who are assigned to workplaces where there is exposure to formaldehyde have received the proper training; and
4. Reporting any spills or releases to EHS.

Employees:

1. Participating in a training session concerning formaldehyde hazards and use;
2. Complying with all elements of this program including their departmental procedures for safely handling formaldehyde; and
3. Reporting an exposure incident or formaldehyde solution spill to their supervisor.

Health services will be provided by 1) the IU Health Center for students and 2) Promptcare East for employees and they will be responsible for:

1. Providing medical consultations and examinations of employees who are overexposed to formaldehyde or those who have signs and symptoms believed to be from an exposure to formaldehyde;
2. Providing a written opinion for each examination and include limitations on exposure if necessary; and
3. Making recommendations for medical removal from workplace exposure when appropriate.

Health Effects of Formaldehyde

The following are the health hazards as reported in Appendix A of this OSHA regulation. Specific information about commercial mixtures or formulations may be obtained from manufacturers' material safety data sheets (MSDS's).

Acute Effects of Exposure

Ingestion (Swallowing): Liquids containing 10 to 40% formaldehyde cause severe irritation and inflammation of the mouth, throat, and stomach. Severe stomach pains will follow ingestion with possible loss of consciousness and death. Ingestion of dilute formaldehyde solutions (0.03-0.04%) may cause discomfort in the stomach and pharynx.

Inhalation (Breathing): Formaldehyde is highly irritating to the upper respiratory tract and eyes. Concentrations of 0.5 to 2.0 ppm may irritate the eyes, nose and throat of some individuals. Concentrations of 3 to 5 ppm also cause tearing of the eyes and are intolerable to some persons. Concentrations of 10 to 20 ppm cause difficulty in breathing, burning of the nose and throat, cough, and heavy tearing of the eyes. Concentrations of 25 to 30 ppm cause severe respiratory tract injury leading to pulmonary edema and pneumonitis. A concentration of 100 ppm is immediately dangerous to life and health. Deaths from accidental exposure to high concentrations of formaldehyde have been reported.



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Skin (Dermal): Formalin (37% aqueous formaldehyde) is severe skin irritant and a sensitizer. Contact with formalin causes white discoloration, smarting, drying, cracking, and scaling. Prolonged and repeated contact can cause numbness and a hardening or tanning of skin. Previously exposed persons may react to future exposure with an allergic eczematous dermatitis or hives.

Eye Contact: Formaldehyde solutions splashed in the eye can cause injuries ranging from transient discomfort to severe, permanent corneal clouding and loss of vision. The severity of the effect depends on the concentration of formaldehyde in the solution and whether or not the eyes are flushed with water immediately after the accident.

Note - The perception of formaldehyde by odor and eye irritation becomes less sensitive with time as one adapts to formaldehyde. This can lead to overexposure if a worker is relying on formaldehyde's warning properties to alert him or her to the potential for exposure.

Chronic Effects of Exposure

Carcinogenicity: Formaldehyde has the potential to cause cancer in humans. Repeated and prolonged exposure increases the risk. Various animal experiments have conclusively shown formaldehyde to be a carcinogen in rats. In humans, formaldehyde exposure has been associated with cancers of the lung, nasopharynx and oropharynx, and nasal passages.

Mutagenicity: Formaldehyde is genotoxic in several in vitro test systems showing properties of both an initiator and a promoter.

Toxicity: Prolonged or repeated exposure to formaldehyde may result in respiratory impairment. Rats exposed to formaldehyde at 2 ppm developed benign nasal tumors and changes of the cell structure in the nose as well as inflamed mucous membranes of the nose. Structural changes in the epithelial cells in the human nose have also been observed. Some persons have developed asthma or bronchitis following exposure to formaldehyde, most often as the result of an accidental spill involving a single exposure to a high concentration of formaldehyde.

Regulatory Requirements

OSHA has set employee exposure limits for formaldehyde. The action level (AL) is 0.5 parts per million (ppm) calculated as an eight hour time weighted average (TWA); the permissible exposure limit (PEL) as an eight hour TWA is 0.75 ppm; and the 15-minute short term exposure limit (STEL) is 2 ppm.

Exposure Monitoring

Areas that have formaldehyde must monitor employees to determine exposures to formaldehyde. Monitoring is not required if it can be documented that the presence of formaldehyde cannot result in airborne concentrations that would cause an employee exposure at or above the AL of 0.5 ppm or the 15-minute STEL of 2 ppm.

