

Standard Operating Procedure for Working with Caustic Chemicals Other Than Hydrofluoric Acid

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1 INTRODUCTION:

This document describes the safety requirements that laboratory workers and supervisors must follow when caustic chemicals are used in UPEI laboratories. Its purpose is to minimize risks to the health of UPEI laboratory workers.

2 SCOPE:

This Standard Operating Procedure (SOP) is under the control of the UPEI Health and Safety Advisor and may be downloaded from the UPEI Health and Safety Website.

This SOP is appropriate for the handling of most corrosive and caustic chemicals in UPEI Laboratories.

These chemicals include acids such as sulfuric, hydrochloric, nitric and glacial acetic and bases such as ammonia, sodium hydroxide and potassium hydroxide.

This document is intended to inform laboratory workers about the health and physical hazards of caustics, including the difficulty of rinsing caustic substances from tissues, and the ability of these chemicals to inflict irreversible damage to the eyes.

A laboratory worker with a chemical background should be able to read and understand this SOP in about 1 hour.

Laboratory Supervisors should use this SOP as a part of Site Specific training by following *SOP2.103 Site Specific Training Using UPEI Safety SOPs*.

This SOP is meant to compliment, but not to replace, other classes of SOPs which are required in UPEI laboratories (such as those related to equipment use) and which must also contain relevant safety information and/or references.

Hydrofluoric acid has unique health and physical hazards and requires special handling not described in this SOP.

3 SAFETY RISKS:

Failure to follow this SOP may result in irreversible eye damage, damage to the respiratory system and/or severe skin injuries.

4 DEFINITIONS:

Acids: Refers to substances that disassociate in aqueous solutions to form Hydrogen ions. Concentrated acids such as glacial acetic acid and sulfuric acid are corrosive and cause severe burns and tissue damage.

Alkalis: Refers to a specific type of base formed from an alkali element such as sodium and potassium hydroxide. Since most common bases are alkalis, the term alkali is often erroneously used to refer to all bases

Bases: Substances that react with Hydronium ions H_3O^+ such as ammonia and sodium carbonate.

Caustics: meaning "to burn" or "burning", refers to an acid or a base that 'eats away', corrodes or chemically burns other materials. Caustic substances are harmful to living tissue

Corrosives: A corrosive is a chemical, solid, liquid, or gas, capable of irreparably harming living tissues or damaging material on contact. Corrosive chemicals include acids and bases. Some corrosive chemicals such as anhydrides are classified under "Dangerously Reactive Chemicals" and are covered in SOP5.105.

Laboratory workers: Refers to all permanent and temporary UPEI employees, students, faculty and visitors who make use of UPEI laboratory space.

5 RESPONSIBILITIES:

Laboratory Supervisors are required to provide laboratory workers with written standard operating procedures for all hazardous processes using caustic chemicals.

Laboratory Supervisors are responsible to verify that all laboratory workers who work with caustic chemicals have been educated in relevant safety issues.

Laboratory Supervisors are responsible to document and maintain a list of laboratory workers who have had safety training for working with caustic substances, and for checking that only appropriately trained individuals are allowed to work with these chemicals in the areas under their supervision.

Laboratory Supervisors should follow SOP2.102 for documenting safety training records.

Laboratory Supervisors are responsible for ensuring that adequately ventilated areas are available for operations utilizing caustic chemicals.

Laboratory Supervisors are required to provide workers with any necessary personal protective equipment.

All laboratory workers who work with caustic chemicals must be satisfied that they have received sufficient education in safety techniques including: use of personal protective equipment; knowledge of potential hazards; use of spill kits; and appropriate emergency procedures, before working with these chemicals.

Before performing any procedure using caustic chemicals an employee must read and be satisfied that they understand the SOP associated with that procedure.

All laboratory workers are required to use due diligence in working with caustic chemicals..

Additional responsibilities for supervisors and workers are defined in the UPEI Laboratory Safety Manual Chapter 2

6.0 REQUIRED SUPPLIES:

FUME-HOODS. A fume-hood shall be used when pouring out concentrated acids and bases.

