

Corrosives

STANDARD OPERATING PROCEDURE (SOP)

Type of SOP: Process Hazardous Chemical Hazardous Class

All personnel subject to these SOP requirements must review a completed SOP and sign the associated training record. Completed SOPs must be kept with the UC Davis Laboratory Safety Manual or be otherwise readily accessible to laboratory personnel. Electronic access is acceptable. SOPs must be reviewed, and revised where needed, as described in the [UC Davis Laboratory Safety Manual](#). Note that not all hazardous chemicals are appropriately addressed in a control-banded SOP, and some chemicals are subject to several control-banded SOPs. The unique properties of each chemical must be considered before including it into a control band.

Date SOP Written:	<u>11/18/19</u>	Approval Date:	<u>9/2/22</u>
SOP Prepared by:	<u>Derrick Kaseman</u>		
	<u>CLSC SOP Task Force</u>		
SOP Reviewed and Approved by (name/signature):	<u>James B. Ames</u>		
Department:	<u>NMR Facility</u>		
Principal Investigator/ Laboratory Supervisor:	<u>Derrick Kaseman</u>	Phone:	<u>530-752-7794</u>
Lab Manager/ Safety Coordinator:	<u>Derrick Kaseman</u>	Phone:	<u>530-752-7794</u>
Emergency Contact(s):	<u>Ping Yu</u>	Phone:	<u>530 848-3596</u>
	<u>James Ames</u>		<u>530 752-6358</u>
<hr/>			
Location(s) covered by SOP:	<u>Chemistry 93, MS1D - All</u>		
	Building:	<u>Rooms</u>	Lab
	Room #(s):	<u>See Above</u>	Phone: <u>530-752-7794</u>

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 gaseous. Corrosives are most hazardous to the eyes, as direct exposure may cause blindness in a matter of seconds. Corrosive gases can damage the lining of the lungs leading to pulmonary edema. Dust from Corrosive solids or aerosolized/evaporated liquids can be inhaled and cause serious damage to the respiratory tract.

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.

Samples denoted by asterisks (*) are sealed NMR samples

Bleach

Sodium Deuterioxide

Chloramine T trihydrate

Deuterium chloride, 20% w/w in D2O

TEMPO

[Lead\(II\) nitrate](#)

Rhodium(III) chloride

Formamide 90% Deuterodimethylsulphoxide 10% *

Sodium hypochlorite, 4-5% aqueous solution

Vanadium(V) oxide

Manganese(II) chloride tetrahydrate

Menthol solution NMR reference standard, 30% in chloroform-d (99.8 atom % D), 5 mm x 8in. *

3. ENGINEERING/VENTILATION CONTROLS

The following is a general plan for all strong Corrosives:

- A. All work should be done in a certified chemical fume hood;
- B. Using Corrosives at elevated temperatures (*e.g.*, perchloric, nitric, piranha solution) requires facility-specific engineering/ventilation controls. Contact chem-safety@ucdavis.edu for details; and
- C. Chemical dispensers should be considered to reduce potential exposures.

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

All work preparing samples with corrosives will be completed in the Fume hood in Medical Sciences 1D Room 18C

4. ADMINISTRATIVE CONTROLS

The following elements are required:

1. Complete the [UC 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, including any applicable laboratory-specific Laboratory Safety Plan(s), prior to receiving unescorted access to the laboratory;
3. Demonstrate competency to perform the procedures to the Principal Investigator (PI), Laboratory Supervisor, laboratory-specific 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 [UC SDS](#));
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 Corrosives described in this SOP; and
10. Abide by the laboratory-specific working alone SOP, 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; and
 - 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.; and
 - strong bases from glass.

INSERT IF APPLICABLE - Describe any additional administrative controls (*e.g.*, restrictions on procedure/work equipment/work locations/unattended operations). Include any chemical-specific administrative controls (*e.g.*, peroxide formers).

NA

REQUIRED - Insert descriptions of any special handling or storage requirements.