Initial monitoring

Initial monitoring shall be conducted to determine who may be exposed to airborne concentrations at or above the AL or STEL. Employee exposure to less than 0.1 ppm indicates a minimal exposure requiring no further action or training.



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Periodic Monitoring

Periodic monitoring shall be conducted for those employees with initial monitoring results at or above the AL or STEL. Those exposed to 0.1-0.5 ppm are required to attend an information and training program but no additional air sampling is required. For employees exposed at greater than 0.5 ppm (or 2.0 ppm for a 15-minute STEL), there are several actions required.

This group must attend an information and training session and repeat air sampling will be conducted every six months for employees with exposure above the AL. Monitoring will be conducted annually for employees exposed about the STEL. In addition, standard industrial hygiene methods will be employed to reduce occupational exposure.

Termination of Monitoring

Periodic monitoring shall be discontinued if the results from two consecutive sampling periods (at least seven days apart) show that the employee exposure is below the AL and the STEL.

Employee Notification

Employees shall be notified within 15 days of when the test results are received of their personal exposure results. If personal exposure is greater than the PEL-TWA of 0.75 ppm and 2.0 ppm for a STEL, a written plan to reduce exposure must be provided to the affected employee.

Air sampling will be repeated when there is a change in procedure, equipment, personnel, or control measures. Air sampling will also be repeated when an employee reports respiratory or dermal conditions believed to be caused by formaldehyde.

Recordkeeping

Personal exposure monitoring records will be maintained by EHS for at least 30 years. All medical surveillance records will be maintained by Occupational Health/Student Health Services for the duration of employment and retained by Medical Records for a period of 30 years thereafter. Respirator fit test records will be maintained by EHS until replaced by a more recent record. Records of training will be kept by EHS.

All records must be made available to the Department of Labor - IOSHA upon request. Personal exposure records are available to the subject employee or his representative. Medical records shall be provided upon request to the subject employee or to anyone with the subject employee's written consent.

Engineering and Work Practice Controls

Engineering controls relate primarily to proper ventilation to control or dilute employee exposure to formaldehyde at or below the TWA and STEL. Depending on the task, proper ventilation may be a chemical fume hood, slot area ventilators, or general room ventilation. Local exhaust methods such as fume hoods or slot ventilators should be used if the formaldehyde source is small enough that the vapors can be contained by such a device.

Work practice controls are those measures which reduce exposure by altering the manner in which tasks are performed. This may include limiting splashing of formalin solutions, washing formaldehyde-soaked materials in water, and maintaining the covers on containers that emit formaldehyde as much as possible. Surfaces contaminated with formalin solutions should be



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cleaned as soon as possible in order to limit skin and inhalation exposures. Food and drink consumption and storage is prohibited from areas where formaldehyde is used and stored to eliminate the potential for ingestion.

Engineering controls and work practices should be analyzed by each department for each task or area. This information should be provided to the users of formaldehyde and appropriate procedures should be implemented to reduce exposure.

Regulated Areas

Regulated areas shall be established where the concentration of airborne formaldehyde exceeds the TWA or STEL. Signs shall be posted at all entrances and access ways with signs bearing the following information:

DANGER
FORMALDEHYDE
IRRITANT AND POTENTIAL CANCER HAZARD
AUTHORIZED PERSONNEL ONLY

All affected employees must be notified of access restrictions for these regulated areas. Access to regulated areas shall be limited to authorized persons who have been trained to recognize the hazards of formaldehyde.

Labeling

Specific label information is required for the following materials: formaldehyde gas, mixtures or solutions containing greater than 0.1% formaldehyde, and any other material capable of releasing formaldehyde into the air at concentrations of 0.1 ppm or greater. Required label information includes:

- That the product contains formaldehyde.
- The name and address of the responsible party.
- The words "Potential Cancer Hazard" and that it is a respiratory sensitizer.
- That physical and health hazard information is available from EHS and from a Material Safety Data Sheet.

Personal Protective Equipment (PPE)

Protective equipment shall be provided by the department according to the task or area where formaldehyde is used or stored. Parts of the body that may need to be protected include eyes, nose and mouth, hands, arms and the trunk of the body. Butyl and nitrile rubber are materials that are effective in limiting penetration of formalin solutions to the skin.

