Formaldehyde Awareness Training Booklet

Environmental Health & Safety
Iowa State University
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INTRODUCTION

This Formaldehyde Awareness booklet has been prepared by staff members of Iowa State University's Environmental Health and Safety Department (EH&S). The booklet is intended to supplement a formaldehyde training session and to provide information on the properties of formaldehyde and its safe use. Together, the training course and booklet are designed to give ISU employees sufficient training and information to prevent unnecessary exposures to formaldehyde. Additionally, the training session and booklet satisfy the employee training requirements under the Occupational Safety and Health Administration's (OSHA) Formaldehyde standard, found in 29 CFR Part 1910 – Subpart Z – "Toxic and Hazardous Substances," (29 CFR 1910.1048).

WHY SHOULD YOU BE CONCERNED?

ISU is committed to providing a safe and healthful work environment for its employees. If you have a potential exposure to formaldehyde, it is important that you understand its hazardous properties and be able to identify necessary steps to prevent exposure. By completing the training and reviewing the contents of this booklet, you will be better prepared to work safely with formaldehyde-containing materials.

In addition to personal safety, OSHA compliance is another reason ISU departments must ensure their employees are working safely with formaldehyde. Departments must ensure that their employees are not exposed to airborne concentrations of formaldehyde greater than OSHA's

Permissible Exposure Limits (PEL's). Two PEL's have been established for formaldehyde: the 8-hour Time Weighted Average (PEL-TWA = 0.75 ppm) and the Short Term Exposure Limit (STEL = 2.0 ppm). To determine formaldehyde concentrations, exposure monitoring must be conducted. EH&S will be responsible for collecting and analyzing air samples at ISU. Monitoring can be scheduled by calling EH&S at 294-5359. Employees will be notified of the monitoring results in writing.

When exposure monitoring indicates formaldehyde levels above OSHA exposure limits, ISU must establish and implement a program to reduce employee exposure below these levels. The program will include engineering controls (such as chemical fume hood or local exhaust ventilation) and/or work practice controls to reduce and maintain employee exposure below these limits.

Additionally, the OSHA standard requires ISU to address the following items:

- Establish regulated areas
- Signs, labels, and Material Safety Data Sheets (MSDSs)
- Personal Protective Equipment (PPE)
- Eye washes and safety showers
- Leaks and spills
- Medical surveillance
- Information and training

FORMALDEHYDE—ITS VARIOUS USES AND FORMS

Formaldehyde is a colorless chemical with a strong, pungent, irritating odor. For laboratory use, it is typically sold as formalin, a methanol-stabilized water solution that contains 37%, 44% or 50% formaldehyde. It is one of the most commonly produced chemicals in the United States, ranking

24th overall in chemical production. Formaldehyde is used primarily in the production of resins, as an intermediate in the production of industrial chemicals (such as ethylene glycol), as a bactericide or fungicide, and as a component in many consumer products.Small amounts of formaldehyde can be found in many common consumer products. Examples include:

- Cosmetics
- Permanent press clothing
- Fabrics, curtains, draperies, rugs
- Urea-formaldehyde foam insulation
- Particleboard, paneling, plywood, fiberboard
- Adhesives
- Paints, varnishes, wallpaper
- Resins, plastics
- Cigarette smoke

Formaldehyde is also used in the funeral service industry, in pharmaceuticals as an antibacterial agent, by the oil industry in the preservation of oil well drilling and production fluids, and is a by-product of many industrial processes.

At ISU, formaldehyde is used primarily in laboratories to fix animal or plant tissues. Its uses range from tissue fixation of whole animal specimens for anatomy and biology courses to fixation of small tissue samples or cell cultures for research. It is also used in RNA analyses and occasionally as a fumigant in biological safety cabinets and animal rooms.

Non-laboratory exposures to formaldehyde include pressed wood research, handling of packages containing formaldehyde, clinical samples preserved in formalin solutions and work with formaldehyde containing resins.

WHAT'S THE PROBLEM?