NA.

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 PPE required upon entering a laboratory, the following are 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. A [video from UCSD](#) highlights the importance of wearing proper PPE when using Corrosives.
 - 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:** 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.

Wear protective gloves, chemical goggles, and lab coat.

6. SPILL AND EMERGENCY PROCEDURES

Follow the guidance for chemical spill cleanup from [SafetyNet #13](#) and/or the [UC Davis Laboratory Safety Manual](#), unless specialized cleanup procedures are described below. Emergency procedure instructions for the UC Davis campus and UCD Medical Center are contained in the [UC Davis Laboratory Safety Manual](#), [campus Emergency Response Guide \(ERG\)](#), and [UCD Health System ERG](#). The applicable ERG must be posted in the laboratory. All other locations must describe detailed emergency procedure instructions below.

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 (*e.g.*, pyrophorics, phenol, etc.). Additional details of lab-specific spill cleanup should be provided if applicable.

NA

INSERT IF APPLICABLE - Descriptions of any specialized emergency procedures for locations outside of the UC Davis main campus and the UCD Medical Center campus.

NA

7. WASTE MANAGEMENT AND DECONTAMINATION

Hazardous waste must be managed according to [Safety Net #8](#), and must be [properly labeled](#). In general, hazardous waste must be removed from your laboratory within 9 months of the accumulation start date; refer to the [accumulation time for waste disposal](#). Hazardous waste pick up requests must be completed using [WASTE](#).

Note: See the [WASTE Factsheet](#) for instructions on how to complete a label.

Waste storage bottles that contain inorganic acid wastes **shall** be capped with pressure-relief caps. EH&S provides vented caps for 4 L bottles free of charge, contact your Laboratory Safety Professional or chem-safety@ucdavis.edu to obtain caps for your containers.

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

These hazardous wastes should have their own containers. The standard WASTE process should be used.

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

NA

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 worn and wash hands, forearms, face and neck as needed. Contaminated clothing or PPE should not be worn outside the lab. Soiled lab coats should be sent for professional laundering. Grossly contaminated clothing/PPE and disposable gloves must not be reused.

8. DESIGNATED AREA

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

Entire laboratory

9. DETAILED PROTOCOL

REQUIRED - Insert or attach detailed laboratory-specific procedures for the process, hazardous chemical(s), or hazard class. You may also include any relevant supporting resources such as SafetyNets, journal citations, etc. that are applicable.

Bleach to be used as a disinfecting/cleaning agent. Should be diluted before use. Other chemicals are used for NMR/EPR samples. They should not be used for any other purpose. Standard PPE outlined in section 5 to be used during sample preparation and should be done in the hood.

TEMPLATE REVISION HISTORY

Version	Date Approved	Author	Revision Notes:
1.0	4/14/2015	CLSC Task Force	New template
1.1	10/13/2015	Chris Jakober	Added lanaguage regarding pressure-relief cap requirement for waste bottles
1.2	3/10/2016	Chris Jakober	Updated URLs following website redesign, added URL to UC DHS ERG
1.3	11/30/2016	Lindy Gervin	Unlocked editable fields
1.4	3/13/2017	Lindy Gervin	Updated links in section 7 to WASTE system
1.5	5/10/2017	Lindy Gervin	Updated email address in sections 3 and 7

LAB-SPECIFIC REVISION HISTORY

Version	Date Approved	Author	Revision Notes:
1	11/18/19	Jeffrey H. Walton	SOP Generation
2	9/2/22	Derrick Kaseman	Minor changes throughout. Updated contact information, room list, and chemical list

Documentation of Standard Operating Procedure Training

(Signature of all users is required)

- ✓ Prior to using **Corrosives**, laboratory personnel must be trained on the hazards described in this SOP, how to protect themselves from these 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 Principal Investigator (PI), or the Laboratory Supervisor if the activity does not involve a 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.

Designated Trainer: *(signature is required)*

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

Name	Signature	Trainer Initials	Date