If an employee might be splashed in the eyes with formalin solutions, goggles are the appropriate eye protection. If significant splashing is likely, a face shield in combination with goggles is recommended. Gloves of appropriate material and thickness for the task should be used to protect hands. For a task that may produce splashes to the trunk of the body, an impermeable suit or rubber apron should be worn to prevent work or street clothing from becoming wet and contacting the skin.



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If an employee must work in an area where the formaldehyde concentration cannot be controlled within the TWA or STEL, a respirator must be worn. Respirator use requires a medical examination, training, and fit testing prior to its first use. Other than for emergency situations, this should not be necessary if appropriate work practices and engineering controls are implemented.

Emergency, Spill Clean-up, and Disposal Procedures

Exposure Emergency

For areas where formaldehyde solutions of 1% or greater are used or stored, an emergency shower must be conveniently located. Areas that use formaldehyde solutions of 0.1% or greater must have an emergency eyewash located within the immediate work area.

If a person's eyes, skin, or clothing are splashed with a formalin solution, the affected area should be washed with water for at least 15 minutes. For overexposure to formaldehyde gas, the affected person should be moved away from the source into fresh air. If there are symptoms of overexposure, the person should report to health services during normal working hours or the hospital emergency room after hours.

Spill Cleanup

Formaldehyde spills may create exposure for those cleaning up the spills. Therefore, a spill should be handled as described in the Emergency Procedures Handbook by contacting Public Safety Dispatch at 274-7911.

Disposal

Aqueous formaldehyde solutions up to 10% in concentration may be disposed by means of the sanitary sewer system. Solutions should be carefully poured into the drain without significant splashing and followed by flushing with cold water for at least five minutes. Formaldehyde concentrations greater than 10% and any other solutions that users are not comfortable in pouring down the drain will be picked up by Environmental Health and Safety.

Medical Surveillance

The medical surveillance program is available to all employees exposed to concentrations above the AL or the STEL, to employees who develop signs and symptoms of overexposure, and to employees exposed during emergencies. All medical procedures covered by this program will be performed by or under the supervision of a licensed physician without cost to the employee.

Medical Disease Questionnaire

A medical disease questionnaire must be administered to employees prior to assignment and annually for a job where exposure to formaldehyde is at or above the AL or STEL and for employees experiencing signs and symptoms of overexposure. The questionnaire asks for information including work history, smoking history, upper respiratory irritation or disease, and allergic skin conditions or dermatitis. Results of the questionnaire will guide the physician in determining whether a medical exam is necessary.



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Medical Examinations

A medical examination shall be provided to the appropriate people as a result of the questionnaire and to those required to wear a respirator to reduce exposure to formaldehyde. The medical exam will cover the following:

- A physical exam with emphasis on irritation or sensitization of the skin or respiratory system, shortness of breath, or irritation of the eyes.
- Pulmonary function testing for respirator wearers.
- Any other testing which the examining physician deems necessary.
- Counseling employees who have medical conditions that may be aggravated by or lead to impairment of their health by formaldehyde exposure.

A medical exam shall also be provided to employees exposed to formaldehyde during an emergency. This exam shall include a medical and work history with emphasis on any evidence of upper or lower respiratory, problems, allergic conditions, skin reactions or hypersensitivity, and any evidence of eye, nose, or throat irritation. The examining physician may also conduct any testing deemed necessary to evaluate the employee's health effects relative to formaldehyde exposure.

Physician's Written Opinion

For each exam performed involving formaldehyde exposure, a written opinion will be completed by the examining physician. The opinion will contain only results that pertain to formaldehyde exposure. Results of the medical exam must be retained and a copy of the written opinion must be provided to the affected employee within 15 days of completion. The written opinion shall include:

- A statement about whether the employee has any medical condition that would place the employee at an increased risk of material impairment of health from exposure to formaldehyde.
- Any recommended limitations on employee's exposure or changes in use of personal protective equipment.
- A statement that the employee has been notified of the first two requirements.

Medical Removal

Under certain conditions, it may be medically necessary to reassign an employee to a comparable position with significantly less exposure to formaldehyde. Medical removal provisions apply only to those employees who report significant irritation of the upper respiratory system or eyes, respiratory sensitization, and dermal irritation or sensitization attributed to workplace formaldehyde exposure. Medical removal does not apply to skin irritation or sensitization caused by products containing less than 0.05% formaldehyde.

The following steps must be taken and conditions met to qualify for medical removal:

- The employee reports signs or symptoms of exposure to health services;
- If a medical exam is deemed unnecessary by the physician, a two-week evaluation/remediation period begins to ascertain if symptoms subside.



