Corrosives

STANDARD OPERATING PROCEDURE (SOP)

Type of SOP: ☐ Process ☐ Hazardous Chemical ☒ Hazardous Class

All personnel who are subject to these SOP requirements must review a completed SOP and sign the associated training record. Completed SOPs must be readily accessible to laboratory personnel. Electronic access is acceptable. SOPs must be reviewed, and revised where needed, as described in the CSUS Chemical Hygiene Plan. Note that not all hazardous chemicals are appropriately addressed in a single control-banded SOP, and some chemicals are subject to several control-banded SOPs. Unique properties of each chemical must be considered before including it into a control band.

Date SOP Written: _____ Approval Date: _____

SOP Prepared by: _____

SOP Reviewed and Approved by (name/signature): _____

Department: _____

Laboratory Supervisor/Principal Investigator: _____

Email: _____ Phone: _____

Emergency Contact(s): _____ Phone: _____

_____ _____

_____ _____

_____ _____

Location(s) covered by SOP: Building (s): _____

Room #(s): _____ Lab Phone: _____

1. HAZARD OVERVIEW

Corrosive substances cause immediate destruction of living tissue and other materials (*e.g.*, metals) by chemical action at the site of contact and can be solids, liquids, or gases. Corrosives are most hazardous to the eyes, as direct exposure may cause blindness in a matter of seconds. Corrosive gases, dust from solids, or aerosolized/evaporated liquids can be inhaled and cause serious damage to mucous membranes and the airways. Corrosives can generally be identified using the Globally Harmonized System Hazard Codes: H290, H314, and H318.

2. HAZARDOUS CHEMICAL(S)/CLASS OF HAZARDOUS CHEMICAL(S)

Most Corrosives fit under the categories of strong/oxidizing, concentrated organic acids, and strong bases.

A. Strong/Oxidizing Acids

Most strong acids are liquids and are most likely to cause immediate pain when they come in contact with the body.

Ex: Nitric Acid (70 %) and Hydrochloric Acid

B. Concentrated Organic Acids:

Ex: Formic and Acetic acid (glacial)

C. Strong Bases

Solid bases, when dissolved in water, can cause serious damage to eyes and skin by their Corrosive action. Fine dust from almost any solid base can cause severe damage to the eyes, upper respiratory tract, and lungs. Fine dust can also cause skin irritation, particularly to damp skin. Contact with strong bases usually goes unnoticed as immediate pain does not always occur. This allows the base time to react with the body part and serious injury may result.

Ex. Potassium and Sodium Hydroxide

D. Other Corrosives

These materials vary widely and a chemical-specific SDS should be consulted prior to use. In case of exposure, the seriousness of the injury depends on such factors as the type and concentration of the chemical, the body parts contacted, and the duration of exposure.

Bromine, hydrogen peroxide (>30%), and most amines are examples of highly Corrosive liquids. Examples of common Corrosive solids include phosphorus and alkali metals. Strong dehydrating agents, such as phosphorus pentoxide and calcium oxide, have a powerful affinity for water and can cause serious burns upon contact with skin.

Ex: Phenol, dehydrating agents, and metal halides

REQUIRED - List (or attach) the applicable chemical(s) for your laboratory, and describe important properties and signs/symptoms of exposure.

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3. ENGINEERING/VENTILATION CONTROLS

The following is a general plan for all strong Corrosives:

A. Use containment devices (*e.g.,* chemical fume hoods, glove boxes, localized exhaust ("snorkel"), etc.) when:
   i. Using volatile and/or semi-volatile substances;
   ii. Manipulating substances that may generate aerosols; and
   iii. Performing laboratory procedures that may result in an uncontrolled release.
B. Using Corrosives at elevated temperatures (e.g., perchloric, nitric, piranha solution) requires facility specific engineering/ventilation controls. Contact CSUS EH&S for details.
C. Chemical dispensers should be considered to reduce potential exposures.

If you must use strong Corrosives without engineering or ventilation controls, you must contact CSUS EH&S for an exposure assessment.

REQUIRED - Insert descriptions of the lab-specific ventilation controls and equipment safety features utilized to reduce the risk of corrosive chemical exposures.

