

Standard Operating Procedure



CORROSIVES

This standard operating procedure (SOP) is intended to provide general guidance on how to safely work with corrosive materials. This SOP is generic in nature and only addresses safety issues specific to corrosive chemicals. In some instances, several general use SOPs may be applicable for a specific chemical.

The major classes of corrosive chemicals are strong acids and bases, dehydrating agents, and oxidizing agents. Liquid corrosive chemicals are those with a pH of 4.0 or lower or a pH of 9 or higher. Solid chemicals are considered corrosive if when in solution they fall in the above pH range. A highly corrosive chemical has a pH of 2 or lower or a pH of 12.5 or higher. OSHA defines a material as corrosive if it meets either of these criteria:

- *Corrosive to skin:* a substance which produces irreversible damage to the skin following an application of the substance for up to 4 hours.
- *Corrosive to metal:* a substance or a mixture that by chemical action will materially damage, or even destroy, metals.

Examples of common corrosives include:

- Strong acids:
 - Hydrochloric acid
 - Nitric acid
 - Phosphoric acid
- Strong bases:
 - Sodium hydroxide
 - Potassium hydroxide
 - Ammonia hydroxide
- Strong dehydrating agents:
 - Phosphorus pentoxide
 - Calcium oxide
 - Sulfuric acid
- Strong oxidizing agents:
 - Hydrogen peroxide ($\geq 30\%$)
 - Sodium hypochlorite
- Corrosive solids:
 - Phenol
 - Phosphorous
- Corrosive gases:
 - Chlorine
 - Ammonia

This SOP does not apply to hydrofluoric acid, perchloric acid, picric acid, aqua regia, or piranha solution.

Potential Hazards/Toxicity

Corrosives materials can cause visible destruction to human tissue, and/or irreversible damage, at the site of contact. These chemicals can erode the skin and the respiratory epithelium and are particularly damaging to the eyes. Inhalation of vapors or mists of these substances can cause severe bronchial irritation.

Most acids are liquids and most bases are solids. Acids, especially when concentrated, are most likely to cause immediate pain when they come in contact with the body. Contact with strong bases usually does not cause immediate pain. This allows the base time to react with the body part and a serious injury may result.

Corrosive compounds present a physical hazard as well. When they come into contact with some metals, like aluminum, they may react and generate hydrogen gas.

As the hazards may vary by compound, users must familiarize themselves with the specific hazards of the compounds they are working with, which can be found on the chemical's Safety Data Sheet (SDS). SDSs are available through the Safety Data Sheet link on Yale's EHS webpage (ehs.yale.edu).

Personal Protective Equipment (PPE)

The University's Personal Protective Equipment Policy can be found on the EHS website (ehs.yale.edu)

Eye Protection

Safety glasses or chemical goggles must be worn whenever handling corrosive chemicals. If there is a potential for splash to the face, then a faceshield must be worn over tight fitting goggles.

Hand Protection

Gloves must be worn when handling corrosive chemicals. Exam style nitrile gloves (minimum 4mil thickness) should be adequate for handling small quantities of most of these in general laboratory settings. However, if skin contact is likely or larger amounts are being used, then a utility grade nitrile or neoprene glove should be worn over the exam style nitrile.

Skin and Body Protection

Long pants or clothing that covers the body to the ankles and closed-toe solid top shoes must be worn when handling these compounds. Lab coats must be worn. Additional protective clothing (i.e., chemical resistant apron) may be necessary when using larger amounts and/or a potential for a splash to the body exists.

Engineering Controls

Fume hoods, or other locally exhausted ventilation, must be used when handling corrosive compounds.

Storage/Handling

Store liquids and solids separately. Store away from incompatibles; many corrosive materials are incompatible with each other, i.e., oxidizing acids are incompatible with organic acids, and acids are incompatible with bases.

- Liquids:
 - Transport in secondary containment.
 - Whenever possible, purchase corrosive liquids in safety coated bottles.
 - Keep concentrated corrosive compounds in secondary containment.

- Store in approved locations, such as chemical cabinets. Strong acids will corrode most metal cabinets. Non-metallic or epoxy painted cabinets should be used.
 - Do not store above eye level (~5 feet) or on benches.
 - Always add acid to water, never water to acid.
 - Avoid violent reactions. Dilution of mineral acid with water is highly exothermic and vessels may become hot enough to burn skin on touch, cause sudden boil over, or to violently de-gas.
- Corrosive Gases:
 - Use and store in vented cabinets or inside a fume hood.
 - To prevent releases to the environment, or possible equipment damage, it may be necessary to scrub exhaust from processes which utilize large amounts of corrosive gases even when working in the fume hood.
 - Close regulators and valves when the cylinder is not in use and flush with dry air or nitrogen after use.

Waste Disposal

Corrosive compounds which have a pH of 5.5-9.5 and do not exhibit any other hazard (i.e., toxicity) may be disposed of down the drain. All other corrosive waste must be collected as hazardous waste.

Emergency Procedures

Fire Extinguishers

An ABC dry powder extinguisher is appropriate if there is a fire involving corrosive compounds.

Eyewash/Safety Showers

An ANSI approved eyewash station that can provide quick drenching or flushing of the eyes must be immediately available within 10 seconds travel time for emergency use. An ANSI approved safety drench shower must also be available within 10 seconds travel time from where these compounds are used. Ensure the locations of the eyewashes and safety showers, and how to activate them, are known prior to an emergency.

First Aid Procedures

If inhaled

Remove to fresh air. Follow up with Acute Care or Employee Health as appropriate (203-432-0123).

In case of skin contact

Go to the nearest emergency shower if contaminated. Yell for assistance and rinse for 15 minutes, removing all articles of clothing to ensure contaminate is completely removed. Follow up at Acute Care/Employee Health as appropriate (203-432-0123).

In case of eye contact

Go to the nearest emergency eyewash. Yell for assistance and rinse for 15 minutes. Follow up at Acute Care/Employee Health (203-432-0123).

Spills

Small Spill

If a small spill occurs inside a fume hood or near other local exhaust ventilation, lab personnel should be able to safely clean it up by following standard spill clean up procedures:

- Alert people in immediate area of spill
- Increase ventilation in area of spill (open fume hood sashes)
- Wear personal protective equipment, including utility grade nitrile gloves
- If available, cover spill with acid/base neutralizer
- If neutralizer is not available, confine spill to small area with adsorbent material (pads, vermiculite)
- Collect residue, place in container, label container, and dispose of as hazardous waste
- Clean spill area with soap and water

Larger Spill

- Call EHS for emergency assistance (203-785-3555)
- Evacuate the spill area
- Post someone or mark-off the hazardous area with tape and warning signs to keep other people from entering
- Stay nearby until emergency personnel arrive and provide them with information on the chemicals involved

Please list the compounds used by this research group which are covered by this procedure. The list should also include the building/room where they are used.

Lab Specific Protocol/Procedure:

Principal Investigator's Signature/Date