GLOVES. Gloves shall be worn whenever acid and alkali solutions are handled. Lightweight PVC gloves should be sufficient to prevent incidental contact with dilute solutions. Heavy nitrile, or other impervious gloves shall be worn whenever concentrated solutions are dispensed. Discard gloves if any holes or leaks develop.

EYE AND FACE PROTECTION Splash-proof chemical goggles or safety glasses with side shields and face shields are required when dispensing or handling concentrated acids and bases. Safety glasses are required when using or handling more dilute acid or alkali solutions.

PROTECTIVE CLOTHING. A lab coat is required when working with caustics.

SPILL MATERIALS Neutralizing and absorbent materials must be readily accessible. Liquid neutralizers that change color when the acid or base are neutralized are easier and quicker to use than powder neutralizers especially for small spills < 100ml.

EXAMPLES:

- 1) Liquid Acid Neutralizer: KOLOR-SAFE: 1L Fisher Cat#19-021-888
- 2) Liquid Base Neutralizer: KOLOR-SAFE: 1L Fisher Cat#19-021-890

7.0 GENERAL PROCEDURES:

- 1) Laboratory procedures should be adapted, whenever possible, to use diluted, rather than concentrated solutions of acids and bases.
- 2) MSDS sheets must be read prior to the initial use of the chemical.
- 3) Caustics, except for acetic acid and formic acid must be stored away from flammable solvents

- 4) Work with concentrated acids and bases must be performed under a fume-hood
- 5) When diluting strong acids and bases, add them slowly to the water.
- 6) The analyst must wear a lab-coat, gloves and eye protection when pouring concentrated acids or bases.
- 7) Work with diluted solutions should be performed in a fume-hood whenever possible.
- 8) In cases where it is not possible to use a fume-hood when working with diluted solutions, the analyst must still work to ensure that their exposure and their co-workers exposure is minimized.
- 9) Ensure that adequate spill kits and absorbent material are available before initiating work
- 10) Ensure that an eyewash station is located nearby.
- 11) If it is necessary to mix strong acids and bases (eg adding Hydrogen peroxide to Nitric acid) extreme care must be used due to the powerful reaction which will generate substantial amounts of heat and splashing.
- 12) Any unattended containers must be labeled according to WHMIS workplace labeling instructions.

8.0 STORAGE

- 1) Acetic acid and formic acid should be stored with flammable liquids (pg 29 ref 2), because they are flammable and react dangerously with other acids.
- 2) Cap acid and alkali containers securely and store them on low shelves to minimize the risk of accidental breakage.
- 3) **DO NOT** store strong acids and strong bases together. If an accident results in rupture or breakage of the containers and they come into contact, they will react violently.
- 4) **DO NOT** store oxidizing corrosive materials including nitric acid and bleach, together with flammable solvents.

9.0 TRAINING:

All laboratory workers are required to have up to date WHMIS and a site specific safety orientation.

All laboratory workers must be made aware of and have easy access to the UPEI Health and Safety Policy and the UPEI Laboratory Safety Manual

The supervisor shall supply this procedure to laboratory workers, verify that they understand it through either an oral or a written Quiz (SOP2.103), and document this process, before the laboratory workers are authorized to work with caustic chemicals in UPEI laboratories.

10.0 SPILL PROCEDURES:

1. Refer to the product Material Safety Data Sheet, and the instructions on spill kits, before using the chemical to understand proper spill clean-up procedures.

Do not attempt to clean up any large spills (eg > 1L concentrated HCl), especially if the vapors from the spill result in noticeable eye or respiratory irritation. For these spills, restrict access to the spill area and dial 0384.

GENERAL

Small spills may be cleaned up by the person who caused the spill.

- 1) Do not attempt to clean up spills without gloves, eye, and face protection.
- 2) Caustic chemicals may contaminate footwear during cleanup of a spill. In these cases obtain shoe coverings or rubber boots.
- 3) Contain the spill and neutralize with an appropriate neutralizing agent.
- 4) Scoop or wipe up the spill and place in a suitable container.
- 5) Sponges used to absorb the rinse water should be added to the spill clean-up wastes.
- 6) Paper towels may be used to wipe up dilute acids and bases. Strong caustics may cause oxidation and heating of organic materials such as paper.
- 7) Label the waste container(s) and follow the Hazardous waste disposal guidelines.

