Perchloric Acid

Standard Operating Procedure

Revision Date: 05/16/22

Laboratory Director (LD) Approval is Required Prior to Performing this Procedure

This standard operating procedure outlines the handling and use of perchloric acid. Review this document and supply the information required in order to make it specific to your laboratory. In accordance with this document, laboratories should use appropriate controls, personal protective equipment, and disposal techniques when handling perchloric acid.

# Description [Provide additional information as it pertains to your research protocol]

Perchloric acid is used as a laboratory reagent in analytical chemistry, a catalyst in wet ‘combustion’, a dehydrating agent in fluoride determination, an ingredient of electrolytic bath in deposition of lead, and for electropolishing of metals. It is also used in the manufacture of explosives and various esters and in separation of potassium from sodium. Heating may cause an explosion. Perchloric acid is known to react violently with water.

## Process [Write the steps for using the chemical in your research protocol]

# Potential Hazards [Provide additional information as it pertains to your research protocol]

* **Perchloric Acid causes severe burns and there’s a risk of serious damage to eyes.** Perchloric acid can be irritating to the skin, eyes, and respiratory tract. Contact with exposed body parts can cause painful burns and even death.
* **Perchloric Acid may cause a delayed reaction resulting in lung damage. Anyone who has an exposure via inhalation should be under medical observation for 24 hours, even if no symptoms have been manifested.**
* Consult your Safety Data Sheet (SDS) and the *Prudent Practices* [Laboratory Chemical Safety Summary for Perchloric Acid and Inorganic Perchlorates](https://www.nap.edu/read/4911/chapter/14#374) (Appendix B, page 374) for more hazard information.
* Explosion hazards exist with:
	+ Anhydrous perchloric acid and certain perchlorate salts
	+ Aqueous perchloric acid if concentrated to greater than the normally-available commercial concentration of 72%.
	+ Mixtures of perchlorates with many oxidizable substances
* Hot concentrated solutions are extremely dangerous – heated perchloric acid acts as a strong oxidizing agent. **Never heat perchloric acid in a standard fume hood, because perchlorates may accumulate in the ductwork and create an explosion hazard for employees servicing the hood.** If you suspect that heated perchloric acid has been used in a hood, contact Environment, Health & Safety (EHS) at (734) 647-1143 before having the hood tested or serviced.
* Do not use perchlorates as drying agents if there is any chance of contact with organic compounds or a dehydrating acid strong enough to concentrate the perchloric acid.

# Engineering Controls [Provide additional information as it pertains to your research protocol]

Perchloric acid must always be used in a fume hood. Do NOT heat perchloric acid in a standard chemical fume hood. If perchloric acid will be heated, a special perchloric acid hood with water washdown system, and a safety shower will also be necessary. All new locations used for heated perchloric acid procedures must be approved by EHS prior to conducting any work.

An eyewash/drench hose combination unit must be available in the immediate work area for any work with corrosive materials.

# Work Practice Controls [Provide additional information as it pertains to your research protocol]

* Avoid personal contact and inhalation of dust, mist or vapors.
* Purchase perchloric acid in the smallest amounts practicable. Purchase in shatter-resistant containers if available (such as PVC-coated glass).
* Withdraw only sufficient amounts for immediate use.
* DO NOT repack or return unused portions to original containers.
* NEVER smoke, eat or drink when handling perchloric acid.
* Consider alternate methods and use a less dangerous acid if possible.
* Set up a designated area for perchloric acid use and label it as such.
* Make sure that flammable and/or organic materials are not located in the work area.
* Once work with perchloric acid is complete, decontaminate the area by wiping it down with a 10% sodium carbonate (Na2CO3, also known as soda ash) solution.

Currently, there are no established occupational exposure limits for perchloric acid. Contact EHS for assistance in performing an exposure assessment.

# Personal Protective Equipment [Provide additional information as it pertains to your research protocol]

Wear a fully buttoned lab coat with sleeves extended to wrists, safety glasses with side shields or full face shield with chemical goggles when there is a danger of contact with the eyes, elbow length PVC gloves, long pants (or other clothing covering the entire leg), rubber apron, and closed toed shoes.

# Transportation and Storage [Provide additional information as it pertains to your research protocol]

* Transport corrosives in secondary containment, preferably a polyethylene or other non-reactive acid/solvent bottle carrier.
* Store in well-ventilated areas with secondary containment, such as a non-reactive plastic bin.
* Store below eye level.
* Store perchloric acid away from light, heat, flammables or combustibles, including organic materials.
* Do not store under the sink, in wooden cabinets, or on paper-lined shelving.
* Do not store with reducing agents or bases.
* Do not store on the floor.

# Waste Disposal [Provide additional information as it pertains to your research protocol]

Because most spent, unused, and expired chemicals/materials are considered hazardous wastes, they must be properly disposed of. **Do not dispose of chemical wastes by dumping them down a sink, flushing in a toilet or discarding in regular trash containers, unless authorized by EHS Hazardous Materials Management (EHS-HMM)**. Contact EHS-HMM at (734) 763-4568 for waste containers, labels, manifests, waste collection and for any questions regarding proper waste disposal. Also, refer to the EHS [Hazardous Waste](http://ehs.umich.edu/haz-waste/) Web page for more information.

# Spill Procedure [Provide additional information as it pertains to your research protocol]

* When a spill occurs, personal safety should always come first.
* Alert and clear everyone in the immediate area where the spill occurred.

**If any large amount of perchloric acid solution is spilled, leave the lab and call UMPD at 911 to request assistance from EHS.** Do not take any action to cover the spill. Post a warning on the lab and do not allow others to enter. Have a person available that has knowledge of the incident and laboratory to assist emergency personnel.

## Minor Chemical Spill

A **minor (small) chemical spill** is one that the laboratory staff is capable of handling safely without the assistance of safety and emergency personnel. In the event of a minor chemical spill, use the following information for a safe cleanup process.

1. Small spills of perchloric acid can be neutralized by slowly pouring sodium carbonate (Na2CO3) or other appropriate inorganic neutralizing agent on the spill.
**NOTE**: The spill should **not** be wiped up with organic or combustible materials (paper towels, rags, etc) because perchloric acid is incompatible with these materials and when they dry, these materials can spontaneously ignite.
2. Transfer the neutralized slurry to a container of water for disposal.
3. A second neutralization, along with wiping/rinsing down the area with a soap and water solution is recommended.

# Training of Personnel

All personnel shall read and fully adhere to this SOP when handling perchloric acid.

# Certification

I have read and understand the above SOP. I have received approval from my Lab Director to perform this procedure. I agree to contact my Lab Director if I plan to modify this procedure.

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### Major Revisions (Tracking purposes only -- Do not print as part of SOP)

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| Date | Revision |
| 09-19-18 | Updated EHS name and logo and format and revised the Exposure/unintended contact section (AKJ) |
| 02-25-19 | Updated links (DML) |
| 05-16-22 | Removed Exposures/Unintended Contact and Emergency Reporting sections (LGS) |