4. ADMINISTRATIVE CONTROLS

The following elements are required:

1. Complete the Laboratory Safety Fundamentals (or approved equivalent) training prior to working in the laboratory;
2. Complete laboratory-specific safety orientation and training on laboratory-specific safety equipment, procedures, and techniques to be used, prior to receiving unescorted access to the laboratory;
3. Demonstrate competency to perform the procedures to the Laboratory Supervisor, Principal Investigator (PI), Safety Officer, and/or trainer;
4. Be familiar with the location and content of any applicable Safety Data Sheets (SDSs) for the chemicals to be used (online SDSs can be accessed from Risk & Safety Solutions);
5. Implement good laboratory practices, including good workspace hygiene;
6. Inspect all equipment and experimental setups prior to use;
7. Follow best practices for the movement, handling, and storage of hazardous chemicals (see Chapters 5 and 6 of Prudent Practices in the Laboratory for more detail). An appropriate spill cleanup kit must be located in the laboratory. Chemical and hazardous waste storage must follow an appropriate segregation scheme and include appropriate labeling. Hazardous chemical waste must be properly labelled, stored in closed containers, in secondary containment, and in a designated location;
8. Do not deviate from the instructions described in this SOP without prior discussion and approval from the PI and/or Laboratory Supervisor.
9. Notify the PI and/or Laboratory Supervisor of any accidents, incidents, near-misses, or upset condition (*e.g.,* unexpected rise or drop in temperature, color or phase change, evolution of gas) involving the Corrosives described in this SOP; and
10. Abide by the department or college-specific working alone policy, if applicable.

For Corrosives, the following are also required:

11. Use a bottle carrier when transporting corrosives between work areas;
12. Strong corrosives must only be used in a room with a properly functioning eye wash. A safety shower must be available within 10 seconds of travel;
13. Except in specific procedures (*e.g.*, making Piranha solution), add acid to water to prevent splashing from sudden boiling;
14. Additional considerations are required for certain, particularly dangerous Corrosive materials (*e.g.* acid/base baths, hot perchloric acid, fuming nitric acid, hydrofluoric acid, aqua regia, Piranha solution, etc.). A chemical-specific SOP shall be developed for use of these materials. Consult the campus Chemical Hygiene Officer for advice; and
15. Due to the Corrosive properties of these materials and their ability to produce fires or explosions in combination with combustible materials, Corrosives should be:
    a. Stored in a manner that separates acids/bases from each other and other materials.
    b. Stored in a manner that is consistent with their properties.
    c. Stored in a container that is corrosion-resistant, and in secondary containment that facilitates flushing and other cleanup procedures in the event of leaks or spills.
    d. Stored on shelves below eye level or in corrosion-resistant acid/base storage cabinets. Epoxy-painted wood or plastic laminate construction with plastic shelves are optimal.
    e. Segregated from incompatible materials, such as:
        - oxidizing acids from organic acids and flammable/combustible materials
        - acids from active metals such as sodium, potassium, magnesium, etc.
        - strong bases from glass

REQUIRED - Insert the laboratory-specific restrictions on maximum quanities to be used and stored. Insert descriptions of any special handling or storage requirements.

5. PERSONAL PROTECTIVE EQUIPMENT (PPE)

At a minimum, long pants (covered legs) and closed toe/closed heel shoes (covered feet) are required to enter a laboratory or technical area where hazardous chemicals are used or stored.

In addition to the minimum attire required upon entering a laboratory, the following PPE is required for work with Corrosives:

A. Eye Protection: Eye protection is required for all work with Corrosives.
   i. At a minimum ANSI Z87.1-compliant safety glasses are necessary.
   ii. Splash goggles may be substituted for safety glasses, and are required for processes where splashes are foreseeable or when generating aerosols.
   iii. Ordinary prescription glasses will NOT provide adequate protection unless they also meet the Z87.1 standard and have compliant side shields.

B. Body Protection: At a minimum a chemically-compatible laboratory coat that fully extends to the wrist is necessary.
   i. For chemicals that are corrosive and/or toxic by skin contact/absorption additional protective clothing (*e.g.,* face shield, chemically-resistant apron, disposable sleeves, etc.) are required where splashes or skin contact is foreseeable.