General Health Effects

Exposure to formaldehyde can result in various negative health effects. People who are exposed to small quantities over long periods of time could potentially develop:

- Sensitization to formaldehyde
- Cancer
- Reproductive effects
- Mutagenic effects

Significant health effects can also result from shorter exposures at very high levels. Formaldehyde is a poison by ingestion and can be a strong skin irritant. Formaldehyde is easily absorbed through the skin and is the tenth most common cause of dermatitis. Exposure to high airborne concentrations of formaldehyde can lead to severe respiratory irritation and can result in permanent respiratory damage. Exposures to airborne concentrations over 100 parts per million parts air (ppm) could result in convulsions, coma or death. Health effects from exposure to various formaldehyde concentrations are listed in Table 1.

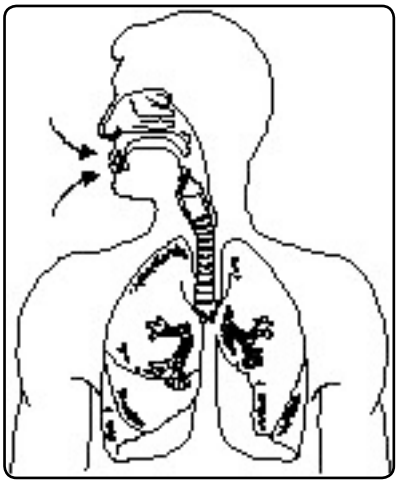


TABLE 1
General Health Effects of Formaldehyde Exposure*

Reported Health Effects	Approximate Formaldehyde Air Concentrations (ppm)**
Odor threshold	0.05 - 1.0
Eye irritation	0.01 - 2.0***
Eye/nose/throat/ respiratory system irritation	1.0 - 3.0
Unable to tolerate prolonged exposures	4.0 - 5.0
Severe respiratory symptoms, difficulty in breathing	10.0 - 20.0
Serious injury to respiratory tract	> 50.0
Death	> 100.0

* Sources: American Conference of Governmental Industrial Hygienists, Inc.: Documentation of the Threshold Limit values & Biological Exposure Indices, Sixth Edition, Volume I, pp. 664-688. ACGIH, Cincinnati, OH (1991)
International Agency for Research on Cancer: IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans, Vol. 29, Some Industrial Chemicals and Dyestuffs, pp. 345-389. IARC, Lyon, France (1982)

** ppm = parts per million parts air

*** The low concentration (0.01 ppm) was observed in the presence of other pollutants that may have been acting synergistically.

Irritant Effects

Formaldehyde irritates mucous membranes including the eyes, nose, throat and respiratory tract. Exposures to formalin and other formaldehyde-containing solutions can also irritate the skin, resulting in varying degrees of burns or rashes.

Repeated exposures to low levels (or a few exposures to high concentrations) of formaldehyde can lead to sensitization.

"Sensitization" is an allergic reaction to a chemical agent due to previous contact with that material. Once sensitized, the allergic reaction is often more severe than after the initial contact, and may not be limited to the site of exposure. Typical allergic reactions to formaldehyde include headache, skin rashes, and irritation of the eyes, nose and upper respiratory system.

Carcinogen

OSHA has identified formaldehyde as a human carcinogen. As such, any container containing formaldehyde must be labeled with the name and include a cancer warning. Several other organizations have also researched formaldehyde's carcinogenicity. Table 2 lists their designations.

TABLE 2
Carcinogenic Classification of Formaldehyde

ACGIH[*]	Suspected human carcinogen
IARC[à]	Probable carcinogen (2A)
OSHA[**]	Carcinogen
NIOSH[¨]	Carcinogen, with no further classification
NTP[©]	Reasonably anticipated to be a carcinogen

* American Conference of Governmental Industrial Hygienists
à International Agency for Research on Cancer
** Occupational Safety and Health Administration
¨ National Institute for Occupational Safety and Health
© National Toxicology Program

Signs and Symptoms of Exposure

It is important that you are able to recognize signs and symptoms of formaldehyde exposure. Exposure to high levels of formaldehyde can cause:

- Watery eyes
- Burning sensations in eyes, nose and throat
- Skin rashes
- Nausea
- Coughing
- Chest tightness
- Allergic reactions

Once a person has become sensitized to formaldehyde, lower exposures can bring on health effects similar to those previously caused by higher exposures.

