Long-term exposure to formaldehyde (HCHO) puts you at increased risk of developing cancer. Short-term exposure – even at very low concentrations - can cause severe irritation to the eyes, skin and respiratory tract. Formaldehyde is a highly toxic and flammable gas with a strong pungent odor. However, it is most commonly used as an aqueous solution (formalin) which often also contains some methanol. It is commonly used in tissue fixing and preservation, disinfection and as an organic chemical reagent.

It is one of the few chemicals with a specific regulatory standard written to protect workers. Cal-OSHA permissible exposures levels for formaldehyde are very low and violations of the standard can result in heavy fines\(^1\). It is the responsibility of the lab supervisor/PI to ensure that all legally-required protections are in place and understood by their workers. EH&S periodically evaluates potential formaldehyde exposures for campus labs.

**Exposure Hazards of Formaldehyde**

**Short-Term Effects of Exposure**
- *Inhalation* – formaldehyde is highly volatile and inhalation is therefore a major route of exposure. Above 0.1 ppm it can irritate the nose, throat and lungs, but its odor threshold is higher – about 1 ppm. Therefore, lack of odor cannot be used as an indicator of safety. Above 25 ppm it can cause severe injury, including pulmonary edema (water in the lungs).
- *Skin contact* – causes skin irritation and in some individuals an allergic dermatitis (rash)
- *Eye contact* – eyes are particularly vulnerable to formaldehyde and above about 2 ppm, it is quickly irritating. Above 20 ppm can cause permanent clouding of the cornea.

**Long-Term Effects of Exposure**
Formaldehyde has been shown to cause cancer in lab animals and can cause cancer in humans. It is listed as a known human carcinogen by the International Agency on Research of Cancer and the National Toxicology Program.

**Cal-OSHA Legal Limits for Exposure**
*Permissible Exposure Limit (inhalation):* 0.75 ppm (8 hr time-weighted average)
*Short-term Exposure Limit (inhalation):* 2 ppm (15 minutes)
*Action Level (inhalation):* 0.5 ppm

If EH&S suspects your exposure to formaldehyde may exceed these levels, UCSB must monitor your exposure level. If you work with formaldehyde outside of a fume hood, or glove box it is likely that your exposure is above-limits. If monitoring confirms that your exposure is above-limits, then a medical surveillance program must be made available to you at no cost.
Controlling Exposures

Engineering Controls
Given its volatility and toxicity, formaldehyde should only be used in a fume hood or glove box. Breathing HCHO fumes is not acceptable.

Protective Clothing and Equipment
- **Skin protection** – gloves must be worn whenever formalin, or tissues preserved/fixed with formalin, are handled. Medium or heavyweight nitrile, neoprene, natural rubber, or PVC gloves should be worn when handling. Disposable (exam) nitrile gloves may be used when handling dilute concentrations (10% or less). Use of a lab coat is strongly recommended.

- **Eyewear** – given the severe effect of formaldehyde on the eye, normal safety glasses are not recommended for procedures with splash potential. Instead, wear chemical goggles or a face shield when handling formaldehyde to minimize the risk of even a small splash or vapor exposure to the eyes.

- **Respirator** – if a fume hood is used, then a respirator is not needed. If a respirator is needed for special circumstances, you must first contact EH&S (x-8787) to enter the UCSB Respiratory Protection Program to satisfy OSHA requirements.

Other Issues

**Material Safety Data Sheets (MSDS)**  - Per Cal-OSHA, formaldehyde users must know what MSDS are, their relevance to health and safety and how to readily access them. These issues are all covered in the EH&S Lab Safety Orientation. Regular users of formaldehyde should have a hard copy MSDS available - see the EH&S website for electronic MSDS access.

**Chemical Hygiene Plan** – Per Cal-OSHA, formaldehyde/formalin is considered a Particularly Hazardous Substance. Therefore, its safe use must be addressed in a laboratory's written Chemical Hygiene Plan (CHP). Since many safety issues are addressed generically in this document, it can be used as a resource in developing your CHP. Lab supervisors/PIs should contact EH&S at x-4899 if you need an orientation to this requirement.

**Flammability** - Formalin is not a significant fire risk. Formaldehyde gas is highly flammable.

**Chemical Compatibility** - See Material Safety Data Sheet

**First Aid** - For skin and eye contact, use the lab emergency shower/eyewash to immediately flush with plenty of water for at least 15 minutes. Remove contaminated clothing. For serious inhalations, immediately move the person to fresh air and call 9-911 for immediate medical attention.

**Spill, Leak and Disposal** - Place leaking containers in a fume hood. If it can be done safely, clean-up small spills with absorbent material – available in many buildings “spill closet”. For larger spills, leave the area and contact EH&S at x-3194. Like other chemical wastes, all formaldehyde wastes should be disposed of through EH&S. Sink disposal is not legal.

Footnotes:
1. Example: Columbia University was fined $77,000 in 1999 for violations of the OSHA formaldehyde standard.