C. Hand Protection: When hand protection is needed for the activities described in this SOP define the type of glove to be used based on: A) the chemical(s) being used, B) the anticipated chemical contact (*e.g.,* incidental, immersion, etc.), C) the manufacturers' permeation/compatibility data, and D) whether a combination of different gloves is needed for any specific procedural step or task.

REQUIRED - Insert descriptions of PPE and hygiene practices used with each process, hazardous chemical (s), or hazardous chemical class, including any specialized PPE needed for a procedural step/task.

6. SPILL AND EMERGENCY PROCEDURES

Follow the guidance for chemical spill cleanup from the CSUS Chemical Hygiene Plan, unless specialized cleanup procedures are described below. Emergency procedure instructions for CSUS campus are contained in the campus Chemical Hygiene Plan and in building specific Emergency Action Plans.

For solid base contact, quickly and carefully wipe off dry solid before rinsing exposed body parts. Use care to not disperse base particles into the air.

REQUIRED - Insert descriptions of any specialized spill clean up procedures for hazardous chemicals used in this SOP. Additional details of lab-specific spill cleanup should be provided if applicable.

7. WASTE MANAGEMENT AND DECONTAMINATION

Hazardous waste must be managed according to the CSUS Chemical Hygiene Plan. Hazardous waste must be stored in compatible containers that are in good condition, must be stored in secondary containment in a designated area, and must be properly labeled. In general, hazardous waste must be removed from your laboratory within 9 months of the accumulation start date. Hazardous waste pick up requests must be completed through the RSS WASTe application (Risk & Safety Solutions) or EH&S Hazardous Waste Pickup Request Form.

Waste storage bottles that contain inorganic acid wastes should be capped with pressure-relief or vented caps.

REQUIRED - Insert descriptions of laboratory-specific information on the waste streams generated, storage location, and any special handling/storage requirements.

REQUIRED - Insert descriptions of decontamination procedures for equipment, glassware, and controlled areas (e.g., glove boxes, restricted access hoods, or designated portions of the laboratory).

Upon completion of work with Corrosives and/or decontamination of equipment, remove gloves and/or PPE to wash hands and arms with soap and water. Additionally, upon leaving a designated Corrosives work area, remove all PPE and wash hands, forearms, face and neck as needed. Contaminated clothing or PPE should not be worn outside the lab. Grossly contaminated clothing/PPE and disposable gloves must not be reused.

8. DESIGNATED AREA

INSERT IF APPLICABLE - Description(s) of designated area(s) in your laboratory. Designated areas are required for "Particularly Hazardous Substances." The entire laboratory, a portion of the lab, a fume hood, etc. can be designated.

9. DETAILED PROTOCOL

REQUIRED - Insert descriptions of PPE and hygiene practices used with each process, hazardous chemical(s), or hazardous chemical class, including any specialized PPE needed for a procedural step/task.

TEMPLATE REVISION HISTORY

Version	Date Approved	Author	Revision Notes:
1.0	5/10/19	NSM Safety Mangager	New template adapted from documents provided by the CLSC taskforce at UC Davis
1.1	3/25/2020	NSM Safety Mng	Fixed broken links and converted to fillable pdf
1.2	6/03/2026	NSM Safety Mng	Edited old hyperlinks. Created more space for fillable sections. Updated with CHP changes

LAB-SPECIFIC REVISION HISTORY

Version	Date Approved	Author	Revision Notes:

Documentation of Standard Operating Procedure Training

(Signature of all users is required)

- ✓ Prior to using **Corrosives**, laboratory personnel must be trained on the hazards involved in working with this SOP, how to protect themselves from the hazards, and emergency procedures.
- ✓ Ready access to this SOP and to a Safety Data Sheet for each hazardous material described in the SOP must be made available.
- ✓ The Laboratory Supervisor/Principal Investigator (PI) must ensure that their laboratory personnel have attended appropriate laboratory safety training or refresher training within the last three years.
- ✓ Training must be repeated following **any** revision to the content of this SOP. Training must be documented. This training sheet is provided as one option; other forms of training documentation (including electronic) are acceptable but records must be accessible and immediately available upon request.

Designated Trainer: *(signature is required)*

I have read and acknowledge the contents, requirements, and responsibilities outlined in this SOP:

Name	**Signature**	**Trainer Initials**	**Date**