11.0 FIRST AID PROCEDURES:

- 1) Any splash or exposure of the skin should be immediately, thoroughly flushed for 5 - 15 minutes. Do not allow contaminated clothing to remain in contact with the skin.
- 2) If skin irritation or dermatitis develops, the affected individual should be sent to a Medical Facility.
- 3) In the event of eye contact, 15 minutes of flushing with water is required. This is especially important with bases, which soak down deep into tissues. The affected individual will likely require assistance to hold the eyelids open during the flushing. If any eye contact with caustic substances has occurred, the affected individual should be examined by a medical doctor.
- 4) If an individual has lost consciousness, dial 0384 for emergency assistance.
- 5) In the event of ingestion and the victim is still conscious have the victim rinse their mouth out with water and call the **Poison Control Center 1-800-565-8161**. (They may direct you to give milk, water, or activated charcoal to help soak up toxins, or syrup of ipecac to induce vomiting). **DO NOT** give anything by mouth unless instructed to do so by the poison control center, or by a physician

12.0 WASTE DISPOSAL PROCEDURES:

Place wastes into clearly labeled, appropriate containers for Hazardous waste disposal. Do not mix different kinds of acids together unless instructed to do so by the supervisor. Acids or alkalis may be neutralized, by an experienced laboratory worker using a fume-hood and proper personal protective apparel. The neutralized solution may be disposed after cooling, by pouring down a sink.

13.0 REFERENCES:

- 1.HALE, J. R. Inherent Safety and Pollution Prevention Strategies for the Analytical Laboratory. Managing the Modern Laboratory Vol. 6, No. 4, 2004
- 2.THOMAS, P., ECKMANN A., Standard Operating Procedure for Caustics Other Than Hydrofluoric, Plasma Science and Fusion Center, MIT
- 3.SHEMATEK, G; WOOD, W. Laboratory Safety Canadian Society of Laboratory Technologists Guidelines 4th ed. 1996
- 4.FURR, KEITH A., CRC HANDBOOK OF LABORATORY SAFETY, 5th Edition, CRC Press, Boca Raton 2000.

14.0 ADDITIONAL INFORMATION:

The cleaning solution formed by adding sulfuric acid to sodium dichromate is a very strong oxidant which can violently react with organic matter. It ignites on contact with alcohol or acetic acid, and containers involved in fires may explode violently. Severe, slow-healing burns are caused by contact with sulfuric acid/sodium dichromate solution. When the work has been completed and personal protective equipment has been removed, wash hands thoroughly with soap and water. If a spill occurs, clean it up immediately in accordance with procedures described in this document. Note that laboratory furnishings (e.g., benches and sinks) sold as "acid resistant" withstand an acid spill unscathed for only a few seconds.

15.0 COMMENTS AND SUGGESTIONS:

16.0 QUESTIONS ON CAUSTICS: These questions should be used by supervisors for assessing laboratory workers safety skills by following SOP2.102 *Site Specific Training Using UPEI Safety SOPs*.

1. What happens if you mix a base and an acid together?
2. Where should caustics and acids be stored?
3. Where are the spill kits for caustics kept in your area?
4. Describe how you would use a spill kit to clean up a spill of 100ml of Hydrochloric acid.
5. What would you do if a coworker splashed Ammonia Hydroxide into their eyes?
6. Where should glacial acetic acid be stored?
7. Where are the eyewash stations in your Area?
8. Where would you find the phone number to the poison control center in an emergency?
9. What PPE should you wear when working with caustic chemicals?
10. What would you do if there was inadequate ventilation in an area where you were told to work with caustic chemicals?

Signature (Primary Author) _____ Date

Signature: Health and Safety Advisor _____ Date

REVISION NUMBER: _____

Effective Date