HOW CAN WE PROTECT OURSELVES?

There are several ways to prevent formaldehyde exposure. The most effective method depends on the particular use of the formaldehyde solution.

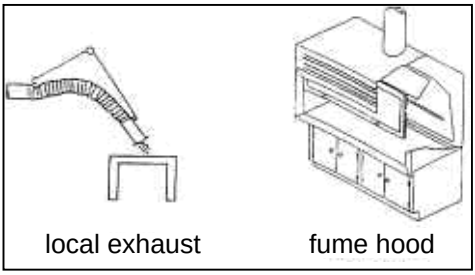
Engineering Controls (Ventilation)

Formaldehyde exposure can often be controlled through the use of engineering controls. Ventilation is the primary engineering control used to limit formaldehyde exposure. The most common ventilation control used at ISU is the chemical fume hood. Fume hoods enclose contaminants produced in the cabinet and exhaust them out of the building. Past monitoring has shown that exposure is minimal when formaldehyde is used in a properly operating fume hood.

Local Exhaust

Local ventilation can also help reduce exposures. This type

of ventilation includes slot hoods and snorkel exhausts, which are placed at the source of the formaldehyde. Local exhaust moves the vapors away from the employee and exhausts them out of the building.



General Exhaust

When the formaldehyde source is large or has many locations within a room or area (as in anatomy labs), general exhaust ventilation can be used to remove vapors from the room air. In laboratories, the general exhaust removes potentially contaminated air directly from the rooms and exhausts it out of the building.

Personal Protective Equipment

Respirators

- Respiratory protection is required when engineering or work practice controls cannot prevent airborne formaldehyde concentrations from exceeding OSHA limits.
- When required, the proper respirator and cartridges must be selected.
- If a full-face respirator is not used, then gas-proof goggles must be used in conjunction with the half mask respirator.
- Respirator cartridges must be replaced every three hours or at the end of the work shift, whichever comes

first.

- To use a respirator, employees must participate in the ISU Respiratory Protection Program.
- To enroll employees in the Respiratory Protection Program, contact EH&S at 294-5359.

Other Equipment

- Appropriate personal protective equipment (such as formaldehyde impervious gloves, lab coat, apron, face and eye protection) must be supplied by the department.

- Supervisors must ensure that protective equipment is properly used to minimize formaldehyde exposure.
- Full body clothing is required if the airborne formaldehyde concentration is unknown or is greater than 100 ppm.

Contaminated Equipment

- Contaminated clothes or equipment must not be taken home.
- If containers are used to store contaminated clothes, they must bear the following label:

DANGER
FORMALDEHYDE CONTAMINATED CLOTHING/EQUIPMENT
AVOID INHALATION AND SKIN CONTACT

- Contaminated clothes and equipment shall be laundered or cleaned before reuse.
- The laundry facility must be informed of the formaldehyde contamination.

Eyewash and Safety Shower

If you are working with formaldehyde or formaldehyde-containing solutions, you must:

- Have an acceptable eyewash within the immediate work area for emergency use. In laboratory applications, an eyewash must be available in each room where formaldehyde is used.
- Have a conveniently located quick-drench shower and ensure that exposed employees can immediately use the shower at all times. Showers must be within 10 seconds of the work area and cannot be located across the hall, in other labs or on different floors of the building.

Material Safety Data Sheets (MSDSs)

To meet the requirements of Iowa's Hazardous Chemical Risks Right to Know standard, ISU departments must:

- Obtain MSDSs for all chemicals that employees work with.
- Ensure that MSDSs are located at the worksite and are "readily accessible" to all employees during all work hours.

