

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

- Silver Nitrate- headache, dizziness, nausea and vomiting. Inability to transport Oxygen, causing headache, fatigue, dizziness.
- Sulfuric Acid- Breathing difficulty due to throat swelling. Breathing difficulty due to throat swelling. Burns in the mouth and throat. Drooling. Fever. Rapid development of low blood pressure (shock) severe pain in the mouth and throat. Speech problems. Vomiting, with blood.
- Formic Acid- irritation of eyes and nose, sore throat, cough, chest tightness, headache and confusion. In severe cases it can cause breathlessness and wheezing. Skin contact with formic acid can cause pain, burns and ulcers.
- Nitric acid- Abdominal pain – severe Burns to skin or mouth, Drooling Fever, Mouth pain – severe, Rapid drop in blood pressure (shock), Throat swelling, which leads to breathing difficulty, Throat pain – severe, Vomiting, bloody, Bluish-colored lips and fingernails, Chest

tightness, Choking, Coughing, Coughing up blood, Dizziness, Low blood pressure, Rapid pulse, Shortness of breath, Weakness.

- Loctite Epoxy Hardener- Corrosive. Causes eye and skin burns. May cause allergic skin reaction. May cause eye, skin, and respiratory tract irritation. May be harmful if swallowed or absorbed through skin. Vapor harmful
- Phosphoric Acid- Ingestion: Can burn the lips, tongue, throat and stomach. Symptoms may include nausea, vomiting, stomach cramps and diarrhea. Permanent damage can result. Effects of Long-Term (Chronic) Exposure: At low concentrations: Can cause dry, red, cracked skin (dermatitis) following skin contact.
- Stay Clean Liquid Flux- corrosive, can cause skin and eye burns, must not be inhaled or swallowed
- Loctite Silver Grade Anti Seize- causes skin irritation and eye damage
- Lime A Way- skin and eye burns
- Hydrochloric Acid- severe Burns to skin or mouth, Drooling Fever, Mouth pain – severe, Rapid drop in blood pressure (shock), Throat swelling, which leads to breathing difficulty, Throat pain – severe, Vomiting, bloody, Bluish-colored lips and fingernails, Chest tightness, Choking, Coughing, Coughing up blood, Dizziness, Low blood pressure, Rapid pulse, Shortness of breath, Weakness.
- Acetic Acid- hives; difficult breathing; swelling of your face, lips, tongue, or throat
- Potassium Hydroxide- Burns and severe pain in the mouth and throat, Throat swelling, which leads to difficulty breathing, Drooling, Severe abdominal pain, Diarrhea, Chest pain, Rapid drop in blood pressure (shock), Vomiting, often bloody, Burning, Severe pain, Vision loss.
- Aluminum Nitrate- methemoglobinemia. cyanosis, cardiac dysrhythmias and circulatory failure, and progressive central nervous system (CNS) effects. CNS effects can range from mild dizziness and lethargy to coma and convulsions.
- Alconox-skin and eye irritation
- Calcium Nitrate Tetrahydrate- skin and eye irritant and can cause irreversible damage to vision and integument.
- Citric Acid- gastrointestinal irritation with nausea, vomiting and diarrhea. Causes respiratory tract irritation. Repeated exposure may cause sensitization dermatitis.
- Silica Alumina Catalyst- irritation of eyes and skin
- Ammonium Metatungstate Hydrate- harmful if swallowed and can cause serious eye damage.

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.

For most corrosives, especially strong acids and bases not part of a commercial product, they are regulated to the wet laboratory area in room 122. Others of an industrial usage or which are part of a commercial product their use should follow all applicable instructions and good safety practices, to ensure you, others or the lab is not exposed to the corrosive chemical. In all cases the appropriate PPE must be utilized.

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.

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.

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.

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.

Corrosives must be handled in the fume hoods if at all possible or applicable, in both cases this must be with all appropriate safety measures in place and PPE. These items should not leave the lab area for any purpose other than initial acquisition and proper disposal.

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

The 2900 Spafford lab is the area designated for these materials. They may not be stored in any other part of the lab, or transported beyond the lab for any reason, or without express permission after review by the LSO.