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- If conditions get worse during the two-week period, the employee shall return to health services prior to expiration of the two weeks.
- If symptoms have not subsided after two weeks, the employee shall be examined by health services.
- If the exam indicates significant irritation or sensitization, health services will make recommendations of restriction or removal.
- For removal, IU will transfer the employee from the current formaldehyde exposure and if possible, transfer the employee to work having no or significantly less exposure to formaldehyde;
- The employee shall be transferred to comparable work for which the employee is qualified or can be trained in a short period (up to 6 months), where the formaldehyde exposures are as low as possible, but not higher than the action level.
- If comparable work is unavailable, IU shall maintain earnings, seniority and benefits until such work becomes available, until the employee is determined to be unable to return to workplace exposure, until the employee is determined to be able to return to his original job status, or for six months, whichever comes first.
- If the affected employee is removed, he will undergo a second medical exam within six months.
- Compensation during removal may be reduced if the employee receives compensation from a public or employer program or from outside employment.

The affected employee may designate a second physician to review his case and repeat exams or tests as deemed necessary. If the employee-designated physician and health services do not agree on their findings and recommendations, a third physician who is a specialist in the field will be selected by the two involved physicians. Involved parties will comply with the findings and recommendations of the third physician unless an agreement was mutually accepted that was consistent with recommendations of at least one of the three physicians.

Hazard Communication

Information and Training

Information and training will be provided to all employees exposed to formaldehyde at or above 0.1 ppm or to solutions containing greater than 0.1 percent formaldehyde. Key people in affected departments will be provided with information that they will use in training their employees. This training must be provided at the time of initial assignment, when a new exposure or procedure is introduced, and at least annually. Information and training shall include the following:

- Location and explanation of this Formaldehyde Hazard Communication Program and the material safety data sheet(s) for formaldehyde-containing products.
- A description of the health hazard of formaldehyde.
- Procedures to follow if signs or symptoms of exposure appear.
- Where formaldehyde is used and stored in the workplace.
- Work practices and engineering controls to limit exposure.



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- Personal protective equipment (PPE) necessary for the job.
- Emergency procedures for exposures, spills, and cleanup.

Employees shall be trained at the time of initial assignment and whenever a new exposure to formaldehyde is introduced to the workplace. The training shall be repeated annually.

Labels

Hazard warning labels shall be affixed to formaldehyde gas containers, all containers with mixtures or solutions composed of greater than 1% formaldehyde, and containers with materials capable of releasing formaldehyde into the air. The label shall identify that the product contains formaldehyde, list the name and address of the responsible party, and state that the physical and health hazard information is readily available from an MSDS.

Material Safety Data Sheets (MSDS's)

Departments using formaldehyde shall keep an MSDS readily available to all employees on all shifts.

Glossary

Action Level (AL) – a concentration of 0.5 part formaldehyde per million parts of air (0.5ppm) calculated as an eight (8) – hour time-weighted average (TWA) concentration.

Authorized Person – any person required by work duties to be present in regulated areas, or authorized to do so by the employer or by the OSH Act of 1970.

Eczematous Dermatitis - is an inflammatory response of the skin to any of multiple exogenous and endogenous agents. Also known as eczema.

Emergency – any occurrence, such as but not limited to equipment failure, rupture of containers, or failure of control equipment that results in an uncontrolled release of a significant amount of formaldehyde.

Employee Exposure – the exposure to airborne formaldehyde which would occur without corrections for protection provided by any respirator that is in use.

Formaldehyde – the chemical substance, HCHO, Chemical Abstracts Service (CAS) Registry No. 50-00-0.

Formalin – an aqueous solution of formaldehyde that contains 4-12% formaldehyde.

Permissible Exposure Limit (PEL) – a concentration of 0.75 part formaldehyde per million parts of air (0.75 ppm) calculated as an eight (8) - hour time-weight average (TWA). No employee shall be exposed to an airborne concentration of formaldehyde above the PEL-TWA.

Responsible Party – the manufacture of the chemical.

Short Term Exposure Limit (STEL) – a concentration of 2 parts formaldehyde per million parts of air (2 ppm) calculated over a 15-minute time period. No employee shall be exposed to an airborne concentration of formaldehyde above the STEL for a 15-minute time period.

References

Title 29, Code of Federal Regulations, Part 1910.11048, *Formaldehyde*.