UNIVERSITY OF VICTORIA
Occupational Health, Safety and Environment

Chemical Safety – Special Hazards

Safe Work Procedure (SWP – 013)

Formaldehyde

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REVISION HISTORY

	Revision Date	*Author*	*Position*
1.	November 24, 2023	Paraskevi Lagaditis	OHSE consultant

DOCUMENT APPROVAL

Approved by: Laboratory Safety Committee

Jody Spence	November 24, 2023
Chair, Laboratory Safety Committee	*Date Approved*

**This revision replaces all previous versions of this document. If a copy is printed, it is the users' responsibility to verify the copy is the most current version of the document.*

University of Victoria

PURPOSE

To provide guidance and instruction of the safe use in laboratories of saturated solution or solid precursors of formaldehyde. In addition to this general Safe Work Procedure (SWP), each lab must develop a lab-specific work procedure unique to the experiments and activities being performed. The Lab SWP must be reviewed by OHSE (see Procedures, #7).

SCOPE

The SWP applies towards the handling, destruction and disposal of formaldehyde containing materials used in laboratories.

TRAINING

The following training is required to be completed prior to being permitted to prepare and work with formaldehyde and related precursors:

- WHMIS
- Lab Safety for Lab Workers
- Biosafety for Lab Workers
- Lab SWP with documented signoff by the individual and their supervisor.

Refresher training in the General and Lab SWP must be provided when:

- there has been an extended timeframe of inactivity, or
- there has been an incident or injury, or
- 2 years has elapsed since the original training

REGULATION AND POLICY

The University of Victoria will follow WorkSafeBC Occupational Health and Safety Part 30 and the University of Victoria Occupational Health, Safety & Environment Department.

RESPONSIBILITY

It is the responsibility of personnel undertaking activities with special hazards to complete all required training and adhere to these safe work procedures, including any additional lab or job-specific procedures.

It is the PI's or supervisor's responsibility to ensure that individuals working with special hazards have been trained prior to commencing work and have demonstrated competency in safely performing all duties associated with ethidium bromide in accordance with these procedures.

DEFINITIONS & ABBREVIATIONS

FS – formaldehyde solution

PFA – paraformaldehyde, a polymerized form of formaldehyde

Formalin – an aqueous solution of formaldehyde and methanol

SDS – safety data sheet

BSC – biosafety cabinet

MATERIALS

Spill X-FP is a proprietary powder available for FS spills by forming a polymer solid so that formaldehyde is no longer able to evaporate into the surrounding work area. Application of Spill X-FP to concentrated FS spills will solidify the solution and form a plastic-like material (polynoxylin). The resulting polymer solid can be quickly and easily removed. In the case of dilute (<15%) formaldehyde (formalin) spills solidification is slow or will not visibly occur and the treated spill will still be a liquid. Nevertheless, application of Spill-X-FP to dilute FS spills will still induce formaldehyde polymerization and inhibit formaldehyde vapours. The amount of Spill X-FP required to polymerize formaldehyde is dependent on concentration – for example one commercial shaker bottle of Spill X-FP (0.84 kg) is effective against a 0.73 L spill of 37% FS or a 7.33 L spill of 4% FS.

HAZARD

Formaldehyde has many uses in industry and research such as an embalming agent, a fixating agent, a nucleic acid denaturant or as an organic chemical reagent. Formaldehyde is a regulated carcinogen and most common exposures for lab personnel are from inhalation or direct skin or eye exposure. Pure formaldehyde is a gas but for practical use, formaldehyde is available as a saturated aqueous solution. Aqueous solutions of formaldehyde are also known as formalin. Formaldehyde aqueous solutions are available in various concentrations as high as 37% or as low as 3.5% and typically contain methanol (1-6%) to inhibit polymerization. A methanol-free alternative called paraformaldehyde (PFA) is also available where formaldehyde is obtained *in situ* by gently heating the solid PFA in an aqueous or buffered solution. PFA is a flammable solid that has a slight odour of formaldehyde and care must be taken when storing and heating.

PROCEDURE

1. Handling

a. Review and familiarize the SDS of FS or PFA prior to use
b. Always wear nitrile gloves, lab coat and safety glasses when handling FS or PFA.
    i. Wear two pairs of disposable nitrile gloves or one pair of non-disposable butyl gloves when there is a significant risk of contact from:
        - Handling concentrated FS
        - Handling specimens in FS
        - Extended handling periods
        - Immersion of the hands is anticipated
c. Handle and/or dilute concentrated (>4%) FS or PFA only within a fume hood, not within a BSC
    i. Always use a secondary container when handling concentrated (>4%) FS
d. Small quantities of dilute FS (<4%) may be used outside of a fume hood, within a BSC, under an extraction arm/snorkel, or on a downdraft table.
e. Use a secondary container or absorbent material/pads on work surface
f. Avoid ignition sources
g. Weigh PFA by either
    i. Bring the scale in the fume hood to weigh, or
    ii. Tare an empty container on the bench and load PFA in to the tared container within a fume hood.
h. Use the smallest practical quantities for the experiment being performed
i. Keep containers closed and sealed until ready for use

j. When fixing cells inside a BSC
    i. Close the plates immediately after dispensing FS or PF
    ii. Wait 5 min
    iii. Transport the plates within a secondary container to a fume hood to continue with experiment.

