



Environmental Health and Safety  
**Tufts University Formaldehyde Plan and Standard Operating Procedures (SOP) for  
Formaldehyde, Paraformaldehyde and Formalin**

CAS #: Formaldehyde: 50-00-0, Paraformaldehyde: 30525-89-4

**Formaldehyde, 37% solution NFPA & HMIS ratings: 3 Health, 2 Fire, 0 Reactivity.**

**Paraformaldehyde NFPA & HMIS ratings: 2 Health, 2 Fire, 2 Reactivity.**

**Toxicity:**

Formaldehyde is a colorless gas with a strong, pungent, irritating odor. Formaldehyde is typically sold as in a water solution containing approximately 37%. This is often referred to as “formalin.” In some research labs this solution is diluted to 10% and is called 10% formalin or just “formalin.” Formaldehyde is also available in the polymerized solid form as para-formaldehyde. The precise hazards associated with exposure to formaldehyde depend both on the form (solid, liquid, or gas) of the material and the concentration of formaldehyde present.

Formaldehyde is used as a fixing agent for pathology specimens and as an antiseptic agent and astringent. Solutions may contain 0.1-37% formaldehyde and may release formaldehyde gas into the air under normal conditions of use.

The 37% solution is flammable and has irritant properties including skin and respiratory tract sensitization and it is a potential cancer hazard. It can be toxic by inhalation, ingestion and skin absorption.

It can be absorbed through skin. In contact with skin it may cause irritation and/or burns; cracking, scaling, white discoloration

It may cause eye irritation from vapors, pain, blurred vision. It may cause irreversible damage if splashed in eyes. Formaldehyde contact with the eye can range from transient discomfort to severe, permanent corneal clouding and loss of vision

Formaldehyde has an odor threshold that ranges from 0.05ppm to 1.0 ppm. However, the perception of formaldehyde or formalin by odor and eye irritation becomes less sensitive with time as one adapts to formaldehyde or formalin.

Remember: symptoms develop over time, so adverse effects may not be immediately noticeable. This can lead to overexposure if a worker is relying on formaldehyde's or formalin's warning properties to alert him or her to the potential for exposure

There are common health effects that occur at various formaldehyde concentrations

**General Health Effects of Formaldehyde Exposure\***

**Reported Health Effects Formaldehyde Air Concentrations**

**(ppm)\*\***

Odor threshold 0.05 - 1.0

Eye irritation 0.01 - 2.0

Eye/nose/throat/ 1.0 - 3.0  
respiratory system irritation  
Unable to tolerate prolonged 4.0 - 5.0  
exposures  
Severe respiratory symptoms, 10.0 - 20.0  
difficulty in breathing  
Serious injury to respiratory tract > 50.0  
Death > 100.0

**Regulations:**

OSHA has established exposure limits for formaldehyde. The permissible exposure limit (PEL) for human exposure should not exceed 0.75 ppm for an 8 hour day (time-weighted average). The short term exposure limit (STEL), which is the maximum allowed for 15 minutes/day is and 2 ppm. OSHA has established an action level of 0.5 ppm for an 8 hour day (time-weighted average).

OSHA requires that a regulated area with specific signage and training requirement and a medical surveillance program must be established for those people *who work regularly with formaldehyde above the action level, STEL or PEL.*

1. All employees that handle and process formaldehyde as a solid, liquid or gas must notify Tufts EHS.
2. Tufts EHS will then send an assessment form to determine the chemical form, amount used at any one time and whether it is always used in the fume hood. This is simple 3 question form, can also be found at the end of this SOP.
3. If the person does not use a fume hood and the amount of chemical exceeds 1 gram at any one time, then personal air sampling will be completed under worst case conditions to assess potential overexposure.
4. If the person is overexposed, then controls must be implemented and the person becomes part of the Formaldehyde Safety Plan (FSP) requiring occupational medical surveillance.

**Good Practices and Personal Protective Equipment (PPE):**

Formaldehyde can be used with little risk to health if used properly.

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.

University labs are well ventilated, but area ventilation may not be enough depending on the nature of the work and concentration of solutions. Work within a fume hood or use another form of localized exhaust (e.g., downdraft table, snorkel, Biosafety cabinet BSC) whenever possible, especially when:

- mixing or transferring solutions,
- working with high concentrations or large volumes in open containers,
- aerosolizing solutions,
- heating solutions, or

- spreading solutions over large surface area.
- Dilute solutions (<4% formaldehyde) may be used on the benchtop in small quantities.
- Handle paraformaldehyde powder (and, preferably, granules or flakes) only in a chemical fume hood. If you are weighing paraformaldehyde powder and the balance cannot be located in a fume hood or BSC, tare a container then add powder in the hood and cover before returning to the balance to weigh the powder.
- Keep solutions and contaminated media in closed containers.
- Use in the smallest practical quantities for the experiment being performed.
- If there is any possibility that an employee's eyes may be splashed with solutions containing 0.1 percent or greater formaldehyde, an eyewash/drench hose must be available within the immediate work area for emergency use.
- Labs handling moderate to large quantities of formaldehyde-containing solutions on a regular basis should contact EHS for assessment of exposure. Areas that handle only small (100 ml or less) pre-filled specimen containers, or that work with formaldehyde-containing solutions exclusively in a functioning chemical fume hood, would have low potential for overexposure, but should contact EHS if there are concerns.
- Once work with formalin/paraformaldehyde is complete, wipe down area with a soap and water solution.
- Have a lab specific SOP covering Formaldehyde or Formalin use.
- Buy in quantities which can be used up in < 6 months
- Use non-hazardous alternatives whenever possible