Labeling

For containers *without* a manufacturer's label, the label must:

- Be legible
- Be written in English
- Contain the following:
    1. Identity of hazardous material(s) within the container, including formaldehyde
    2. Appropriate hazard warning(s), (such as *DANGER – POTENTIAL CANCER HAZARD)*

Regulated Areas

If formaldehyde use results in exposures over OSHA limits, access to the area must be restricted to trained employees. All area entrances must have this sign posted:

Leak/Spill Control

Departments must implement a program to detect formaldehyde leaks and spills, including regular visual inspections of containers, tanks, and other vessels containing formaldehyde. The program must be conducted by trained employees and include:

- Preventive maintenance at regular intervals (inspection for leaks).
- Provisions to contain spills, decontaminate floors and equipment and dispose of waste [for instance, spill kits, standard operating procedures (SOP's) for emergencies, waste disposal procedures, etc.].

HOW DO YOU KNOW IF YOU'RE BEING EXPOSED?

Formaldehyde has an odor threshold that ranges from 0.05 ppm to 1.0 ppm. There are common health effects that occur at various formaldehyde concentrations (see Table 1, page 5). The only way of knowing with certainty whether you're being exposed, however, is by personal monitoring.

EH&S Monitoring

Personal monitoring is required to determine formaldehyde exposure levels. EH&S will perform monitoring upon request. Periodically EH&S updates exposure information through questionnaires and follow-up monitoring when appropriate. Please note that formaldehyde used solely inside a properly functioning fume hood has, through prior campus monitoring, proven to be of minimal concern. If you work with formaldehyde and have never been monitored or if you would like additional monitoring, call EH&S at 294-5359.

Medical Surveillance

EH&S, in cooperation with the Occupational Medicine Department, coordinates a medical surveillance program for ISU employees who have job-related exposures to various chemical or physical hazards. OSHA requires that any employee exposed to an action level (AL) of 0.5 ppm or a short-term exposure level (STEL) of 2.0 ppm be enrolled in a medical surveillance program. All ISU employees who are exposed to chemical or physical hazards (such as noise, extreme temperatures, vibration, infectious disease agents, etc.) should fill out a workplace Hazard Inventory Form. This form enrolls an employee in the Occupational Medicine Program and triggers EH&S medical questionnaires and, if necessary, medical monitoring. Hazard Inventory Forms are available upon request at 294-5359. These forms should be filled out by new employees and by existing employees whenever workplace hazards change.

TRAINING AND INFORMATION

EH&S has developed a Formaldehyde Training Module, which is available to ISU departments. The module

contains a copy of this booklet, an overhead covering OSHA-required information, a short formaldehyde video and instructions for presenting the information.

The training module can be reserved by calling 294-5359. Additional resources are available on the EH&S website at http://www.ehs.iastate.edu. Please remember, if employees use formaldehyde, they must have annual training and information on the following topics:

- Contents of the OSHA formaldehyde standard
- Material Safety Data Sheets (MSDSs)
- Medical surveillance program
- Signs and symptoms of formaldehyde exposure
- Potential health effects of formaldehyde
- Methods to report adverse signs or symptoms
- Personal protective equipment (PPE)
- Methods for handling spills, emergencies, cleanup
- Engineering and work practice controls used to limit formaldehyde exposure
- Location of written formaldehyde safety resources
- Descriptions of operations using formaldehyde in the workplace

SUMMARY

- Know the health hazards associated with formaldehyde exposure.
- Know where formaldehyde is/may be used (regulated areas).
- Know how to protect yourself when working with formaldehyde.
- Report to your supervisor any incidents that result in significant formaldehyde exposure.
- Contact EH&S (294-5359) and Occupational Medicine (294-2056) if you are suffering adverse health effects related to formaldehyde exposure.
- Contact EH&S if you are working with formaldehyde outside of a fume hood and have not had exposure monitoring.
- Contact EH&S to borrow the Formaldehyde Training Module for departmental training.