2. Storage

a. Store concentrated (> 4%) stock bottles or hazardous waste solutions of FS or PFA in secondary containment within a flammable cabinet
b. Store diluted pre-measured formaldehyde solution in a fridge or freezer.
c. Do not store formaldehyde solutions or PFA with oxidizing agents, reducing agents, metals or acids
d. Store PFA solid away from water

3. Spills

a. Follow OHSE's general spill response instructions
b. Do not attempt to clean up any spill if not trained. Seek assistance or call Campus Security (250-721-7599)
c. Specific steps for spills within a fume hood
    i. FS of PFA liquid spills without Spill X-FP
        - Don personal protective equipment, nitrile or butyl gloves, safety glasses, lab coat and closed toe shoes
        - Cover spill with absorbent spill pads
        - Collect spill pads and double bag
        - Soak area with detergent, then rinse with water
        - Collect and double bag all hazardous waste clean up materials
        - Label and submit for disposal through the hazardous waste system indicating the material is "Formaldehyde contaminated debris"
        - Store bagged hazardous waste temporarily in a fume hood or flammable cabinet

    ii. FS or PFA liquid solution spills with Spill X-FP
        - Don personal protective equipment, nitrile or butyl gloves, safety glasses, lab coat and closed toe shoes
        - Encircle the spill with Spill X-FP powder agent to prevent the spill from spreading
        - Cover the spill with Spill X-FP agent
            a. The more concentrated the FS is, the more Spill X-FP is required
            b. One 0.84 kg Spill X-FP agent container is effective for a 0.73 L spill of 37% FS or a 7.33 L spill of 4% FS.
        - Wait for 30 minutes, exit the lab if necessary.
            a. Concentrated FS spills will produce a solid sludge
                - Polymerization will be evident within 5 minutes and will be hot (up to 55 °C)
                - Wait until solid sludge has cooled before cleaning up
            b. Dilute FS or PFA spills will appear as a cloudy solution

- No solidification will be evident
- The solution mixture will be warm (~40 °C)
- Wait until solution has cooled before cleaning up

- Scoop the solid sludge into an appropriately sized plastic (polyethylene or polypropylene) container or bucket
    a. For dilute spills (<10% FS), simply cover with absorbent spill pads
- Wipe up residue with an absorbent spill pad
- Soak the area with detergent, then rinse with water
- Collect and double bag all hazardous waste clean up materials/debris
- Label and submit for disposal through the hazardous waste system indicating the material is “Spill X-FP formaldehyde spill waste”

iii. Solid PFA spills

- Wet absorbent pad or paper towels with water
- Lay wetted absorbent pads over powder spill
- Wipe up spill with the wetted absorbent pads
- Soak area with detergent, then rinse with water
- Collect and double bag all hazardous waste clean up materials
- Label and submit for disposal through the hazardous waste system indicating the material is “Paraformaldehyde contaminated debris”
- Store bagged hazardous waste temporarily in a fume hood or flammable cabinet

d. Specific steps for spills outside of a fume hood:
    i. Secure the area and warn others.
    ii. Immediately evacuate the area.
    iii. Post “do not enter” signs on the doors of the lab.
    iv. Contact Campus Security at 250-721-7599.
e. Complete a *Department Incident & Investigation Report* to document and review the spill incident.

4. Decontamination

a. Rinse labware in contact with FS or PFA solutions with water and collect washings for FS or PFA hazardous waste disposal
b. Wipe down work area with a soap and water solution

5. First Aid and Emergencies

a. Call 911 to summon an ambulance if there is a medical emergency.
b. Call Campus Security at 250-721-7599 for first aid.
c. If material has contacted the eyes, use emergency eyewash and flush for at least 15-20 minutes.
d. For skin contact, flush affected area with running water for at least 15-20 minutes.
e. For inhalation, move immediately to fresh air and seek medical attention immediately.

6. Waste Disposal

a. Dispose excess FS or PFA solutions in the OHSE provided 10L or 20L "Formaldehyde/Alcohol" hazardous waste container.
    i. Store hazardous waste containers in a flammable cabinet
b. Dispose pads after completion of tasks
c. Dispose all contaminated disposable labware and PPE into the toxic solid waste container.
d. Dispose FS or PFA solutions that may contain tissue and/or blood in red anatomical pails for incineration.

7. Lab SWP

In additional to this general SWP, each lab that is using FS or PFA requires a Lab SWP that includes specific procedures:

a. Preparation of FS or PFA solution
b. Maximum quantities permitted
c. Decontamination.
d. Disposal methods.
e. Spill response.

REFERENCES

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