### **Protective Equipment**

- Safety glasses or splash-proof goggles if there is a risk of splashing.
- Lab coats (recommended)
- Wear appropriate gloves (Nitrile is recommended, latex may be used for dilute solutions but should be changed if splashes occur). Nitrile gloves are recommended, breakthrough time >360 min. Rubber/latex breakthrough time is only 10-15 min.
- Inspect all PPE prior to use. Check all PPE for cracks, degradation, discoloration, or holes
- Change gloves frequently. Just because the breakthrough time is >360 min doesn't mean you should use one pair of gloves for 6 hours. If you are using latex be aware if you splash any on your hands and change gloves.
- DO NOT REUSE disposable gloves.
- Store PPE away from sources of formaldehyde or formalin. Formaldehyde vapors can permeate the lab coat or glove material, reducing its barrier-properties
- Wash hands after handling, whenever you leave the lab, and always before eating.
- Don't wear PPE (gloves, scrubs, lab coat) *outside* of the lab/work area.

### **Transportation and Storage**

- Solutions with over 25% formaldehyde are flammable and should be stored in a flammables cabinet. Concentrations below 25% are no longer flammable.
- Transport formaldehyde solutions in secondary containment, preferably a polyethylene or other non-reactive acid/solvent bottle carrier.

- Keep container in cool, well-ventilated area.
- Keep container tightly closed and sealed until ready for use.
- Store in secondary containment with flammables, away from oxidizers, reducing agents, metals, and acids.
- Keep containers of paraformaldehyde (PFA) solid away from water.
- Avoid storing on the floor.

### **Labeling**

All containers of formaldehyde or formalin must be labeled with the word “Formaldehyde or Formalin” and the concentration. This includes:

- Stock solutions whose concentrations are 10 % > and < 37 %
- Working solutions
- Specimens preserved in formalin.

### **Spills:**

If you spill a small amount (minor spill) of Formaldehyde, paraformaldehyde and formalin notify your supervisor for cleanup assistance. A major spill is any amount of chemical that the lab staff cannot easily and safely clean up without outside assistance. In this case, vacate the lab and call your supervisor and TUPD at 617-627-6911 or x6-6911 from a Tufts Campus phone.

Employees in the area should be prepared to clean up minor spills, including most spills confined to the chemical fume hood. Wearing double nitrile gloves, splash goggles, face shield and lab coat, use absorbent pads to absorb spilled material. For small spills of solid PFA, dampen the absorbent pad with methanol before placing over the spilled material and allow to sit for a few minutes before wiping up. After spill has been completely absorbed, wash down contaminated area with soap and water at least two times. Contaminated PPE and clean-up materials must be placed in a clear plastic bag or compatible container for pick-up by EHS.

### **Accidents/Exposures:**

**If inhaled** and there is respiratory irritation associated with exposure, remove all persons from the contaminated area. **In case of skin contact** take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. **In case of eye contact** rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. **If swallowed** do NOT induce vomiting.

For any accident involving a formaldehyde exposure you should consult a physician and report all work related accidents, injuries, illnesses or exposures to your supervisor who should complete an accident incident form. More information and these forms can be found at:

<http://publicsafety.tufts.edu/ehs/accident-and-incident-reporting-at-tufts-university/>

### **Disposal:**

Formalin and paraformaldehyde solutions and powders must be disposed of as chemical waste following the standard guidelines while accumulating wastes and awaiting chemical waste pickup. Make sure the waste bottle is fitted with a proper screw cap and notify the TEHS for disposal.

### References:

- SDS for Formaldehyde, paraformaldehyde and formalin, Sigma Aldrich.
- Genium's handbook of safety, health, and environmental data for common hazardous substances. 1999.
- Krister Forsber, S.Z Mansdorf. *Quick Selection Guide to Chemical protection Clothing 3<sup>rd</sup> edition*. 1997.
- OSHA Fact Sheet Formaldehyde.  
[https://www.osha.gov/OshDoc/data General Facts/formaldehyde-factsheet.pdf](https://www.osha.gov/OshDoc/data%20General%20Facts/formaldehyde-factsheet.pdf)
- OSHA Safety and Health Topics: Fomaldehyde.<https://www.osha.gov/SLTC/formaldehyde/>
- OSHA Regulations. 29 CFR, 1910-1048. Occupational Safety and Health Standards, subpart Z. Toxic and Hazardous Substances: Formaldehyde.  
[https://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10075](https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10075)
- 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)

### Useful Formalin and Paraformaldehyde Links:

- <http://www.cdc.gov/niosh/docs/81-111/>
- <http://www.cdc.gov/niosh/topics/formaldehyde/>
- <http://www.cdc.gov/niosh/npg/npgd0293.html>

### Formaldehyde Assessment Form:

- 1) What form of formaldehyde do you purchase?
  - a. Liquid formaldehyde (please provide concentration that you typically purchase).
  - b. Solid paraformaldehyde
  - c. Formaldehyde gas
  
- 2) Do you always work with this form of formaldehyde in a fume hood?
  
- 3) Please list the amount and concentration that is used at any one time.