9. DETAILED PROTOCOL

The Luhmann lab at 2900 Spafford has no processes in use or protocols beyond safe handling of these materials specifically, given this a link is provided to each sds for the following corrosive compounds. It should be noted that if any new experiment or laboratory process intends to use any of the compounds not relating to the normal usage of a commercial compound (ie locktite etc.) then the process must first be reviewed by the PI and LSO. Various sources for SDS can be found at: <https://safetyservices.ucdavis.edu/units/ehs/research/safety-data-sheets>

- Silver Nitrate- https://beta-static.fishersci.com/content/dam/fishersci/en_US/documents/programs/education/regulatory-documents/sds/chemicals/chemicals-s/S25526.pdf
- Sulfuric Acid- https://beta-static.fishersci.com/content/dam/fishersci/en_US/documents/programs/education/regulatory-documents/sds/chemicals/chemicals-s/S25899.pdf
- Formic Acid- <https://www.fishersci.com/shop/msdsproxy?productName=A11750&productDescription=FORMIC>
- Nitric acid- <https://www.fishersci.com/msds?productName=A467250%26productDescription=NITRIC>
- Loctite Epoxy Hardener- [https://ypsswhdoal-a0d0758e9.dispatcher.hana.ondemand.com/SAP_GATEWAY/odata/SAP/YPSSWH_DOO_SRV/SafetyDataSheetSet\(Appid='YPSSW_SDSUA_EXT',Matnr='1440606',Laiso='EN',Rvlid='US',Dmskey=''\)/\\$value](https://ypsswhdoal-a0d0758e9.dispatcher.hana.ondemand.com/SAP_GATEWAY/odata/SAP/YPSSWH_DOO_SRV/SafetyDataSheetSet(Appid='YPSSW_SDSUA_EXT',Matnr='1440606',Laiso='EN',Rvlid='US',Dmskey='')/$value)
- Phosphoric Acid- https://beta-static.fishersci.com/content/dam/fishersci/en_US/documents/programs/education/regulatory-documents/sds/chemicals/chemicals-o/S25470B.pdf
- Stay Clean Liquid Flux- <https://www.rsd.net/assets/item/1434.pdf>
- Loctite Silver Grade Anti Seize- <https://pim.henkelgroup.net/henkel/sds/A/1999141/US/EN>
- Lime A Way- <http://sds.chemtel.net/webclients/chenebrothers/10044975SDS.pdf>
- Hydrochloric Acid- http://sds.chemtel.net/webclients/safariland/finished_goods/Pioneer%20Forensics%20-%20PF021%20-%20PF022%20-%20Hydrochloric%20Acid.pdf
- Acetic Acid- https://beta-static.fishersci.com/content/dam/fishersci/en_US/documents/programs/education/regulatory-documents/sds/chemicals/chemicals-a/S25118.pdf
- Potassium Hydroxide- <https://fscimage.fishersci.com/msds/19431.htm>
- Aluminum Nitrate- <http://www.t3db.ca/toxins/T3D1515>
- Alconox- https://alconox.com/resources/standarddocuments/sds/sds_alconox_english_ghs.pdf
- Calcium Nitrate Tetrahydrate- <https://www.fishersci.com/shop/msdsproxy?productName=C1083&productDescription=CALLCIUM+NITRATE+GRAN+TECH+3KG&catNo=C108-3&vendorId=VN00033897&storeId=10652>
- Citric Acid- <http://www.igasplc.com/media/29404/CITRIC-ACID-SDS11350.pdf>

- Silica Alumina Catalyst-
<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=343358&brand=ALDRICH&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fproduct%2Faldrich%2F343358%3Flang%3Den>
- Ammonium Metatungstate Hydrate-
<https://www.sigmaaldrich.com/MSDS/MSDS/DisplayMSDSPage.do?country=US&language=en&productNumber=463922&brand=ALDRICH&PageToGoToURL=https%3A%2F%2Fwww.sigmaaldrich.com%2Fcatalog%2Fproduct%2Faldrich%2F463922%3Flang%3Den>

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 UCDHS 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

[illegible]

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