Formaldehyde and Formalin Fact Sheet

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. Formalin is typically 37% formaldehyde by weight (40% by volume) and 6-13% methanol by volume in water. **The 10% Neutral buffered formalin used at the VHSO laboratory contains 3.7% formaldehyde by weight**. Formaldehyde is commonly used in tissue fixing and preservation, disinfection and as an organic chemical reagent.

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 indication of safety.

Exposure Hazards of Formaldehyde

Acute (Short-Term, Immediate) Effects of Exposure

- **Low Exposure Levels (0.1-5 parts per million):** Burning, tearing of eyes; skin irritation.
- **Moderate Exposure Levels (10-20 ppm):** Burning of eyes, nose and trachea; severe coughing; severe difficulty breathing; and intense tearing of eyes. Above 20 ppm can cause permanent clouding of the cornea.
- **High Exposure levels (50-100 ppm):** Tightening in the chest; irregular heartbeat; severe headache; pulmonary edema (fluid in the lungs); inflammation of the lungs; possibly even death.
- **Concentrations of 100 ppm** are immediately dangerous to life and health (IDLH).

  Note: The National Institute of Occupational Safety and Health (NIOSH) considers 20 ppm of formaldehyde to be IDLH.

Chronic (Long-Term, Delayed) Effects of Exposure

- **"Sensitization"**: Some workers may be especially sensitive to formaldehyde and may develop an "allergic" reaction to very low-level exposures. This is called "sensitization" and can occur suddenly, even after an employee has worked with formaldehyde for years with no reaction.
- **Eczema**: Workers exposed to formaldehyde solutions or resins can develop eczema (flaking and itching skin), which may involve the eyelids, neck, hands, arms, armpits and scrotum. The condition may also be caused by contact with clothing contaminated with formaldehyde.
- **Dermatitis**: Contact with formaldehyde or contaminated clothing can also cause a severe form of skin disease called "dermatitis." Dermatitis may range from simple

reddening of the skin to severe cracking and blistering. Prolonged exposure may cause the fingernails to turn soft and brown-colored.

- **Eye Damage**: Direct contact with the eye will cause severe burning and tearing, and may damage the cornea.
- **Cancer**: Formaldehyde is known to cause nasal cancer and may be associated with other respiratory cancers and cancer of the brain. The National Institute for Occupational Safety and Health (NIOSH) has recommended that formaldehyde be treated as a potential human carcinogen. The American Conference of Governmental Industrial Hygienists (ACGIH) also calls formaldehyde a suspected human carcinogen.
- **Reproductive System**: There is also evidence that women workers exposed to formaldehyde experience menstrual disorders. Other studies have found that formaldehyde can damage the genetic make-up of certain cells, which means it may cause birth defects.

Legal Limits for Exposure (OSHA 29 CFR 1910.1048)

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 (8 hr time-weighted average)

What does Action Level mean? The trigger for increased industrial hygiene monitoring and initiation of worker medical surveillance. Monitoring must continue until the results of two consecutive sampling periods taken at least 7 days apart show the exposure level has been reduced to below the action level.

Each employee assigned to the following job classifications will have an 8hr baseline exposure sampling: pathologist, histotechnician, histotechnologist, cytotechnologist, autopsy assistant, and microbiologist. Formaldehyde monitoring must be repeated any time there is a change in production, equipment, process, personnel, or control measures.

Medical Surveillance

Physical symptoms such as respiratory irritation or dermatitis should be an alarm that an employee is being overexposed to formaldehyde. A physician who knows the complete background of the nature of the worker's exposure should perform an examination. Monitoring of the employee's condition should continue as any treatment program is carried out. In addition, any other employees who may also be exposed to formaldehyde in the workplace or may show any symptoms of exposure to formaldehyde should be examined. Medical examinations should be performed on an annual basis with special emphasis on the skin and the respiratory tract, and should include a medical history.

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Controlling Exposures

Engineering Controls

- Local Exhaust Ventilation: formaldehyde is removed from the worker's breathing area. Laboratory work with formalin or specimens preserved in formalin should be done under a fume hood.

- General Dilution Ventilation means providing at least 10 room air exchanges per hour to keep air moving in a work area and capture velocity of at least 100 feet per minute.

Work Practice Controls

All work practice procedures should aim to prevent contact with formaldehyde and reduce exposure to vapor to the lowest reasonably obtainable level.

- Solutions should be poured from the container by a method that will prevent employee contact with the solution and reduce exposure to formaldehyde vapors.

- Formalin should be stored in tightly closed containers in a cool, secure area and properly labeled.

- Keep formalin baths under a fume hood where possible, open lids only as long as it takes to complete your task.

- Avoid skin contact; use appropriate PPE when handling formalin.

Protective Clothing and Equipment

- Skin protection—Heavy duty waterproof gloves if contact with formaldehyde likely; nitrile gloves if contact is unlikely; impervious aprons and other protective clothing must be worn whenever formalin is handled.

- Eyewear—Splash proof goggles or safety glasses with full face shields must be worn wherever there is potential for formaldehyde solution to contact the eyes. Mounted safety shields may also be used.

Personal Hygiene

Workers should wash thoroughly, any areas of the body which may have come in contact with formaldehyde:

- After exposure and at the end of the workday
- Before lunch breaks and rest periods
- Before eating, smoking or using toilet facilities

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Other Issues

Safety Data Sheets (SDS)—Formaldehyde users must know what SDSs are, their relevance to health and safety and how to readily access them.

Flammability—Formalin is not a significant fire risk. Formaldehyde is flammable and explosive but only in higher concentrations. Explosive concentrations may build up in improperly ventilated storage rooms and fume hoods. Formaldehyde should NEVER be stored near or used with hydrochloric acid because the two chemicals combine to form bis Chloromethyl Ether BCME), a very powerful cancer-causing agent.

First Aid

Eye Contact: Immediately flush the eyes with large amounts of water for at least 15 minutes. Do not allow victim to rub eyes or keep eyes closed. Seek medical attention immediately.

Skin Contact: Immediately flush the contaminated skin with soap and water for at least 15 minutes. If formaldehyde penetrates clothing, immediately remove the clothing and flush the skin with soap and water for at least 15 minutes. Promptly seek medical attention if symptoms are present after washing.

Inhalation: Move the exposed person to fresh air at once. Give oxygen if available or perform rescue breathing if not breathing. Get medical attention if symptoms persist.

Ingestion: Rinse mouth. DO NOT induce vomiting. Get medical attention immediately.

Spills, Leaks, and Disposal

All spills should be cleaned up immediately, regardless of size.

Large spill (37% Formaldehyde): Greater than ¼ cup or 100 milliliters. Immediately turn off ignition sources. All personnel should evacuate the immediate area. Close all doors to contain vapors. Notify medical center safety and PLMS supervisor. Cleaning major spills must be done by a trained operator wearing appropriate respiratory equipment.

Note: If spill occurs in histology on the cutting table, the person in the area should flush the table with the water wash and then proceed with his work.

Small spill (37% Formaldehyde): Less than ¼ cup or 100 milliliters. Use proper personal protective equipment. Absorb spill with absorbent sand or Spill-X-FP, Formaldehyde Polymerizer Spill Treatment Agent. After the formaldehyde solution is removed, the spill area and the cleanup supplies should be rinsed thoroughly with large amounts of cold water. Formaldehyde waste should be disposed of by the medical center safety office.